Integrated Curriculum for Secondary Education Natural Science, Years 1 and 2

Ministerio
de Educación, Cultura
y Deporte

CNIIE

Integrated Curriculum for Secondary Education Natural Science, Years 1 and 2

Currículo Integrado hispano-británico para ESO.
Ciencias de la Naturaleza 1.º y 2.º

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General Introduction to the MEC/British Council Bilingual Project

1. Project background and objectives

The MEC/BC bilingual project, initiated in 1996 in primary as a unique experiment within the Spanish state education system, and in September 2004 the classes that had started their bilingual education 8 years earlier took the project forward into Secondary schools.

The formal agreement between the Ministry of Education and Science and the British Council states that the aim of the project is to provide students from the age of three to sixteen with a bilingual, bicultural education through an integrated Spanish/English curriculum based on the Spanish National Curriculum and aspects of the National Curriculum for England and Wales.

The implantation of such a curriculum requires, firstly, with regard to English as a subject, a very different classroom approach from the traditional EFL classroom where the focus is on learning English as a foreign language; secondly, a similar new methodology for teaching and learning other curricular areas through English. Such an integrated approach sits very positively within the Directives of the Council of Europe which insists on the need for students to be competent in three European languages by the end of the obligatory period of Secondary Education and that the learning of the first foreign language should begin in the early years of formal education. In addition to this, the secondary integrated curricula have consistently focused on the continuing development of students' skills and learning strategies, thus firmly establishing learning as a lifelong process.

The specific objectives of the Project in the Secondary education level are to:

- Continue the acquisition and learning of both languages through an integrated content-based curriculum
- Encourage awareness and understanding of the diversity of both cultures
- Facilitate the exchange of teachers and students
- Encourage the use of modern technologies in learning other languages
- Promote the certification of studies under both educational systems, if and when appropriate

2. Rationale: curriculum document for Secondary Education

The current documents have been designed as the logical continuation of the *Integrated Curriculum for Primary Stage*. It includes:

- A clear delineation of the contents to be taught in English, Science and Geography and History for the level of 1st and 2nd year of Secondary Education.
- A definition of the linguistic and scientific skills and of the attainment targets students are expected to reach.
- A choice of resources to be used by teachers.

3. Constitution of the working parties

The present documents were written by three working parties (English, Science and Geography and History) consisting of Spanish and British Primary and Secondary teachers, who have worked on the Project for more than three years, and contributed with their experience to bridge the gap between both levels.

4. Approach adopted by the working parties

The members of the combined working parties exchanged their knowledge and teaching experience to produce a document in which the language and skills acquired by pupils in primary are brought together and built to provide coherence and progression to the curricula.

Both the Spanish and English curricula were studied in depth in order to produce a Spanish/English integrated curriculum comprising both contents and methodological approaches.

5. Subjects to be taught in English

The areas in which English must be taught, targets reached and students evaluated will be the following:

- English, language and literacy.
- Science.
- Geography and History.

Secondary students must have 5 English sessions per week; Science and Geography and History will have the same hours allocated as those in the current Spanish education system.

Each school may include other subjects, if their timetable permits, if and when their contents and methodology follow the bilingual project guidelines.

6. Roles of teachers in the project

The bilingual Project has been most successful in those primary schools in which it has been perceived as an integrated programme involving heads, all teachers, and parents. This was possible due to the coordination between all members of staff. Where teachers had time and opportunity to meet, plan and obtain feedback, it was noticeable how much higher the standards were.

The transition to Secondary Education has similarly shown that co-ordination is still an essential element for the bilingual project to be successful. However, co-ordination in Secondary Education is to be undertaken along two dimensions:

- With the Primary school. It is essential for Secondary teachers to keep in touch with their Primary colleagues so as to obtain maximum feedback and information about the students themselves and knowledge of materials, skill development, and methodology. Many Secondary schools initiated this type of contact even before receiving the first class of bilingual students (by means of visits, meetings with their Primary colleagues or even joint teaching sessions). It is therefore essential for this contact to continue now that the bilingual project has passed into Secondary education.
- Secondary teachers must co-ordinate among themselves. This involves:
  - English teachers meeting often enough for everyone to be aware of progress. In the development and evaluation of the bilingual project, the English department should be involved as a whole.
  - Teacher coordination amongst English and Science and/or Geography and History teachers to discuss the way the bilingual project as a whole is developing. This inter-departmental co-ordination becomes increasingly essential in order to cater for more complex learning needs. Issues which traditionally have not been part of subjects, such as linguistic awareness for Science or Geography and History teachers, or non-fiction texts, for English teachers must be dealt with and require cooperative planning and negotiation.

7. Attainment targets

At the end of the 1st and 2nd year, for English, Science and Geography and History, there should be an approximate profile for each class:

- 20% students at band 1 (lowest)
- 70% students at band 2
- 10% students at band 3 (highest)

The curriculum writers have offered these bands by way of reference; if these targets are not being achieved then this should lead to a school management examination of:

- The number of hours being spent on the English part of the curriculum.
- Methodological approach and use of resources.
- Coordination among teachers.
- The need to challenge students and raise standards of expectation.

Introduction to the Science Curriculum

This Integrated Science Curriculum for ESO 1 and 2 is based on the current Spanish and British curricula.

Teachers are strongly advised to read through the whole of the present document before beginning to plan their personal work for the year in order to obtain an overall view of the curriculum. This would also facilitate both long and short term planning of individual units within the different topic areas over the year.

In some areas, the order of teaching topics has been changed to allow the pupils to use an English textbook and to work within topic areas. In 2001 the QCA (Quality Control Agency, Department for Education and Skills – DfES) produced a series of detailed Schemes of Work for teaching science from 11-14. There is now a vast amount of resource materials based on this scheme, including textbooks and support materials from all the major publishers, web based resources and huge amounts of software. Information on some of these materials can be found in the section on teaching resources.

1. Methodology

- A major aim of this Integrated Curriculum is to encourage an imaginative approach to science teaching. Not only do our pupils need to learn scientific facts but also, increasingly, they need to be able to use and apply their scientific knowledge.
- Pupils need to be encouraged or challenged to reflect upon scientific interpretations: Where did the information come from? How do we know it is true? How can I check

on it? They also need to understand how scientific ideas are developed, they need to be able to plan and carry out scientific investigations to test out ideas experimentally. In doing this they will be developing their practical skills, learning how to solve problems, learning how to evaluate their results and so to be able to evaluate the scientific information which they will be coming in to contact with on a daily basis throughout their lives. Current concerns which could affect all of us include diet, dangers of antibiotics, mad cows, HIV, IVF, SARS, cloning, genetic testing, environmental pollution, global warming. Pupils need to be able to evaluate the importance and relevance of these complex, science-based topics for themselves. So this curriculum aims to give the pupils experience of many types of scientific enquiry such as:

- recognising patterns and correlations
- using first hand and second hand sources of information including ICT
- identification and classification techniques
- how to use and evaluate some scientific techniques or applications
- the need for fair tests involving controls
- using experimental models and analogies.

2. The use of practical work

As well as teaching Geology, Biology, Physics and Chemistry the course also specifies which science skills should be taught. Teaching science skills is as important as reaching the contents.

– Practical skills work can be used for a number of reasons such as:
  - To back up theory work.
  - To give the pupils first hand experiences.
  - To learn how to carry out a scientific investigation.
  - To develop science skills.
  - To stimulate the pupils' interest.

– Teachers will use a variety of different approaches to practical work with their pupils which might include the following if appropriate:
  - Starting a topic with an investigation to allow the pupils to find out some of the key concepts through their own work. In practice this cannot be used too often as it can be time consuming and it must be carefully structured to allow the pupils to be led in the right direction.
  - Using practical work to illustrate a concept. The teacher will have already introduced the main points and questioned the pupils to assess their basic understanding then the structured practical will be used to reinforce the theory.
  - Practical demonstrations by the teacher so that the results can be discussed at the time.
  - Small practical activities during a theory lesson to break it up and to introduce new ideas and points for discussion.

– Practical work need not use a lot of equipment nor a lot of time and it may vary from:

  Full investigations such as:
  - finding out what yeast needs to grow
  - finding out about acid rain and the effects it has on plants

- investigating which felt tip pen inks are mixtures and which are pure colours
- a biology field trip lasting a whole day.

Short practicals such as:

- looking at onion cells under the microscope and drawing them
- separating sand and salt
- finding the density of a selection of solids.

Or quick activities such as:

- acting out the stares of matter
- setting off a water rocket
- using a syringe to feel how air can be compressed but water cannot.

3. Different approaches to teaching and learning

All pupils do not learn in the same way so it is important to give them a range of different kinds of experiences to give them the opportunity to develop. The range of types of experience can be summarised as:

Examples of possible activities		
Type of experience	**Used by pupils**	**Used in teaching**
Visual	PowerPoint slides, making videos, making a poster, use colour codes for revision, mind maps, making graphs, key diagrams, computer based learning.	PowerPoint slides. Posters on the walls. Video. Internet searches. Practical demonstrations. Visits to museums and planetariums.
Audio and linguistic	Word puzzles, write a magazine article, poems and songs, crosswords, discussion, debates, comprehension tests, library search, presentations to the class.	Word walls. Using music. Setting library or newspaper search investigations. School magazine. Entering national science competitions.
Kinaesthetic, physical	Model making, practical tasks, role-play, making flash cards, dance.	Hands-on practical lessons. Using role-play to act out ethical dilemmas.
Mathematical	Organising tasks into steps, listing key points, making tables and graphs of information, making timelines, creating flow charts.	Preparing quantitative practical lessons to generate data. Using flow charts to sequence an activity. Using Excel for dealing with data tables and graphs.

These types of experiences above should be taken into account when preparing the scheme of work to ensure a good range of different activities.

This does not mean that there is no place for the normal class where the teacher stands at the front and delivers a lesson. On the contrary, the teacher has an even more central role in ensuring that all the pupils are given the best opportunity possible to understand the concepts and take an active part in their own learning. Rather than lecturing to the pupils, the teacher has to continually be looking for feedback, by questioning the pupils, testing them to see if they understand.

When carrying out practical activities pupils will usually be working in groups. This is an important part of learning how to work together and support each other within the team.

4. Assessment of practical work

See page 137 for an example of how a practical investigation might be assessed using assessment criteria.

The teacher will assess different aspects of practical work. The main areas are:

Area	Skills to be taught	Examples of opportunities for teaching the skills
Ideas and Evidence	Making predictions, looking at how scientists worked in the past, considering evidence and scientific explanations.	Different theories about the structure of the Universe. Early ideas about the elements. Life on Mars? Microbes and disease.
Planning investigations	Making a plan to answer a particular question, identifying key variables, making a fair test, selecting appropriate apparatus.	Particle theory: evidence from simple experiments. Planning solubility experiments. Are all living things made from cells? What does yeast need to grow? How can you purify water?
Obtaining and presenting information	Collecting data, using tables, bar charts and graphs, using ICT, practical tasks such as model making.	Collecting and displaying the results of the above investigations. Investigating habitats, constructing a database on the organisms present. Collecting ecological data during a field trip (e.g. relating populations of plants to light intensity or moisture). Making tables comparing different rocks and minerals.
Considering results	Drawing conclusions, explaining using scientific knowledge and understanding.	Solubility and yeast investigations. Which felt-tip colours are mixtures? Considering second hand evidence for the greenhouse effect. Air pressure demonstrations.
Evaluating results	Accuracy of the results, how investigations can be improved. These aspects of evaluation should be kept in mind when planning a scheme of work. Assessment is considered in more detail on pages 137 and 138	Solubility and yeast investigations. Separating salt from seawater. Does acid rain damage plants?

5. Teaching materials and resources

This course is designed so that teachers can choose text books in English as appropriate for their pupils. As the Integrated Curriculum is designed to cover the Spanish and English

objectives, there is no "ideal" textbook. However, given the methodological approach, many teachers may find an English textbook to be more appropriate.

The British system has 5 years of secondary education from year 7 to year 11; the equivalents of these in the Spanish system are:

Y7	6º Primaria	Key Stage 3
Y8	1º ESO	Key Stage 3
Y9	2º ESO	Key Stage 3
Y10	3º ESO	Key Stage 4
Y11	4º ESO	Key Stage 4

Y7 to Y9 are called Key Stage 3 and are taught in secondary schools.

In the Integrated Curriculum some of the Y7 work will have been done in 6º Primaria but we have designed the curriculum to cover as much of Y7 and Y8 in 1º ESO as possible. 2º ESO is a combination of Y8 and Y9 work. The topic order is flexible to correspond with the chosen textbooks and the supplementary material available. However it is suggested that Biology, Physics, Chemistry and Geology topics could be alternated within each term to give a more varied course. This would also ensure that one whole area of Science (such as Physics) is not missed out at the end of the year because of lack of time.

The Science Curriculum

The Science curriculum is divided into four main sections:

Space
Physics and Chemistry
Geology
Biology

This is not necessarily a teaching sequence, in fact it is suggested that the different sections should be mixed up so that the pupils do not have a large block of Biology at the end of each year. Parts of the Biology, Physics and Chemistry could be done in each term.

Each of the sub-sections is split up into a suggested teaching sequence which should be followed as some concepts need to be introduced before others.

The introduction to each section includes the titles of the section and the areas to be covered. There is also a section on assumed knowledge, which summarises the sections of the syllabus already covered in Primary 6 (or sometimes Primary 5) or, in the case of ESO 2, already covered in ESO 1. This could be used to introduce the section to the pupils by finding out what they already know. It could be done using a quick quiz. It is important to realise that the pupils will already have a great deal of scientific knowledge and understanding; we have to find out how much and then build on this foundation.

Where appropriate, reference has been made to a link with literacy (LL) geography (GL) mathematics (ML) history (HL) or ITC (IT) in the schemes of work.

The **key words** should be displayed on a vocabulary board whilst the topic is being studied to focus attention and aid spelling.

- **Duration of lesson** The suggested time of the lesson or lessons, usually 1 or 2 hours.
- **Lesson content** This is what will be taught during the lesson.
- **Lesson objectives** This is an outline of the learning expectations for pupils from that lesson.
- **Suggested Activities** Ideas of how to teach the lesson content.
- **Resources** Suggestions of useful resources which are needed or would be useful for that lesson.
- **Assessment** These should be used in conjunction with the assessment section.
  These are suggestions for assessment opportunities that may come up in each lesson.

1. Science Targets

In 1st and 2nd year of ESO pupils should be taught:

Ideas and evidence in science

- about the interplay between empirical questions, evidence and scientific explanations using historical and contemporary examples (for example the possible causes of global warming)
- that it is important to test explanations by using them to make predictions and by seeing if evidence matches the predictions
- about the ways in which scientists work today and how they worked in the past, including the roles of experimentation, evidence and creative thought in the development of scientific ideas

Investigative skills

Planning

- use scientific knowledge and understanding to turn ideas into a form that can be investigated, and to decide on an appropriate approach
- decide whether to use evidence from firsthand experience or secondary sources
- carry out preliminary work and to make predictions, where appropriate
- consider key factors that need to be taken into account when collecting evidence, and how evidence may be collected in contexts (for example, fieldwork, surveys) in which the variables cannot readily be controlled
- decide the extent and range of data to be collected and the techniques, equipment and materials to use (for example, appropriate sample size for biological work)

Obtaining and presenting evidence

- use a range of equipment and materials appropriately and take action to control risks to themselves and to others
- make observations and measurements, including the use of ICT for data logging (for example, variables changing over time) to an appropriate degree of precision
- make sufficient relevant observations and measurements to reduce error and obtain reliable evidence
- use a wide range of methods, including diagrams, tables, charts, graphs and ICT, to represent and communicate qualitative and quantitative data

Considering evidence

- use diagrams, tables, charts and graphs, including lines of best fit, to identify and describe patterns or relationships
- use observations, measurements and other data to draw conclusions
- decide to what extent these conclusions support a prediction or enable further predictions to be made
- use their scientific knowledge and understanding to explain and interpret observations, measurements or other data, and conclusions

Evaluating

- consider anomalies in observations or measurements and try to explain them
- consider whether the evidence is sufficient to support any conclusions or interpretations made
- suggest improvements to the methods used, where appropriate

Space

Students should be taught:

The Solar System

- how the movement of the Earth causes the apparent daily and annual movement of the Sun and other stars
- the relative positions of the Earth, Sun and planets in the Solar System
- about the movements of planets around the Sun relating these to planet day length and years
- that the Sun and other stars are light sources and that the planets and other bodies are seen by reflected light

Physics and Chemistry

Students should be taught:

Solids, liquids and gases

- how materials can be characterised by melting point, boiling point and density
- how the particle theory of matter can be used to explain the properties of solids, liquids and gases, including changes of state, gas pressure and diffusion

Elements, compounds and mixtures

- that the elements are shown in the periodic table and consist of atoms, which can be represented by symbols
- how elements combine through chemical reactions to form compounds with a definite composition
- that mixtures (for example, air, sea water and most rocks) are composed of constituents that are not combined
- how to separate mixtures into their constituents using filtration, evaporation, distillation, chromatography and other appropriate methods

Chemical changes

- how chemical and physical changes and how new materials can be made
- what to look for to see if a chemical reaction has occurred, and they should give some examples of chemical reactions
- how to distinguish metals and non metals in order of their properties
- how to know which kinds of chemical react with acids to form hydrogen

- how to know reactions of a variety of substances with oxygen. They should know chemistry laws: conservation of mass
- how to write word equations to summarise simple reactions

Acids and bases

- to use indicators to classify solutions as acidic, neutral or alkaline, and to use the pH scale as a measure of the acidity of a solution
- about some everyday applications of neutralisation

Physical processes

- how the forces act and their effects, how to measure forces and their units
- how to recognise that motion is affected by forces including gravitational attraction, magnetic attraction and friction
- some examples of helpful friction and unhelpful friction
- how to distinguish balanced and non balanced forces (for example, forces are balanced when an object is stationary)
- to understand that the sum of several forces determines changes in the direction or the speed of movement of an object
- how to interpret simple distance/time and speed/time graphs

Light

- that light travels at a very high speed, much faster than sound
- that light travels in a straight line and that the path of light can be represented by rays
- that materials may be transparent, translucent or opaque and that light may be absorbed, transmitted or reflected when it hits an object
- that light is reflected from plane surfaces in a predictable way

Sound

- about amplitude and pitch in musical instruments
- that sound is caused by vibrations and that a picture of sound waves can be shown on an oscilloscope
- that sound needs a medium to travel through, it cannot pass through a vacuum
- how loudness can be measured in decibels
- about human hearing and how deafness may be caused by loud sounds
- about the differences between sound and light

Heat and temperature

- about the Celsius temperature scale
- about the difference between heat and temperature
- how heat is conducted through materials
- how the particle model can be used to explain thermal conduction
- about insulation and how air is a very good insulator
- that solids, liquids and gases expand on heating and how this can be explained using particle theory
- about how heat can be transferred by convection in liquids and gases
- about the radiation of heat waves
- some of the practical applications and consequences of heat transfer by conduction, convection and radiation

- that when physical changes (for example, changes of state, formation of solutions) take place, mass is conserved
- about the variation of solubility with temperature, the formation of saturated solutions, and the differences in solubility of solutes in different solvents

Geology
Students should be taught:

- about the expansion, contraction and the freezing of water can lead to the physical weathering of rock
- that rocks at the Earth's surface disintegrate through exposure to water in the environment which causes chemical reactions
- that rock fragments become sediment grains which can be transported by water currents and deposited when the energy is dissipated
- that the remains of dead organisms and their shelly material can accumulate to form sediments
- to relate a landscape to a process of weathering
- about the formation of rocks by processes that take place over different timescales, and that the mode of formation determines their texture and the minerals they contain
- how igneous rocks are formed by the cooling of magma, sedimentary rocks by processes including the deposition of rock fragments or organic material, or as a result of evaporation, and metamorphic rocks by the action of heat and pressure on existing rocks
- that the Earth's layers and lithosphere is composed of plates in relative motion and that plate tectonic processes result in the formation, deformation and recycling of rocks
- the origin, depth and distribution of earthquakes in relation to major features of the Earth's surface
- the evidence for the movement of continents
- characteristics of seismic waves generated by earthquakes
- volcanic processes and relationship with plate margins
- the Earth's atmosphere and hydrosphere

Biology
Students should be taught:

Cells and cell functions

- that animal and plant cells can form tissues, and tissues can form organs
- that complex organisms have specialised organ systems
- that the survival of whole organisms depends on the successful working of all their parts
- the functions of chloroplasts and cell walls in plant cells and the functions of the cell membrane, cytoplasm and nucleus in both plant and animal cells
- ways in which some cells, such as ciliated epithelial cells, sperm, ova, and root hair cells, are adapted to their functions
- to relate cells and cell functions to life processes in a variety of organisms
- that life processes such as respiration and photosynthesis occur in cells
- that respiration and photosynthesis are processes that involve energy transfer from the Sun through light to carbohydrates
- that energy transfer enables cells to gain and make use of energy to live

Classification

- to classify living things into the major taxonomic groups including the five kingdoms
- about humans as animals

Living things in their environment

Adaptation and competition
- about ways in which living things and the environment can be protected, and the importance of sustainable development
- that habitats support a diversity of plants and animals that are interdependent
- how predation and competition for resources affect the size of populations (for example, bacteria, growth of vegetation)
- that living things are adapted to the environment in a variety of ways

Feeding relationships
- about food webs composed of several food chains, and how food chains can be quantified using pyramids of numbers
- how toxic materials can accumulate in food chains
- how energy flows through ecosystems and can be represented as pyramids of energy
- about the Biosphere and how it can be divided into Biomes

The effects of humans on the environment
- that air pollution can be caused by sulphur dioxide which leads to acid rain
- some of the sources of water pollution
- that biomass (burning wood and methane generation) can be used an energy source

2. ESO 1. Units of work

Topic: Living Things- Life Processes

Key words: Movement, respiration, sensitivity, growth, reproduction, nutrition (Mrs Gren).

Previous learning experience: How animals are born, grow, use their senses, move, eat, breathe and reproduce.

Topic outline:
- To consolidate work taught in years 5 and 6.
- To introduce the key concepts of Mrs Gren.

Key web page:
http://www.bbc.co.uk/schools/ks3bitesize/science/organisms_behaviour_health/life_processes/activity.shtml

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Brainstorm ideas about what makes something alive	To introduce the life processes; to use Mrs Gren mnemonic to link each of these words to the fact that they are the characteristics all living things must have.	Ask if a car is alive. Can it move? Does it eat? Does it breathe? Elicit ideas about what conditions we would need to survive. Show BBC KS3 web link that defines MRS GREN.	Show a car at a petrol station to stimulate discussion on what we mean when we say something is a living thing. Is it alive? (review) http://lgfl.skoool.co.uk/content/primary/science/when_is_matter_alive/index.html Main life processes http://www.bbc.co.uk/schools/ks3bitesize/science/organisms_behaviour_health/life_processes/activity.shtml	To be able to describe what makes something a living thing. To list the 7 life processes that are characteristic to all living things. To compare the differences between an object and a living thing.
1 hour	Examples of different living things; (mainly plants and animals). Movement Respiration Sensitivity Growth Reproduction Nutrition.	To reinforce the concepts of life processes. To understand the difference between breathing and respiration. To understand sensitivity as a response to external factors. To explain that growth means an increase in the size and number of cells. To recognize the reproduction as an increase of number (cells or individuals). Importance of nutrition to get matter and energy. To be aware of external (visible) and internal (non visible life processes). To define all the life processes.	Brainstorm previous ideas about the definitions of life processes. Follow the process of respiration in a human and in a plant. Play- role, drawing or video. Show videos and examples of movement in plants and inside a cell.	http://www.zephyrus.co.uk/characteristics.html Life processes in animals: http://www.oum.ox.ac.uk/thezone/animals/life/index.htm carnivorous plants http://www.youtube.com/watch?v=z10iiTkV3XU&feature=related http://www.youtube.com/watch?v=0SjSJapQJzc&feature=related sensitive mimosa http://www.youtube.com/watch?v=Zq3UuHlPLQU&feature=related tropism http://www.youtube.com/watch?v=zctM_TWg5Ik&feature=related	Assess understanding from questions. Match questions. Gap fillings.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Focus on minimum conditions needed to stay alive on our planet (water, sun, oxygen, temperature) Examples of extreme conditions of life and how different living things are adapted.	To know the different conditions that make life possible on our planet and how living things are adapted to. To introduce the concept of the biosphere. Introduction to biodiversity and evolution.	From a human's needs extend in form of a graph, mind map or similar showing the main factors that affect the life on our planet. Discuss why scientists think that it is possible that life had existed on Mars. What are the conditions needed for life?	Puzzle about What does life need? http://www.marsquestonline.org/investigations/01_life.html Interactive activity comparing mars and earths conditions of life. http://www.marsquestonline.org/investigations/02_surface.html Extreme condition sea vents creatures http://www.teachersdomain.org/resource/tdc02.sci.life.eco.deepseavents/	List conditions for human life. List conditions for life. Essay about life on earth and other planets.

Topic: Living Things-What are Living Things Made From? Cells

Key words: Nucleus, cell membrane, cell wall, cytoplasm, organelles (mitochondria, chloroplasts and vacuoles) tissue.

Previous learning experience: Plants and animals have organs and organ systems which carry out particular life functions. The names and functions of some major organs in plants and animals. Some of the life processes common to living things.

Topic outline:

- Introduction to cells and cell theory.
- Learn that cells are the basic units of life and are organised into tissues from which organs are made:
  - explore cell structure and differences between plant and animal cells
  - learn about some functions of cells

Key web page: http://www.bbc.co.uk/schools/ks3bitesize/science/organisms_behaviour_health/cells_systems/revise1.shtml

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Cell structure (Nucleus, cytoplasm, cell membrane and organelles) Plant cells also have a cell wall, large vacuoles and sometimes chloroplasts. Concept of prokaryotic and eukaryotic.	To identify the main parts of an animal and plant cell. To understand the main functions of the different parts of the cell (plant and animal cell).	Use audiovisual material to show the main parts of the cell focusing on the similarities and differences between plant and animal cells. Drawing and labelling plant and animal cells.	General http://www.bbc.co.uk/schools/ks3bitesize/science/organisms_behaviour_health/cells_systems/revise1.shtml Game about cell: http://www.purposegames.com/game/153/info http://www.purposegames.com/game/2bde3fa5 Plant cell and animal cell http://lgfl.skoool.co.uk/content/keystage3/biology/pc/learningsteps/CAFLC/launch.html Prokaryotic versus eukaryotic and specialised cells http://glencoe.mcgraw-hill.com/sites/dl/free/0078600472/164155/00035805.html	Making a model of a cell (paper models, plasticine models). Drawing and labelling plant and animal cells. Fill a table focusing on similarities and differences between plant and animal cells.
1 hour	Structure and function specialised cells. Red blood cells, muscle cells, sperm cells, nerve cells. Xylem cells, palisade cells, root hair cells. Tissues Main animal and plant tissues.	To link the structure of cell and tissues to the functions they have. Some cells are specialised to carry out special functions.	Use audiovisual material. Identify a variety of specialised cells and tissues. To observe prepared animal tissue slides.	Résumé and test http://www.bbc.co.uk/schools/ks3bitesize/science/organisms_behaviour_health/cells_systems/activity.shtml http://lgfl.skoool.co.uk/content/keystage3/biology/pc/learningsteps/SPALC/launch.html From cells to tissues http://www.teachersdomain.org/resource/tdc02.sci.life.stru.different/ quiz http://www.bbc.co.uk/apps/ifl/schools/ks3bitesize/science/quizengine?quiz=cells&templateStyle=science	Match questions that relate structure and function. Identify cards of cells and tissues. List the main animal tissues and function. List the main plant tissues and functions.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
				http://www.teachersdomain.org/resource/tdc02.sci.life.cell.cellgallery/ game summary http://mrhardy.wikispaces.com/file/view/Animal%20Cell%20and%20Plant%20Cell%202.swf http://wsgfl2.westsussex.gov.uk/aplaws/intergames/sec_science/cells.swf	
1 hour	Tissues make organs. The major human organs: Plant organs: functions of the roots, stem and leaves	Plants and animals have organs which carry out particular life functions.	Use audiovisual material to show the positions and functions of the main organs. To observe the main parts of a typical plant. Highlight the relationship between structure and function.	Résumé and test http://lgfl.skoool.co.uk/content/keystage3/biology/pc/learningsteps/OLTLC/launch.html http://lgfl.skoool.co.uk/content/keystage3/biology/pc/learningsteps/ORSLC/launch.html skeleton http://www.childrensuniversity.manchester.ac.uk/interactives/science/bodyandmedicine/skeleton.asp digestive system http://www.childrensuniversity.manchester.ac.uk/interactives/science/bodyandmedicine/digestive.asp games about organ systems http://www.teachersdomain.org/asset/lsps07_int_bodysystems/ http://www.hps.cam.ac.uk/whipple/explore/flashpages/thebody/	Paper models Plastic models Labelling drawings showing the main organs of a plant and an animal. Match questions that relate structure and function.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Cell theory	The cell is the basic unit of structure. The cell is the basic unit of function. All cells arise from pre-existing cells.	Time line showing discovery of the cell and cell theory. Contributions of different scientists. Literacy activity with the biography or discoveries of Leeuwenhoek, Hooke, Schlieden, Schwann or Virchow.	PowerPoint about cell theory: http://step.nn.k12.va.us/science/lifesci/ppt/Cell_Theory_b.ppt Time lines: http://www.timeline-help.com/the-cell-theory-timeline.html	Time line showing discover of cell and cell theory. Literacy activity (LL) (HL)

Topic: Living Things-Cells-Use of Microscope and Stereomicroscope

Key words: Ocular, objective, magnification, slide, cover slip, focusing, size, scale.

Previous learning experience: Some ideas about light and lenses.

Topic outline:
- Use of magnifier lens and optical microscope.
- Concept of magnification power.

Key web page: http://www.microscope-microscope.org/microscope-home.htm

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Use of stereo microscope. Use of optical microscope.	To observe the difference between external and internal structures. To learn how to focus a microscope. To learn how to work out magnification.	Observe the same specimen through a stereomicroscope and a microscope. Using a slide made with graph paper sealed with cell tape is an easier way to realise the differences between looking at the surface of a specimen or looking through the specimen. This material is very useful to explain magnification concept.	Parts and use of a stereomicroscope http://www.hometrainingtools.com/using-a-stereo-microscope-science-teaching-tip/a/1119/#UsingStereoMicroscope http://lgfl.skoool.co.uk/content/keystage3/biology/pc/learningsteps/UAMLC/launch.html Compound microscope parts http://bio.rutgers.edu/~gb101/lab1_cell_structure/section2_frames.html How to use a microscope http://shs.westport.k12.ct.us/mjvl/biology/microscope/microscope.htm Laboratory material	Fill labelling diagrams of both microscopes. Evaluation grid to check group work; observation and measurements; scientific understanding to explain and interpret observations, measurements and other data. (ML)
1 hour	Observations of living material (onion skin, yeast, petals, moss) using microscope and stereomicroscope.	To be able to prepare material for viewing under a microscope. To work in groups. Science Skills Literacy production	Use a microscope safely and effectively. Prepare simple specimens on a slide for observation using a microscope. Make observations using a microscope and to record these as drawings.	Lab. material. Biological specimen. How to prepare a plant cell http://lgfl.skoool.co.uk/content/keystage3/biology/pc/learningsteps/PSCLC/launch.html How to prepare an animal cell http://lgfl.skoool.co.uk/content/keystage3/biology/pc/learningsteps/PSALC/launch.html Preparing material http://www.microscope-microscope.org/activities/school/preparing-slides.htm	Drawing with scale (power of magnification) the observed material. (ML) Report writing following a classic scheme (aims, equipment, method, data, results, conclusion, improvement).

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	The discovery of the microscope.	Literacy activity. To use skimming, scanning, highlighting and note taking as appropriate to different texts. To learn how ideas about the structure of living things have changed.	Read text and look at information about the history of microscope discovery. Show pupils evidence of the early observations made by Robert Hooke and others to illustrate how the development of the microscope changed the way in which scientists viewed the structure of living things.	History of microscope http://msnucleus.org/membership/html/jh/biological/microscopes/lesson1/microscopes1a.html http://www.history-of-the-microscope.org/ http://www.az-microscope.on.ca/history.htm	Time line focusing on the most important facts and scientist. Identify key points using an appropriate technique *e.g. using flow charts or a series of labelled diagrams.* (LL) (HL)

Topic: Living Things-The Five Kingdoms. Classification of Living Things

Key words: Characteristics, taxonomic group, variation, classification, identification, genus, species, autotrophic, heterotrophic, monera-bacteria, fungi, protosist, algae.

Previous learning experience: Classify living things as: animals, plants and microorganisms.

Topic outline:
- Practice in making and using keys.
- The Five Kingdoms: classification of living beings.
- Introduction to taxonomy.

Key web page: http://www.youtube.com/watch?v=5uJ8QeFRvJA&feature=related

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Use of dichotomy keys or flow charts, tree graphs or gathering groups to classify.	To observe, take notes, organise and represent. To understand the basis of and the reasons for the classification of living things. To practice in making and using keys.	Classification of objects (buttons, screws, nails) Classification of class (living things, nonliving things, pupils). Classification of models, cards. A practical exercise in the classification of organisms. Making a key to distinguish characteristics.	Dichotomous Key Activity http://www.lnhs.org/hayhurst/ips/dichot/ http://www.biologyjunction.com/dichotomous_keying.htm	Identify similarities and differences in organisms of the same species. Use dichotomous key. Elaborate a dichotomous key.
2 hour	Biodiversity concept Main features of five kingdoms.	To introduce the concept of biodiversity. General common feature versus specific features. Important external facts and internal features.	Table gathering the main factors of five kingdoms focusing on type of cell, organisation of cells (tissues) way of obtaining nutrients (energy). Include a representative and common example of each group with extra work about life use etc… Draw examples of representatives from each group.	Biodiversity interactive picture http://www.nhm.ac.uk/eb/speciesscape.shtml General overview of five kingdoms http://www.youtube.com/watch?v=5uJ8QeFRvJA&feature=related	Accurate table gathering the main factors of the five kingdoms. Matching questionnaire. Elaborate a poster wall or PowerPoint with the species chosen.
1 hour	Linnaeus terminology. Family genus species.	To understand the importance of classifying living things.	Choose and research the Latin name of some known animals comparing the common and non common features (dogs, cats, lions, wolves). Elaborate pyramid, Venn diagram or other graph to represent the inclusion in a taxonomic group. Make a family tree with parents grandparents' cousins. Introduce the classification of human species.	A film about Carl Linnaeus http://www.youtube.com/watch?v=Gb_IO-SzLgk&feature=related To find common names and Latin names http://www.nhm.ac.uk/eb/lookupsp.shtml	Literacy activities A list of latin names of common species and gathering in groups. (LL) (HL)

Topic: Living Things- The Five Kingdoms. Monera, Fungi, Protoctista, Plants and Animals

Key words: Mosses, ferns, conifers, vertebrates, reptiles, amphibians, mammals, birds, fish, invertebrates, arthropods, arachnids, insects, crustaceans, coelenterates, sponges, roundworms, flatworms, cnidarians, myriapods, annelids, echinoderms and mollusks.

Previous learning experience: Identify microorganisms as living things. Recognize the main distinguishing features of microorganisms. Recognize beneficial mutual or harmful properties of microorganisms. General features of animals and plants.

Topic outline:
- Five kingdoms description.

Key web page: http://www.teachersdomain.org/resource/lsps07.sci.life.oate.animalclass/

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Microorganisms concept. Useful and harmful microorganism.	To understand the difference between taxonomic classification and other types of classification (useful /harmful; wild/tamed).	Classify bacteria, fungi and viruses as micro-organisms, name some of the diseases they can cause and describe how they can be transmitted. Use of microorganisms in industry. Importance of microorganisms in soil formation.	Review from previous year helpful and harmful http://www.bbc.co.uk/schools/ks2bitesize/science/living_things/microorganisms/play.shtml http://www.sciencekids.co.nz/gamesactivities/microorganisms.html interactive screen about the most common microorganism http://www.childrensuniversity.manchester.ac.uk/interactives/science/microorganisms/whatandwhere.asp	Essay about microorganisms and disease or microorganisms and industry or ecological importance. Use of information. Check pupils work for accuracy of ideas and understanding.
1 hour	Virus Monera (Bacteria)	Properties of virus Properties of bacteria. Common bacteria	Viruses cause diseases such as colds, polio, mumps, chicken pox, AIDS. Are they alive? Why not? (lack of respiration, reliance on other living cells for reproduction, no movement, no excretion, no respiration). Common diseases caused by bacteria. (Pneumonia, bronchitis, Salmonellosis, Cholera gastroenteritis, Diarrhea Meningitis, Tetanus).	Flu Virus attack http://www.youtube.com/watch?v=Rpj0emEGShQ&feature=related http://www.cposcience.com/home/Portals/2/Media/post_sale_content/viral%20dna.swf	Wall poster or essay about common virus and diseases they cause.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
		Prevention of infection safety measures	Penicillin discovery. Fleming literacy activity. Prevention of infectious diseases.	Bacteria general characteristics http://glencoe.mcgraw-hill.com/sites/dl/free/0078600472/164155/00044676.html Soil bacteria http://www.microbelibrary.org/images/loynachan/bacteria-480x360.mp4 Fleming video introduction penicillin http://www.youtube.com/watch?v=iXJhu1T3XQk&feature=related http://www.teachersdomain.org/resource/odys08.sci.life.gen.discovery/ Fleming biography http://myhero.com/go/hero.asp?hero=a_fleming http://www.answers.com/topic/alexander-fleming	Wall poster or essay about common bacteria and diseases; bacteria and industry; bacteria and soil. Display work on Fleming. Check pupils work for accuracy of ideas and understanding. (LL) (HL)
1 hour	Protocists Main characteristic	To learn that there are single celled organisms that may look like plants (have chloroplasts - Euglena) or like animals (e.g. Amoeba or Paramecium).	Protoctists. Looking at pond water under the microscope. Investigating what organisms are present using a key to identify some of the organisms. Importance of algae in ecosystems, as food, medicine and fuel.	Protocists general characteristics http://glencoe.mcgraw-hill.com/sites/dl/free/0078600472/164155/00044685.html Soil algae http://www.microbelibrary.org/images/loynachan/cyano-algae-320x240.mov	Accurate labelled drawing of observations.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Fungi main characteristic Lichens	To learn that Fungi are very common but they live underground or in dead wood etc. Fungi are made up from fine hair like cells called hyphae. Fungi feed on ready-made food like us. Special symbiosis between alga and fungi.	Fungi. Examine some different examples of fungi such as that found on moldy bread, or rotting wood. Look at them under the microscope. Identify the hyphae as the main organism. Look for spores. What are the fungi feeding on? Look at mushrooms, toadstools etc. Identify them as the fruiting bodies not the main body of the fungus which grows underground. Cut open the mushroom, look at the gills and spores under the microscope. Observe lichens in lab.	Soil fungi http://www.microbelibrary.org/images/loynachan/fungi-320x240.mov Laboratory microscope and specimens. A single celled fungus: yeast What does yeast need to grow? Put the yeast water mixture into a 100ml conical flask with a balloon over the end. Yeast will produce carbon dioxide, so the biggest balloons show the greatest activity. Which temperature is best?	Accurate labelled drawing of observations. Share ideas and information, carry out the task and then review ideas. Decide what to measure. Assessment of how to control variables Accurate drawing of observations.
1 hour	Plants Main plants groups: mosses, ferns, conifers and flowering plants	To recognize the main external characteristics of the main plant groups.	Observe the characteristics of mosses, ferns, conifers cones and flowers with stereomicroscopes and magnifier.	Plant classification: http://www.youtube.com/watch?v=bYNiqAAuMnc&feature=related Movie about gymnosperms and angiosperms http://glencoe.mcgraw-hill.com/sites/dl/free/0078600472/164213/00044690.html	Accurate drawing of specimens in the lab. Wall poster. PowerPoint presentation with photos taken in lab. or another display to show the four groups.
1 hour	Animals	To recognize the differences between groups of vertebrates.	Briefly review what the pupils already know about the main invertebrate groups and their distinguishing features. Adaptations to environment.	Game to identify animals http://www.teachersdomain.org/resource/lsps07.sci.life.oate.animalclass/ Quiz to identify animals http://www.teacher.scholastic.com/activities/explorations/bug/bugs_interactive.swf Interactive activity to classify animals http://www.nhm.ac.uk/eb/sortitout1.shtml	• Classify animals as invertebrate or vertebrate. •Give an example of one vertebrate group which can be subdivided. • Find and present information about one subgroup of vertebrates in an appropriate written format. • Summarise the features

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
		Recognising the differences between groups of invertebrates.	Describe representatives of each of the main invertebrate groups: echinoderms, molluscs, annelid worms, crustaceans, coelenterates, sponges, arthropods. Adaptations to environment. Use common invertebrates used as food.	Invertebrates general features http://glencoe.mcgraw-hill.com/sites/dl/free/0078600472/167348/00038301.html Invertebrates key http://www.nhm.ac.uk/eb/invertkey.html http://www.youtube.com/watch?v=zWGPu84bLH4	that groups of vertebrates have in common. • Give an example of one invertebrate group which can be subdivided. • Find and present information about one subgroup of invertebrates in an appropriate written format. • Summarise the information about some main groups in a table.

Topic: Living Things-Biodiversity and Conservation

Key words: Biodiversity, fossils, extinction endangered species, plagues, invaders.

Previous learning experience: Awareness that different habitats support different plants and animals and have identified ways in which plants and animals in a particular habitat depend on each other. Students have explored local habitats to establish the variety of living organisms within them.

Topic outline:
- Fossils and biodiversity.
- Adaptations to habitats.

Key web page: http://www.pbs.org/wnet/nature/lessons/endangered-relationships/video-segments-crash/4739/

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1hour	Fossils, diversity Natural extinction	Concept of fossils as former living things. Process of Fossilisation. Extinction as a natural event in evolution.	Explain how the materials could decay or remain and the possibility of change. Review the different causes of extinction of dinosaurs.	Fossilisation http://mrhardy.wikispaces.com/file/view/Fossilisation.swf http://www.teachersdomain.org/asset/ess05_int_fossilintro/ A living fossil http://www.pbs.org/wnet/nature/lessons/endangered-relationships/video-segments-crash/4739/ What killed the dinosaurs? http://www.pbs.org/wgbh/evolution/extinction/dinosaurs/index.html	Accurate and labelled drawing of fossils. Infer hypothesis from facts.
1hour	Adaptation and introduction to habitat. Distribution of organisms in different habitats is affected by environmental factors, e.g. light, nutrients or water availability.	To identify features which are different in different habitats. To describe adaptations to life in a variety of habitats: • how habitats vary • how plants and animals are adapted to live in a particular habitat.	Show the pupils various examples of habitats using photos, video footage, posters etc. Choose at least one terrestrial and one aquatic habitat. Highlight ways in which habitats vary through the year. Describe some strategies which plants and animals adapt to avoid climatic stress.	Humming birds beaks http://www.pbs.org/wnet/nature/lessons/the-birds-and-the-beaks/video-segments-extraordinary-birds/1481/ Provide pupils with a list of adaptive animal and plant characteristics and ask them to decide on the most important for a particular habitat. Plant adaptations http://lgfl.skoool.co.uk/content/primary/science/plants_diff_places/index.html Animal adaptations http://lgfl.skoool.co.uk/content/keystage3/biology/pc/learningsteps/ADSLC/launch.html Habitats http://www.bbc.co.uk/nature/habitats	Match questionnaire about adaptations and habitats.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1hour	Preservation and extinction endangered species, plagues and invaders. Impact of human on the earth.	Main factors that affect the survival of a species. To understand the growth of human populations. Our dramatic and dangerous effect on the ecology of the whole Earth.	Describe the factors that affect the survival of a species: Habitat destruction, introduced species, overexploitation (hunting, overfishing, and cutting down forests) climate change, toxic waste pollution…).	Quiz about diversity http://www.amnh.org/ology/biodiversity#features/whatdoyouknow_bio/?TB_iframe=true&height=450&width=750 A table game of extinction http://www.amnh.org/ology/biodiversity#features/stufftodo_bio/endangered.php?TB_iframe=true&height=500&width=750 Importance of species http://www.pbs.org/wnet/nature/lessons/endangered-relationships/video-segments-crash/4739/ Ten species in extreme danger of extinction http://www.canaryzoo.com/Endangered%2010%20species.htm Human impact: http://www.bbc.co.uk/schools/ks3bitesize/science/environment_earth_universe/changes_in_environment/activity.shtml	Essay about local or regional endangered species, plague or invaders. List the effects of human activities on biodiversity.

Topic: Matter in the Universe: Properties of Matter

Key words: Strength, elasticity, plasticity, ductility, malleability, hardness, permeability, transparency magnetism, conductivity, flexibility, mass, volume, density.

Previous learning experience: Types of materials.

Topic outline:
- General properties of matter: mass and volume.
- Specific properties: density.

Key web page: http://ww2.unime.it/weblab/mirror/ExplrSci/dswmedia/density.htm

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Warm up. Review from previous years. General properties of materials. Strength, elasticity, plasticity, ductility, malleability, hardness, permeability, transparency magnetism, conductivity, flexibility.	To refresh properties (characteristics of common materials). To link structure and properties of materials with their use.	List common materials used for students in class and home. (Plastic, metal, wood, glass, fabric, stone). Classify and define the materials based on different criteria (natural- artificial, raw-transformed hard, permeable, shiny…..). Choose solid, liquid and gas materials used in everyday life. Try to find differences according to their specific properties such as hardness, fragility, elasticity, plasticity.	Interactive activities: http://www.bbc.co.uk/schools/scienceclips/ages/7_8/characteristics_materials_fs.shtml http://www.bbc.co.uk/schools/scienceclips/ages/5_6/sorting_using_mate_fs.shtml	Dichotomous key or other type of classification of materials. Tables of uses of materials, and properties.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
2 hours	Mass and volume Units and Instruments	To differentiate general properties (mass and volume) from specific properties (colour, taste...). To identify instruments for measuring them and units. Mass – scales kg. Volume – measuring cylinders using ml, describe $m^{3.}$	Measure mass and volume (use regular solids such as cubes). Displacement of water in a measuring cylinder could be used for irregular solids. Compare the volume of a regular dice calculated by using measures and formula with the volume of water displaced in a measuring cylinder.	Laboratory material. Virtual on line lab: http://ww2.unime.it/weblab/mirror/ExplrSci/dswmedia/density.htm	Complete a worksheet with the equipment used, procedure, data and conclusions. (ML)
2 hours	Concept of density.	To identify density as a specific property. Use of density to identify pure substances. (Gold for instance).	Calculate density of different solids. Which solids will float? Test the predictions. Literacy: Students could relate the story of Archimedes's principle.	Virtual lab: http://www.explorelearning.com/index.cfm?method=cResource.dspView&ResourceID=362 Crown of Syracuse http://www.youtube.com/watch?v=wEvtahSn_ms&feature=related http://www.math.nyu.edu/~crorres/Archimedes/Crown/CrownIntro.html http://library.thinkquest.org/4116/History/stories.htm Comparing density (coke tins): http://www.elmhurst.edu/~chm/vchembook/121Adensitycoke.html Density in liquids. http://www.teachersdomain.org/asset/phy03_vid_zhot/	Calculations of density. (ML) Essay report. Assess pupils' ability to make predictions based on scientific principles. (LL) (HL)

Topic: Matter in the Universe: Solids, Liquids and Gases. Particle Theory

Key words: Compressibility, diffusion, expansion, particle, condensing, freezing, melting, evaporation, boiling, vaporization and sublimation.

Previous learning experience: Experience of identifying solids, liquids and gases and describing the properties of each. Know that the same material can exist as a solid, liquid and gas. Have observed that melting solids and freezing liquids are the opposite of each other. Have observed situations in which evaporation and condensation take place.

Topic outline:
- Solids, liquids and gases. Properties.
- Particle theory of solids, liquids and gases.
- Changes of state.

Key web page: http://www.bbc.co.uk/schools/ks3bitesize/science/chemical_material_behaviour/particle_model/activity.shtml

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Properties of three states of matter on the basis of shape, volume, compressibility and ability to move by flow.	To differentiate the three states of matter and highlight their main characteristics.	Investigate the three states of matter. Take a cylinder of wood. Does its shape or volume vary? Repeat with some coloured water. Does its shape or volume change? Predict what happens with gases. Investigate compressibility, diffusion and expansion of gases through different experiments: - Fill a syringe with air and close it with the plunger. Press on it. What happens? - Cover the "mouth" of a flask with a balloon. Heat the flask. What happens? (Even warming with the hands will work, and then cool with ice).	Expansion, size, shape: http://www.bbc.co.uk/schools/ks3bitesize/science/chemical_material_behaviour/behaviour_of_matter/activity.shtml http://www.bbc.co.uk/schools/ks3bitesize/science/chemical_material_behaviour/particle_model/activity.shtml Compression, volume: http://lgfl.skoool.co.uk/content/keystage3/chemistry/pc/learningsteps/SLGLC/launch.html	Make a table to organise information. Accurate essays of experiments.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
				expansion of gas: http://www.teachersdomain.org/asset/phy03_vid_zstraw/	
1hour	The Particle theory of matter. Kinetic theory of matter.	The properties of solids, liquids and gases depend on their particles (molecular structure) and the movement of the particles.	Describe. Act out the **particle theory.** Make a table comparing particle distribution in solids, liquids and gases. Pupils could act as particles or plastic balls in a sheet or marbles on trays can be used for interactive demonstrations.	Particle theory: http://lgfl.skoool.co.uk/content/keystage3/chemistry/pc/learningsteps/TPTLC/launch.html	Drawings showing an understanding of kinetic theory. Variety of observations using correct scientific vocabulary. Elaborate a model of particle theory. Conclusions consistent with the particle theory.
2 hours	Changes of state. Condensing, freezing, melting evaporation, boiling vaporisation, and sublimation.	To explain the change of states on basis of particle theory. To understand the importance of heat and movement of particles to explain the different states.	Explain daily examples of changes of state (shower and glass in the bathroom, cooking and glasses in the kitchen; melting of ice; freezing liquids in the fridge; sublimation of a naphthalene (mothballs). Usefulness of changes of state, distillation of water and alcohol; processing of food and medicines (sublimation-lyophilization) ; melting of metals.	Changes of state: http://lgfl.skoool.co.uk/content/keystage3/chemistry/pc/learningsteps/WATLC/launch.html http://www.footprints-science.co.uk/states.htm Melting and boiling point: http://lgfl.skoool.co.uk/content/keystage3/chemistry/pc/learningsteps/MBPLC/launch.html Simulator of changes of state: http://lgfl.skoool.co.uk/content/keystage3/chemistry/pc/learningSimulations/COSSC/launch.html	Elaborate diagrams showing the changes of state. Wall poster, ICT presentation or essay about industrial use of knowledge in changes of state.

Topic: Matter in the Universe: Pure Substances and Mixtures, Elements and Compounds. Separating Methods

Key words: Element, compound, pure substance, mixture, homogeneous, heterogeneous, periodic table, metals and non metals, filtering, distilling, chromatography, solution, solvents, solute, concentration, saturated solution.

Previous learning experience: Experience of dissolving solids in water and realizing that not all are soluble. Have separated mixtures of solids and liquids. Observe that not all liquids contain water. All materials are made up of very small particles.

Topic outline:
1. Pure substances and mixtures. Homogeneous and heterogeneous mixtures.
2. Atoms and molecules. Elements and compounds. Symbols. Common elements and compounds.
3. Separating mixtures. Sieving, decanting, filtering and distilling.
4. Solutions.

Key web page: http://www.bbc.co.uk/schools/ks3bitesize/science/chemical_material_behaviour/compounds_mixtures/activity.shtml

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Ability to distinguish between pure substances and mixtures. Most common substances are mixtures.	To discuss the different meaning of the word "pure" in everyday language and in scientific language. Definition of "pure substance".	Distinguish between homogeneous and heterogeneous matter. Prefixes homo- / hetero-. Observation of a stone of granite and a mixture of flour and water. What is heterogeneous? What is homogeneous? Why?	Good introduction: http://www.bbc.co.uk/schools/ks3bitesize/science/chemical_material_behaviour/compounds_mixtures/activity.shtml	Ability to classify substances according to particular criteria. Understanding what is meant by homogeneous and heterogeneous matter. Make a list of homogeneous and heterogeneous; pure and impure substances at home.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
2 hour	Elements. An introduction to the Periodic Table. Importance of common elements in the universe in living things and non living things.	Atoms are the basic building blocks of matter. Atoms can be represented by symbols.	Which elements do the pupils know? What are their properties? Pupils could design cards of the elements and build up a periodic table on the wall with the group cards. Which elements are we made from? Amount of main elements in the universe, in earth and in livings things.	Game.30 common elements: http://www.purposegames.com/game/186/info Quiz http://www.docbrown.info/ks3chemistry/emc1mp.htm	Appropriate card with the symbol of element biological and industrial use and hazard Appropriate graph comparing the percentage of common elements in universe, lithosphere and living things.
2 hours	Metals and non metals properties. Alloys as examples of metal mixtures	Properties of metals and non-metals that are useful in our civilization.	Provide pupils with a range of questions about metals and non-metals, e.g. Are metals good conductors of heat/electricity? Where do we get metals (iron, zinc, copper, lead, gold and silver) from? What are they used for? Help pupils to make a comparison of non-metals and metals and explain what makes metals useful.	Atoms and properties metals and non metals http://www.bbc.co.uk/schools/ks3bitesize/science/chemical_material_behaviour/atoms_elements/activity.shtml metals http://lgfl.skoool.co.uk/content/keystage3/chemistry/pc/learningsteps/MTLLC/launch.html non-metals http://lgfl.skoool.co.uk/content/keystage3/chemistry/pc/learningsteps/NMTLC/launch.html alloys: steelmaking: http://www.youtube.com/watch?v=8OZ-WSQmLgc http://www.youtube.com/watch?v=Ea_7Rnd8BTM&feature=related http://www.steel.org/Internal/Renderers/ArticleRenderer3.aspx?targetItem=8f069c7f-c603-4e61-8b19-8c8c96becba1&siteLocation=1a9b9451-cfae-4d50-8210-189fa50644b8	Produce an information sheet that is correct and well sequenced and contains appropriate information making some generalizations about the properties of metals which make them useful.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
2 hours	Separating mixtures: Filtering, evaporating. Separating mixtures of different liquids: Distillation Chromatography	To use basic laboratory techniques (dissolving, filtering, and evaporation) to obtain salt from a salt solution. Distillation can separate liquids with different boiling points. Chromatography can be used to separate mixtures of different liquids (to identify them).	How can we get clean salt out of dirty seawater? (Alternatively: How can we get clean salt from dirty salt?) Distilling demonstration to separate water and alcohol. Demonstrate how to separate the different coloured compounds in an ink mixture on filter paper, using a wick of the paper dipped into the solvent (water). Provide pupils with prepared chromatograms and information about the contexts in which these might be needed, e.g. in forensic science, in identifying traces of substances in urine or medical preparations , and asking them to interpret the evidence from each chromatogram.	Production of salt by evaporation: http://videos.howstuffworks.com/discovery/35570-howstuffworks-show-episode-9-solar-salt-production-video.htm http://www.good-science-fair-projects.com/evaporation.html http://www.industry-animated.org/evap_brine.swf desalination: http://videos.howstuffworks.com/planet-green/27665-g-word-water-desalination-video.htm desalination by reverse osmosis: http://www.youtube.com/watch?v=nbPNw3JaL7w&feature=related Distillation: http://www.footprints-science.co.uk/flash/distillation.swf Chromatography: http://www.footprints-science.co.uk/Chromatography.htm http://www.exploratorium.edu/afterschool/activities/index.php?activity=172&program=951 Salt from rock salt: http://resources.schoolscience.co.uk/ICI/11-14/materials/match3pg1.html	Descriptions of experiment and analysis of results. Essay about different ways that we use separating methods in our society.
2 hours	Elements can be joined together to make compounds. The importance of hydrogen and oxygen in the universe and in the Earth.	Compounds consist of fixed combinations of atoms that cannot be easily separated.	Some common examples such as water, salt, carbon dioxide etc. Splitting water: using electrolysis to acidified water to make oxygen and hydrogen, electrolysis of salt water to make chlorine gas.	Elements and compounds: http://www.teachersdomain.org/asset/lsps07_int_naturematter/ Making iron (II) sulphide: http://www.youtube.com/watch?v=p5gf-odaxKA&feature=related Electrolysis http://myweb.tiscali.co.uk/chemteach/sw	Model of water, salt, carbon dioxide with plasticine, cork, polystyrene, toothpick, wire… etc .

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
				f/electrolysis2.swf Use of hydrogen as fuel: How a hydrogen cell works: http://www.youtube.com/watch?v=6UwSazq8GTU In a car http://www.youtube.com/watch?v=kTXdhuIn8go&feature=related	
2 h	Solutions as homogeneous mixtures. Definition of solution, solvent, solute, concentration.	To use the particle model to explain what happens when a substance dissolves. More salt dissolves in hot water than in cold. Dissolving is faster in hot water because the particles are moving more quickly.	Investigations: Pupils plan their own investigations. How much salt can dissolve in 50ml of water? What happens if you use hot water? Can more salt dissolve? Demonstration of the different solubility of many substances (e.g. copper sulphate or salt, sugar, flour, marbles, sand...)	What happens when salt dissolves? Animation of salt dissolving. http://resources.schoolscience.co.uk/BAMA/14-16/aerosch2pg3.html Interactive activity about dissolving: http://www.bbc.co.uk/schools/scienceclips/ages/10_11/rev_irrev_changes_fs.shtml	Practical write up: observations table and graph of results. (ML) Evaluation of the investigation. Conclusion in terms of particle theory.

Topic: The Liquid Part of the Earth

Key words: Aquifers, groundwater, glacier, drought, solvent, cohesive, surface tension, evaporation, condensation, sistillation, water cycle, hydrological cycle.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
2 hours	Distribution of water on the Earth.	To learn that 97% of water on the Earth is in the oceans. Most of the other 3% is in the glaciers or ice caps (68.6%) in Greenland and Antarctica. The remaining freshwater is found in groundwater (30.1%).	Ask pupils to discuss in small groups and write down a list of places where water can be found on Earth. Give pupils data from graphs on water distribution on the Earth and ask them to design a bar-chart of global water distribution.	Two of the best sites for this topic are The U S Geological Society-Water Science for Schools: http://ga.water.usgs.gov/edu/and water.org at: http://water.org	Assessment of graphs.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
		Surface water and other freshwater 1.3%.	Ask pupils to identify water sources in their local area using maps. Using a map of Spain ask pupils to identify places of very high and very low rainfall. Use a table of global water distribution to visually represent the ratio of Earth's water distribution (i.e. the percentage of Earth's total water found in the ice-caps, glaciers, seas, groundwater, freshwater lakes, great lakes, saltwater lakes, atmosphere and rivers).This could be completed as a two columned table. The first column could be a cartoon sketch of the water source. The second column could contain details of the percentage of water or total volume of water in cubic km. With the aid of the information table on the **Learning to Give** website, students can create a model to visually represent the distribution of the Earth's water across the globe using different sized containers of water and measuring cylinders. They can represent the relative amount of water in the oceans (9.72litres) and compare it to other sources e.g. icecaps (200ml), groundwater (62 ml) etc.	Table of global water distribution http://ga.water.usgs.gov/edu/earthwherewater.html Demonstration of global water distribution- http://learningtogive.org/lessons/unit382/lesson1.html	

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
2 hours	Water is a scarce commodity in many countries of the world.	To evaluate the importance of underground water in countries like Spain that has drought problems in some areas.	Choose a case study of an area in Spain that has very low rainfall. Look at how this affects daily life, farming, food, animals and landscape. Look at the water usage and needs of a person in a water restricted environment and compare and contrast this to own situation. Issue pupils with information on groundwater from usgs website opposite and ask pupils to complete ground water true/false quiz. Project work on water shortages in Spain.	http://water.org/ Ground Water_ http://ga.water.usgs.gov/edu/mearthgw.html http://water.org/ **Featured Projects** section or other appropriate information of countries suffering consequences of water shortages and poor sanitation.	Assessment of project work on shortages of water in Spain.
		To become aware that, although there are large quantities of water on Earth, it is a scarce commodity and unequally distributed.	Market place activity. Photocopy information of water shortages and its effects in the **Featured Projects** section in water.org website. Stick posters of the information on the wall around the class. Split class into 8 groups for each of the different countries (Bangladesh, Ethiopia, Ghana, Haiti, Honduras, India, Kenya and Uganda). Students study the posters and report back to other groups on their findings. Ask class to complete Global Water Crisis Survey Group Activity Chart. Discuss quote from WHO that," The global water crisis is not about absolute shortages of physical supply but rather that the roots of the crisis in water can be traced to poverty, inequality and unequal power relationships, as well as flawed water management policies that exacerbate scarcity." A variety of lesson plans for secondary and middle schools on this topic can be found at the water.org website:: http://water.org/news/lesson-plans/	Global Water Crisis Survey_ http://static.water.org/pdfs/WPMidCurricFULL.pdf	

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
2 hours	Looking at some of the properties of water.	Recall that water freezes at 0 c and boils at 100c. Recall that water is neutral and has a pH of 7. Recall that pure water does not conduct electricity but does become a conductor once it starts dissolving substances around it. Recall that water has: a high specific heat capacity, a high surface tension and a relatively high density. Recall that pressure affects the boiling point of water. Recall that water expands when frozen.	USGS Water properties quiz from Water Science for schools website. Provide students with information on the properties of water from the US Geological Survey webpage. Give class ten minutes to learn the properties then test them with a short quiz. Brainstorm properties of water or carry out investigations about water in the laboratory. These could involve measuring boiling and freezing points. Measuring pH of water. Compare pH of distilled water with rain-water or river water. Measure current in distilled water and compare it with water with varying amounts of salt in it. Ask pupils to design a mind map of the properties of water. Evaporation practical Heat a solution of copper sulphate so that the solid can be formed as the heat stored in in the container evaporates the remaining amount. If timed correctly students can observe the crystallization process under the microscope. Experiment to demonstrate surface tension using a paperclip: http://www.sciencebob.com/experiments/paperclip.php Other experiments and information on surface tension can be found at: http://physics.about.com/od/physicsexperiments/a/surfacetension_4.htm	http://ga.water.usgs.gov/edu/sc3.html Hodder Science A Chapter 5.4“Changes of State” Melting and boiling experiment Hodder Science A chapter 5 Activity 5.2a “Dissolving and Temperature” page 113. For simple activities on properties of water: http://sciencenetlinks.com/lessons/the-water-cycle/ Surface tension of water. http://ga.water.usgs.gov/edu/surface-tension.htm Water the universal solvent: http://ga.water.usgs.gov/edu/solvent.html Evaporating basin, copper sulphate solution, Bunsen burners, beakers, eye protection.	Assessment of quiz from US Geological Survey webpage. Complete flow diagram outlining different stages of distillation process.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
		Recall why water is known as the universal solvent. Recall that distillation is evaporation followed by condensation. Know that fractional distillation works because each liquid boils at a different temperature. Explain distillation using ideas about particles. Describe some applications of distillation. Recall that distillation of sea water provides water in some countries with warm, dry climates.	Discuss why water boils at a lower temperature at altitude. Show students the effect of freezing a can of coke in the freezer. Use information on the USGS website to explain why water's chemical composition and physical attributes make it such an excellent solvent. YouTube video demonstrating distillation of seawater http://www.youtube.com/watch?v=zW3C1RRulmg Distilling alcohol/water practical. Pupils can separate alcohol from water using Liebig condenser. As an alternative to doing the experiment this activity could be demonstrated using the BBC Bite size webpages on distillation at http://www.bbc.co.uk/schools/gcsebitesize/science/aqa_pre_2011/rocks/fuelsrev2.shtml Mention could be made here of other applications of distillation e.g. crude oil distillation. Look at various methods to use distillation to get clean drinking water in countries with warm, dry climates. Discuss advantages/disadvantages of each design.	Long neck side arm conical flask: Liebig condenser, thermometer, bung, electric heating mantle, mixture of 20cm3 ethanol to 150cm3 water, eye protection heatproof mat. Ice melting.	

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
			Show PowerPoint presentation on solar distillation of water. http://www.slideshare.net/sunilsudhakaran/solar-water-distillation-for-drinking-purposes		
2 hours	Hard and Soft water	To understand what is meant by "soft water" and "hard water" and be able to distinguish between the two. To understand advantages/disadvantages of hard and soft water.	Ask pupils to explain the difference between distilled water and mineral water. Elicit idea that distilled water is pure water. Discuss what scientists mean by a "pure substance." Experiment testing water of varying hardness. Give pupils samples of water of varying amounts of hardness including distilled water and mineral water. Ask them to test which water is harder using the "soapsud test". In the experiment the distilled water will make more soapsuds than the mineral or hard water. Pupils can analyse different water samples to determine which one is the purest. The most pure will have the least dissolved solid. Heating a known and fixed volume of the water samples will enable a fair comparison to be made. The water samples will include distilled water and water with different quantities of salts dissolved in them. Discuss some of the applications of distilled water and de-ionized water. (Chemical and biological laboratories, car batteries, heating and cooling systems, steam irons, aviation industry etc.). Pupils complete table listing advantages/disadvantages of hard water.	Experiment testing water hardness http://www.teachervision.fen.com/tv/printables/SRPA08301_3.pdf Numbered water samples made up using distilled water with varying amounts of calcium sulphate. (e.g. o, 40mg/l, 80mg/l 120mg/ l etc. Measuring cylinders, soap solution, rulers. What is water hardness- http://www.unitedutilities.com/Waterhardness.aspx Water Hardness Factsheet- http://www.unitedutilities.com/Documents/WaterhardnessFactSheet.pdf Distilled water uses http://en.wikipedia.org/wiki/Distilled_water	Written explanation of difference between hard and soft water. Written task on uses of distilled water.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Water Cycle	To understand processes that occur in the water cycle and evaluate its importance. To understand that the sun is the main energy source that makes the water cycle possible.	Fill a glass with water and ask pupils how old they think the water is. Explain that even if it fell during a rain storm 2 weeks ago, it could be the same water that Tyrannosaurus Rex drank more than 65 million years ago. Elicit idea from pupils that water is constantly recycled through the water (or hydrological) cycle. Draw a cloud on the board with some raindrops and a sloping line under the cloud. Ask the pupils to work in groups outlining their ideas on the water cycle and explain why rain is not salty. Ask pupils to label diagram from geobite website to illustrate the hydrological cycle. Pupils can design a schematic diagram outlining the water cycle. Weaker pupils may need the assistance of labels or flashcards to support them. Students could build a model to simulate the water cycle. See activity on webpage opposite. The US Geological Survey has detailed information on the water cycle at : http://ga.water.usgs.gov/edu/watercycle.html The US Geological survey also contains a variety of topics related to the water cycle that could be used as individual or small group projects at: http://ga.water.usgs.gov/edu/watercycleoceans.html	model of water cycle http://www.ucar.edu/learn/1_1_2_4t.htm hydrological cycle diagram- http://geobytesgcse.blogspot.co.uk/2006/10/hydrological-cycle.html US Geological Society Water Cycle http://ga.water.usgs.gov/edu/watercycle.html Water Cycle Quiz http://cgz.e2bn.net/e2bn/leas/c99/schools/cgz/accounts/staff/rchambers/GeoBytes/GCSE%20Revision/Hot%20Potatoes%20GCSE%20Quizzes/Hydrological%20Cycle.Glossary/Hyd_cycle_glossary_select_quiz.htm	Flow diagram to represent the different stages of water cycle.
2 hours	Contaminated water and its purification. Distinctive agents that contaminate rivers reservoirs seas and oceans.	To identify human activities that contaminate water including the undesirable effects of water pollution by sewage and chemical waste. Pollution due to pesticides, insecticides	Ask pupils to list as many types of water pollution as they can. Compile a table outlining examples of natural and man-made water pollution. Ask pupils: Why should we measure water pollution? What should we measure? Where and when should we measure it? Pupils measure ph in local rivers/ponds and sea.	WHO Water Sanitation Health provides useful information sheets on waterborne diseases http://www.unitedutilities.com/Keyfactswaterquality.aspx	Assess students' efforts to explain separation techniques used at open day in local water purifying plant.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
		and herbicides. Pollution due to non-biodegradable plastics in the environment. To describe and outline the treatment of the public water supply using sedimentation, filtration and chlorination and biological treatment. To recall that acid rain can be caused by air pollution from cars and power stations, and it damages certain materials and living thing.	Visit to local water purification plant. Pupils could write a letter to local councillor suggesting ways to improve water quality in their area or the sea (e.g. pollution control, improve sanitation, raw sewage, drugs in water supply, vector control and eradication, heavy metals, oil and plastics). Tell pupils that the local water company has been receiving complaints about the quality of the water, so it is having an open day at its laboratories. It wants to have some information boards explaining how it treats water, but it also wants to explain the science behind the different ways of purifying water or analysing it to see what salts it contains. Ask pupils to prepare some labelled diagrams explaining how each separation technique works. They should include ideas about particles in their diagrams and/or labels and what each method can be used for. This activity could be completed as an assessed task. Complete activities on groundwater pollution from Idaho.gov.media webpage. Using cards match various statements about the gases which cause acid rain to the names of the gases. A number of lesson plans including experiments on this topic can be found at: http://www.epa.gov/students/teachers.html#epawater The Acid Rain teachers pack provide detailed information and activities on this topic: http://mhchem.org/221/wq/rain/Acid_Rain.pdf Pupils could be provided with information from the teacher's pack on the case studies of acid rain in different countries. In pairs or individually, they could report their findings on the effects of acid rain as a PowerPoint presentation to the class.	Video of sewage treatment plant- http://www.bbc.co.uk/learningzone/clips/sewage-treatment/4199.html http://www.deq.idaho.gov/media/471647-ground_water_contamination_lesson_plan.pdf Acid rain activities: http://mhchem.org/221/wq/rain/Acid_Rain.pdf	

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Water and European Law. Water is a Human Right.		Prepare 20 needs/wants cards to establish basic human needs e.g. safe drinking water, toilets, television, MP3, food etc. Ask children to categorise them under two headings, the first one needs, the second wants. Establish that millions of people do not have their basic needs met. Use the wateraid website for examples of such cases. Complete activities on wateraid website e.g. card activity on convention on the rights of the child to illustrate the deprivation of human rights in some countries.	Water as a human right- http://www.wateraid.org/documents/secondary_lesson_plans__human_rights_and_sanitation_250310.pdf Convention on rights of the child- http://www.wateraid.org/documents/secondary_lesson_plans__human_rights_and_sanitation_250310.pdf	
1 hour	Our responsibility not to waste water.		Ask pupils to keep a diary of water use in the home for a week in a book or on a spreadsheet. Explore the issue of wasting water and discuss what happens to water once it has been used. Discuss the patterns of water consumption and how reducing consumption might improve the environment. Use united utilities, Oxfam and Uswitch websites to categorise water usage into low, medium and high usage. Compare class usage with that of a case study village. How many trips to the water pump each day to meet needs? ML List as many possible ways you can of saving water in each area of the home. Visit the Water Efficient Home at United Utilities website for useful suggestions to save water. Pupils design a poster showing how to save water in school/house/work and explaining the benefits of reducing water consumption.	Using water wisely- http://www.unitedutilities.com/usewaterwisely.aspx Water efficiency- http://www.uswitch.com/water/water-efficiency-guide/ water efficient house http://www.unitedutilities.com/WaterEfficiencyHouse.aspx	Assess posters on reducing water consumption.

Topic: Earth's Atmosphere

Key words: Troposphere, stratosphere, mesosphere, thermosphere, weather, climate, water cycle, carbon cycle, ozone layer, atmospheric pressure, barometer, greenhouse gases.

Previous learning experience: Air is a mixture of gases. Living things need oxygen to live and they produce carbon dioxide. Plants produce oxygen and need carbon dioxide for photosynthesis.

Topic outline:
- Origin of the atmosphere.
- The gases that make up the atmosphere.
- The extent and structure of the atmosphere.
- Weather.
- The ozone layer.
- Air pressure.
- Respiration combustion and photosynthesis.
- Greenhouse effect.
- Atmospheric pollution.

Key web pages:
http://www.ucar.edu/learn/1_1_1.htm
http://www.windows2universe.org/earth/Atmosphere/overview.html

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Origin of the atmosphere	To explain the origin of the gases that make up the atmosphere in particular oxygen the product of photosynthesis. To explain the relationship between the early volcanic activity of the Earth and change in atmospheric conditions. To recall the gases that were believed to be present in the early Earth's atmosphere.	Explain to pupils that during the first billion years of the Earth's existence there was intense volcanic activity. This activity released the gases that formed the early atmosphere and water vapour condensed to form the oceans. Give students details of gases believed to be present in early Earth's atmosphere. Explain that some theories suggest that during this period, the Earth's atmosphere was mainly carbon dioxide and there would have been little or no oxygen gas (like the atmospheres of Mars and Venus today). There may also have been water vapour and small proportions of methane and ammonia. Show pupils YouTube "History of Earth's atmosphere in one minute". Give them brief written summary of details of origin of Earth's atmosphere and ask them to present their own oral history of atmosphere demonstration in one minute. This could be done in pairs. Construct a timeline of the changes that occurred to the atmosphere as the Earth cooled and lakes, seas and oceans formed. Imaginative writing activity. Pupils imagine they have access to a time-machine that can take them back in time. They are members of a scientific team who have been assigned to collect data on the earth's atmosphere over a period of 4.6 billion years. Pupils decide on dates of visit and research information on atmosphere at that time.	Origin of the atmosphere YouTube history Early Earth Atmosphere in one minute[YJ1] YouTube- http://www.youtube.com/watch?v=LDTxNZZwoZo Early Earth atmosphere- http://www.youtube.com/watch?v=2NBopWWXSwY Early Earth Atmosphere http://www.universetoday.com/26659/earths-early-atmosphere/ BBC Bitesize :Changes to the Earth and its atmosphere - http://www.bbc.co.uk/schools/gcsebitesize/science/aqa/earth/earthsatmosphererev3.shtml PowerPoint on history of atmosphere- www.http://sallyholl.com/science/ppt/evolution_of_atmosphere.ppt Evolution of the Earth's Atmosphere http://www.docbrown.info/page21/GeoChangesANS01.htm	Peer/Teacher assessment of one minute talks. Produce accurate timeline. LL assessment of imaginative writing activity

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Recall the gases that make up the atmosphere and their most important characteristics.	To recall that air is a mixture of different gases consisting of small molecules with large spaces between them. To recall that the relative proportions of the main gases in the atmosphere are approximately 78% nitrogen, 21% oxygen, 1% argon and small traces of other gases. To understand that other gases or particulates may be released into the atmosphere by human activity or by natural processes (e.g. volcanoes) and that these can affect air quality.	In small groups, list gases that make up the atmosphere. Ask pupils to estimate percentage of each gas in atmosphere. Match cards with names of gases that make up atmosphere with cards with their relative percentages. Pupils could also match cards with the names of the gases with cards detailing the properties of each gas. Ask pupils to design a model drawn to scale showing relative percentages of the gases that make up Earth's atmosphere using cm2 coloured paper. Each gas should be represented with a different colour. Pupils can prepare tables naming the gases in air, drawing simple molecular diagrams of these gases, their main properties and their chemical formulae. Use spreadsheet or draw diagrams to compare relevant amounts of gases in Earth's atmosphere to those of nearest planets- Venus and Mars.	An Introduction to the Atmosphere. The Goldilocks Principle – A Model of Atmospheric Gases http://www.ucar.edu/learn/1_1_1.htm Composition of air- http://www.docbrown.info/page21/GeoChangesANS01.htm Power of the Planet video on atmosphere- www.youtube.com/watch?v=J5ViCNJAkHg Cards labelled with the names of the different gases that make up the air. Cards stating various percentages of gases found in air. Table comparing gases in Venus and Mars with Earth – http://www.ucar.edu/learn/1_1_2_1t.htm Student notes on the Atmosphere can be found at : http://www.ucar.edu/learn/1_1_1.htm	Cloze procedure exercise on gases in air http://www.docbrown.info/page17/OCR21stCQuiz/ocr21stwfc11a.htm Label blank bar/pie charts of gases in air

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Describe the extent and structure of the atmosphere.	To recall that as the atmosphere gradually thins with increasing altitude, it has no sharp boundary but simply blends into outer space.	Complete activity on ucar website opposite, "How high does the atmosphere go?" This activity shows the relative thinness of the atmosphere when compared to the size of the Earth - Draw a semi-circle on whiteboard to represent the top section of the earth. Ask various pupils to estimate where the atmosphere ends by drawing a line on the board. Establish the true extent of the atmosphere based on the data from website. Use ucar website as above to build model structure of atmosphere layers to scale using measuring cylinder and different coloured sand.	How high does the atmosphere go? http://www.ucar.edu/learn/1_1_2_2t.htm Activities including Model of layers of atmosphere http://www.ucar.edu/learn/1_1_2_2t.htm	Label layers of atmosphere. Match layers to information about each layer. Project work on different layers of atmosphere and their characteristics.
		To recall that, the atmosphere is divided vertically into four layers, the troposphere, stratosphere, mesosphere and thermosphere. To recall that these divisions are based on temperature.	Draw diagram of Earth and its atmosphere showing different layers. Label diagram with details of each layer or compile table with information on each layer. Compile table showing different layers of atmosphere and some of the main characteristics of each layer. Details of layers can be found in the "Windows to the Universe" webpage. Complete mix and match activity where students match cards with information describing each atmospheric layer with the name of that particular layer. Pupils could research information on the atmosphere at the BBC "How big is space?" website at: http://www.bbc.com/future/bespoke/space_infographic	Information on layers of atmosphere http://www.windows2universe.org/earth/Atmosphere/layers.html Information on the different layers of the atmosphere: http://www.buzzle.com/articles/atmosphere-layers-facts-about-the---atmosphere-layers.html	

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
3 hours	Weather	Recall that most of the important weather phenomena occur in the troposphere. To understand the difference between climate and weather. To understand how the atmosphere regulates temperature. To recall that Atmospheric circulation is the movement of air around the surface of the Earth. To recall how pressure systems affect the daily weather. To recall that low-pressure systems are associated with clouds and precipitation that minimize temperature changes through the day and high-pressure systems are normally associated with dry weather and mostly clear skies. To understand that atmospheric circulation is caused by uneven heating of the Earths' surface. To understand that climates are influenced by many	Pose question: In which layer of the atmosphere does most of the important weather phenomena occur? Establish the fact that it occurs in the troposphere? Give pupils a map of Europe with a number of named localities marked and a selection of 'unnamed' climate graphs. Ask them to match the graphs with the named places and to write a rationale for their choices. Discuss with pupils the difference between weather (here and now) and climate (averages over time) using atlas climate maps, and weather satellite images and forecasts for Europe. Display diagrams showing Earth's surface absorbing solar radiation and heating up. Explain how warm surface heats nearest layers of air. Radiation that is not absorbed by the ground is reflected and escapes from the atmosphere. Not all the excess radiation reaches outer space. Carbon dioxide and water vapour reflect some back to Earth's surface and heats it up. Play weather bingo from TES resources site. View the YouTube video extract and pause at requested section to allow pupils to answer questions posed on weather and climate. Discuss answers and continue viewing to establish main differences. Use wiki answers website to produce cloze procedure passage. A very useful teacher's pack on this topic, with student activities, can be found at ACE (Atmosphere Climate & Environment Information Programme: http://maritimesun.com/news/wp-content/uploads/2012/03/Weather_Climate.pdf Use Times Educational Supplement power-point	wiki answers http://wiki.answers.com/Q/Why_does_weather_only_happen_in_the_troposphere Weather bingo- http://www.tes.co.uk/ResourceDetail.aspx?storyCode=3013077 YouTube video http://www.youtube.com/watch?v=wUiwtVSkUwQ Information on climate/weather http://www.ucar.edu/learn/1_2_2_8t.htm Times Educational Supplement power-point presentation http://www.tes.co.uk/teaching-resource/climate-zone-map-6173254/ http://www.teachersdomain.org/asset/ess05_vid_watercycle/	Labelling activity for hydrological cycle http://www.bbc.co.uk/schools/ks2bitesize/science/materials/changing_states/read5.shtml Comparison of Climatic Types worksheet http://www.tes.co.uk/teaching-resource/climate-zone-map-6173254/

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
		factors, such as proximity to the equator or poles and proximity to the seas as well as ocean currents, atmospheric pressure belts and prevailing winds. To recall that the Earth has a curved surface that rotates on a tilted axis and the equatorial regions receive more heat from the sun than the poles. To relate humidity with condensation and precipitation. To understand the processes of the water cycle	presentation and complete "Comparison of Climatic Types worksheet". Split pupils into groups. Each group should research into a different climate zone and report back to class. Compare results. Show teachers domain animated clip of water cycle (no commentary). Ask pupils to write about what they viewed, discuss written accounts gather information and explain complete process, condensation, evaporation and precipitation. Ask pupils to design a diagram/poster of water cycle. Show diagram of water cycle and ask pupils to label / explain each stage of the process. Activities on differences between climate and weather can be found at http://www.ucar.edu/learn/1_2_2_8t.htm An extensive bank of resources for teaching this topic can be found at "Metlink. Resources for teaching weather and climate in schools" http://www.metlink.org/weather-climate-resources-teachers/useful-links.html Weather and Climate Teacher's resource pack: http://www.lordgrey.co.uk/~f014/usefulresources/aric/Resources/Teaching_Packs/Key_Stage_4/Weather_Climate/pdf/Weather_&_Climate.pdf		
2 hours	The Ozone Layer	Above the troposphere is the stratosphere, which exhibits warming because of the absorption of ultraviolet radiation by ozone. To recall that chlorofluorocarbons (CFC's) commonly used in refrigerators and aerosol cans, release reactive chlorine into the upper	Watch short video on ozone layer- link on video 1 Watch http://www.youtube.com/watch?v=2NBopWWXSwY Complete activities from "Climate Change and Ozone Depletion Teacher's Pack" This is a very useful teacher's pack with student activities on this topic: http://freedownload.is/pdf/teaching-packs-uk	1. Introduction to Ozone: http://www.ucar.edu/learn/1_5_1.htm 2. Ozone layer Depletion – - Video #1 video clip on the ozone layer - Video #2 close-up view of ozone molecules absorbing solar radiation - Video #3 the break-up of ozone molecules by chlorine atoms UNESCO Pack:	Assessment of descriptive writing. LL Assessment of completed activities from UNESCO "Climate Change and Ozone Depletion" teacher packs.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
		chlorine into the upper atmosphere. These break down ozone and damage the ozone layer. To recall that the Montreal Protocol On Substances That Deplete The Ozone Layer is a landmark international agreement designed to protect the ozone layer.	A corresponding Student's pack is also available at: http://www.unesco.org/education/ozonaction_student_web.pdf Provide handouts from Times Educational Supplement webpage (see tes link above) and ask pupils to read and list gases that cause depletion of ozone layer. Pupils could complete some of the activities on ozone from the edu/learn web pages. Descriptive writing exercise - What would happen to planet Earth if the ozone layer did not exist? LL Written account or summary of details of "Montreal Protocol" Complete activities from UNESCO's Ozone Education Pack for Secondary Schools at: http://www.unesco.org/education/ozonaction_student_web.pdf Windows2universe activity including worksheets http://www.windows2universe.org/teacher_resources/teach_ozone.html	UNESCO Pack: http://www.unesco.org/education/ozonaction_student_web.pdf	
2 hours	Air Pressure	To relate pressure to force an area, using appropriate examples. To define pressure and state formula pressure=force/area. To recall standard units of pressure, force and area. To describe applications of atmospheric pressure. To explain atmospheric pressure in terms of the weight of the atmosphere acting on Earth's surface.	Experiments showing air has mass. Using weighing scales, ask pupils to compare mass of empty balloon with mass of balloon when full of air. Put some cotton wool in the bottom of a glass beaker, turn the beaker upside down and insert it in basin of water. The cotton wool stays dry due to the pocket of air trapped in the glass. Use the equation p = F/A to calculate the pressure you exert on the Earth wearing training shoes compared to high heeled stiletto shoes. Using cm squared paper, calculate the pressure of a mass acting over a large area compared to a small area e.g. the pressure you exert on the ground wearing school shoes compared to high heeled shoes.	Air Pressure simple air pressure experiments : http://www.youtube.com/watch?v=vGulvutZJpg A variety of simple air pressure experiments can be found at the howstuffworks website: http://tlc.howstuffworks.com/family/science-projects-for-kids-air-pressure.htm Weighing scales, cm squared paper, snow shoes, high- heeled shoes	Problem solving using pressure force and area formula. Assess project work on famous scientists who have contributed to our understanding of air pressure.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
		To solve simple problems using atmospheric pressure. To describe the simple mercury barometer and its use in measuring atmospheric pressure. Understand and investigate Aristotle's phrase," Nature abhors a vacuum"	Calculate the pressure exerted by a brick while resting on different faces. Complete simple problems on pressure using "Stilettos and Snowshoes" worksheet from "Measuring - Foot- Pressure" website opposite. Pupils can use P=F/A formula to solve simple problems. Research Torricelli's experiment with mercury and atmospheric pressure. Draw diagram and write explanatory notes explaining how a barometer works. Students could complete projects on individual scientists who have contributed to our understanding of air pressure (Aristotle, Archimedes, Torricelli, Pascal, Bernoulli, Robert Boyle etc.) Students construct their own simple barometer using instructions outlined in website opposite. Pupils can carry out investigations on climate, recording data in tables and graphs, using thermometers, barometers, rain gauges, anemometers and weather vanes. Show YouTube video of crushing a can with air pressure.	http://www.sciencelearn.org.nz/Science-Stories/Measurement/Measuring-foot-pressure http://www.studydoctor.co.uk/site/wp-content/uploads/2010/05/Lesson-1-Density-and-pressure.pdf Make a barometer_ http://www.wikihow.com/Make-a-Simple-Weather-Barometer	

Topic: The Solid Part of the Earth

Key words: Rocks, minerals, continental-crust, oceanic-crust, mantle, core, sedimentary, metamorphic, igneous, weathering, transportation, erosion, magma, lava, rock-cycle.

Previous learning experience: Naturally occurring and man-made materials. Grouping rocks. Erosion. Uses of rocks. Different types of Soil.

Topic outline:
- Define minerals and rocks.
- Learn about the main rock forming processes.
- Learn how rock-forming processes are linked by the rock cycle.
- Use the concept of rock texture as one of the key characteristics in identifying igneous, sedimentary and metamorphic rock.
- Relate processes observed in other contexts (e.g. crystallization and precipitation), to processes involved in the rock cycle.
- Uses of rocks and minerals.

Key web pages:
Joint Earth Science Teacher's Association: http://www.esta-uk.net/jesei/index2.htm
US Geological Survey: http://education.usgs.gov/index.html

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
2 hours	An Introduction to rocks and minerals?	To explain the difference between a rock and a mineral. To be able to define the terms "rock" and "mineral". To recall that a mineral is a naturally occurring, inorganic solid that possesses a definite chemical structure,	Prepare some cards or worksheets with true or false statements about minerals and rocks. Ask students to discuss them and decide which are true and which false. Elicit from the activity 1. That a mineral is a naturally occurring, inorganic solid that possesses a definite chemical structure, which gives it a unique set of physical properties. 2. That a rock is a naturally occurring and coherent aggregate of one or more minerals. Challenge pupils to learn the 10 most common	Set of cards with true and false statements about rocks and minerals. Cards of minerals Common Minerals produced in Spain http://minerals.usgs.gov/minerals/pubs/country/2009/myb3-2009-sp.pdf Common minerals activity- http://www.esta-uk.net/jesei/elements/home.htm Good site for various lessons on rocks	Define rocks and minerals. Test pupils' knowledge of most common minerals found in rocks. Test pupils' knowledge of the eight most common elements found in Earth's crust. Assess creative writing activity.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
		which gives it a unique set of physical properties. To recall that most rocks are aggregates composed of two or more minerals. To recall the most common naturally occurring elements on Earth's crust.	elements found on the Earth's crust (See Joint Earth Science Education Initiative website opposite). Challenge pupils to learn the most common minerals on the Earth's crust. Provide examples or photos if possible. Challenge pupils to learn the percentage of the Earth's crust that each mineral makes up. Class/ small group discussion on why geologists study rocks and the Earth. Explanation of the different kinds of information geologists can find from rocks. A range of activities and lesson ideas on this module, including this topic are available at the JESI (Joint Earth Science Education Initiative), The Earth Science Teachers Association Time to teach and UKRIGS websites. Creative writing – pupils imagine they are visitors from another planet who secretly visit Earth and collect samples of rocks and minerals. Produce a scientific report or information table documenting results. Include a description and information about the properties of each specimen. LL.	and minerals http://www.timetoteach.co.uk/Unit3DRocksandsoils.html Images of types of rocks and minerals http://geology.com/rocks/ Earth Science On-Site http://www.ukrigs.org.uk/esos/wiki/index.php5?title=SNA/KS3/Prep Joint Earth Science Education Initiative -http://www.esta-uk.net/jesei/index2.htm Most common elements http://www.windows2universe.org/earth/geology/crust_elements.html Samples of common minerals and elements	
1 hour	The layers of the Earth	To recall the compositional layers of the Earth (crust, upper mantle, inner-mantle, outer and inner -core). To recall that the Earth's layers are not homogeneous.	Draw diagrams of Earth labelling different layers. Explanation of the relative thickness of each of the layers. Issue pupils with information on the different layers from Wikipedia or other available textbooks. Ask them to compile table stating characteristics of each layer (e.g. temperature, pressure, composition etc.).	www.enchanted learning.com labelling Earth activity http://www.enchantedlearning.com/subjects/astronomy/planets/earth/Continents.shtml Structure of Earth: http://en.wikipedia.org/wiki/Structure_of_the_Earth	Labelling blank diagram to show the names of the different layers of the Earth.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
		To compare relative thickness of continental and oceanic crust.	Look at images comparing relative thickness of continental and oceanic crust. Draw diagrams showing continental/oceanic crust include information on average thickness of each (see enchanted learning website). Compare thickness of Earth's crust to a postage stamp suck on a football activity; (Earth's crust: Thinner than you think practical). http://www.esta-uk.net/jesei/earthcru/home.htm	Diagram of continental crust http://www.enchantedlearning.com/subjects/astronomy/planets/earth/Continents.shtml Layers of the Earth animation http://education.nationalgeographic.com/encyclopedia/crust/?ar_a=1	
2 hours	Description of the three rock types: Sedimentary Metamorphic and Igneous Rocks	To recall that geologists separate rocks into three categories (Sedimentary Metamorphic and Igneous). To describe the texture of different types of rock.	Give the students a variety of different rock specimens that have been labelled. Ask them to describe their appearance in as much detail as possible. (Vocabulary to help them may be provided to encourage them to use the correct terms e.g. texture/grain size/interlocking crystals etc.) When finished ask them to sort the rocks into three different groups of their own choosing. Or- Put the name of the three different rocks on the board e.g. sandstone, granite and gneiss. Ask pupils to write down as many facts about them as they can and share ideas with classmates. Follow this up by asking them how the three types of rock are connected. Follow up by describing criteria geologists use to separate rocks into the three groups. (Sedimentary rocks are made from grains that are often rounded, igneous and metamorphic rocks are made from interlocking crystals, the latter with the crystals often arranged in bands or layers). Ask pupils to re-sort their groups. Reinforce the main ideas by using examples/photos of typical examples of each type of rock. Look at geological maps of your local area in order to find out where igneous, metamorphic and sedimentary rocks can be found.	Specimens of sedimentary, metamorphic and igneous rock e.g. Conglomerate, sandstone, limestone, chalk, coquina, mudstone, shale, slate, marble, granite, gabbro, basalt, pumice and obsidian. Hand lens magnifiers. Photos from internet of samples of each of the three types of rock. Photos of rock/mineral specimens http://www.rocksforkids.com/RFK/Rocks&Minerals.html#C	True /False quiz on main ideas of lesson. Classify common examples of rocks from each of the three rock types. Peer-assess leaflets for accuracy of information, design and layout etc. LL

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
			Give pupils a selection of rocks to look at using hand lenses and ask them to group them. Compile list of differences and similarities between them. Ask pupils to suggest ways in which they were formed. Make a class database of rocks. Carry out investigations of the properties/uses of different types of rocks. PowerPoint presentations on specific rocks found in local area. Show pupils examples of three rock types. Students can produce an information leaflet on rocks including data about their formation. LL		
2 hours	Sedimentary Rock	To name some common sedimentary rocks. To describe the characteristics of sedimentary rocks. To recall how sedimentary rocks are classified. To understand that sedimentary rocks are formed in flat layers, but can then be folded by plate movements. To understand that fossils are impressions of the remains of once	Review what students know about different rocks, weathering and sedimentation by asking them some questions relating to photographs or specimens. Establish key points e.g. the physical and chemical causes of weathering that rocks consist of grains that fit together and that over time layers of sediment accumulate. Introduce the idea of compacting grains by showing pupils the effect of squashing wet sand and asking them to observe the loss of water; show them pictures of deep layers of sedimentary rock and ask them to think about the pressure at the bottom of a cliff. Explain that the pressure exerted by deep strata will be very great. Ask pupils to look at some damp sand and some sandstone with a hand lens, or under the microscope, and look for clues about what is holding the grains together. Remind pupils that rocks are mixtures and establish that the 'glue' comes from minerals in the sediment that have dissolved and been left as the water evaporated.	Rock samples or photographs from internet of sedimentary rocks e.g. conglomerate, sandstone, siltstone, shale, limestone, chalk, coal, oil. Classifying sedimentary rocks http://www.rocksandminerals4u.com/sedimentary_rock.htm Shells/Plastic models of animals Plasticine in variety of different colours Plastic cups Organic sedimentary rocks http://www.windows2universe.org/earth/geology/sed_organic.html Formation of sedimentary rock: http://www.ehow.com/how-does_4567195_organic-sedimentary-rocks-form.html	Naming some sedimentary rocks e.g. Chalk, sandstone and shale. Written description of how sediments form and how they settle into layers. Using drawings identify sequences of different layers being formed at different times. Suggesting explanations for observations on sedimentary rocks. Written assessment on characteristics of sedimentary rocks .

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
		living organisms, preserved by the process of lithification. To explain processes involved in the weathering, erosion, transport, and deposition of sedimentary rock. To describe how clastic sedimentary rock can be formed by pressure from layers of sediment resulting in the compaction and cementation of grains. Recall that chemical sedimentary rocks are formed from dissolved minerals that are precipitated or separated from water. Explain the formation of organic sedimentary rock.	Show students tables of clastic and chemical sedimentary rock from rocks and minerals 4u website. Explain that clastic sedimentary rock is formed as bits of weathered rock become cemented together and that chemical sedimentary rocks are formed from dissolved minerals that are precipitated or separated from water. Ask pupils where coal or petrol comes from. Show short clip from YouTube on coal formation. Explain that organic sedimentary rock is formed from the accumulation and lithification of organic debris, such as leaves, roots, and other plant or animal material. Show pupils some samples of fossils or rock containing fossils and ask them what information the fossils can give them about the rock. Pupils place a shell into the bottom of a plastic cup and build up layers of "sediment" using coloured plasticine balls to represent the grains of sediment. Different layers can be made with different coloured balls of plasticine. The layers are then compressed in the cup, so that each layer remains complete and the balls of plasticine fuse together. After a few layers have been made the plasticine, "sedimentary rock" can be removed from the cup. The shell can be removed leaving the "fossil" imprinted on the model. Use simple keys to identify sedimentary rocks. Design simple keys to recognize rocks. The Geological Society webpage contains a number of experiments on sedimentary, metamorphic and igneous processes at This site also contains useful teachers' notes.	Coal formation from youtube http://www.youtube.com/watch?v=c5far-kRyXY General information on sedimentary rocks http://geology.about.com/cs/basics_roxmin/a/aa011804b.htm Geological Society http://www.geolsoc.org.uk/page3652.html	Use/Design simple keys to recognize different rock specimens.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
2 hours	Metamorphic Rock	To name some common metamorphic rocks. To describe how metamorphic rocks differ from sedimentary rocks. To recall that the properties of the rock change when metamorphism takes place. To appreciate that the changes undergone by a rock depend on the pressures and temperatures it is subjected to. To recall that fossils are very rarely found in metamorphic rock. To recall that metamorphic rocks are made from other types of rock that have undergone great heat and pressure changes.	Ask pupils to write the meaning of the word "metamorphism". Ask them to guess what metamorphic rock is. Explain that metamorphic rocks can come from igneous, sedimentary or other metamorphic rocks. Look at samples of metamorphic rocks with a hand lens. Ask pupils to describe them with the aid of a vocabulary list. Elicit from pupils that in metamorphic rocks the crystals may be aligned, they may be less porous, fossils are very rare, normally they will be destroyed or severely distorted, no grains may be visible, and the rock may be harder. Show the pupils samples of gneiss, marble, slate and schist and ask them for explanations about their origins. Show students images of where metamorphic rock is likely to be formed in the Earth's crust e.g. deep underground, at the base of mountains, in zones radiating from intrusions of magma underground, on glaciated terrain after transportation by ice, or on the surface of eroded mountains. Ask pupils to explain why fossils are only very rarely found in metamorphic rock. As a homework activity pupils could explain how a volcano is built up over thousands of years. Experiments simulating metamorphic processes from JESI webpage http://www.esta-uk.net/jesei/index2.htm	Samples of metamorphic rock e.g. slate, schist, gneiss and marble. Geological Society Section on metamorphic rocks http://www.geolsoc.org.uk/gsl/education/resources/rockcycle/page3459.html About.com Geology. Section on metamorphic rocks http://geology.about.com/cs/basics_roxmin/a/aa011804c.htm	Use simple keys to recognize rocks or minerals. Geological Society quiz on metamorphic rock http://www.geolsoc.org.uk/page3647.htm

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
2 hours	Igneous Rocks	To recall how igneous rock is formed. To recall that magma is molten rock inside the Earth and lava is molten rock on the surface of the Earth. To recall that lava and magma cool to form igneous rock. To understand that the speed of cooling affects crystal size. Fast cooling produces rocks with small crystals and slow cooling produces larger crystals. To name some examples of igneous rock. To describe the texture of igneous rock. To describe how hot liquid magma can flow out of volcanoes as lava and solidify or be blown out as ash which settles.	Show pupils a video clip of a volcanic eruption, asking them to observe that magma can flow out as lava or be blasted out as ash, and compare the resulting rocks. Ask them to suggest the origin of the magma. Remind students that they have considered two kinds of rock, sedimentary and metamorphic. Explain that there is a third type- igneous rock. To show how temperature affects crystal size, carry out class experiment to compare size of copper sulfate crystals when cooled rapidly with a Bunsen burner or left to evaporate slowly at room temperature. Look at resulting crystals under a microscope. To reinforce idea of the effects of cooling rates on crystal size pupils can model the effects in the playground. The pupils represent atoms free to move around in an open space, as in a melt. On cooling, indicated by a signal, they stick together by putting one hand on the shoulder of the person nearest them to begin forming crystals. The longer this goes on, the larger and fewer the crystals will become. Ask pupils to relate differences in crystal size (number of pupils bonded) and number of crystals (number of groups of pupils) to cooling time and to explain in terms of the particle model of matter. Provide pupils with a variety of rock samples and ask them to classify them into types of rock, *e.g. igneous and non-igneous,* and then to subdivide them into rapid- and slow-cooling types, and/or suggesting where they were formed, e.g. *obsidian (glasslike, very fast cooling on surface) pumice (gas bubbles, fast cooling on surface) basalt (small crystals, moderate cooling near surface) gabbro/granite (large crystals, slow cooling in the Earth)* Show diagram of a volcano on board. Ask students what happens to lava when it flows out	Hodder Science B Chapter 11.3 Making Crystals page 244 http://webarchive.nationalarchives.gov.uk/20090608182316/http://volcano.und.nodak.edu Copper sulfate crystals, crucibles, Bunsen burners, microscopes or hand-lenses. http://webarchive.nationalarchives.gov.uk/20090608182316/http://www.geo.mtu.edu/volcanoes/world.html Examples of igneous rock e.g. basalt, granite, diorite, obsidian and andesite.	Use simple keys to recognize rocks or minerals. Test your knowledge quiz at Geological Society http://www.geolsoc.org.uk/gsl/education/resources/rockcycle/page3448.html Activities involving ordering of rocks in a sequence and what this can tell us about the relative timing of their formation. http://www.esta-uk.net/jesei/sequenc/index.htm Label tectonic plates

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
		To describe and explain the processes responsible for earthquakes and volcanic activity at plate margins. To recall the main locations where igneous rock forms.	of the volcano and get them to mark it on the diagram. Build up a rock cycle by asking what happens to rocks, eliciting ideas about weathering, erosion and transport and then what happens to the sediments and so on. Use information from charts on the composition of igneous rocks. Ask students to do more research on earthquakes or tsunamis, e.g. find out where the major danger areas are. Fill in blank maps marking in major danger areas. Discussion of why people still live in these areas. Show pupils diagrams of different tectonic plate boundaries and ask them to explain where and how different types of igneous rock are formed. Explain that Igneous rocks form in three main places: where lithospheric plates pull apart at mid-ocean ridges, where plates come together at subduction zones and where continental crust is pushed together, making it thicker and allowing it to heat to melting.	Volcanoes that are currently active can be found at www.geo.mtu.edu/volcanoes/world.html and also at http://volcano.und.nodak.edu National Geographic video on Volcanoes DVD of volcano e.g. Dante's Quest Rock samples of igneous and non-igneous rock e.g. igneous – gabbro, granite, pumice, basalt, feldspar obsidian Non –igneous -chalk, limestone, coquina, slate and gneiss.	
2 hours	The rock cycle	To recall that the Earth is continually changing. To recall that the rock cycle links together the processes of rock formation.	Ask pupils to design a flow diagram or concept map outlining main stages of rock cycle. Pupils could mark areas of tectonic activity on blank map of the world labelling the main countries affected. Explain that the Earth is a dynamic planet, and that rock is constantly being created and destroyed. Investigate names of major tectonic plates and where they are located. Demonstrate videos and discuss volcanic eruptions as one of the consequences of the rock cycle.	Hodder Science B Chapter 11. Activities on -Driving the Rock Cycle Geological Society Animated rock cycle http://www.geolsoc.org.uk/gsl/education/resources/rockcycle	Label different stages of rock cycle. Define processes of rock cycle. Assessment of descriptive or factual writing on rock cycle.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
		To explain that the surface of the Earth is divided into plates and the movements of these plates cause earthquakes and magma formation. To recall how the rock cycle provides a continuous supply and transformation of Earth materials.	Research maps that show details of ocean floor. Look at videos of new rock being formed at mid-Atlantic ridge. Ask pupils to produce their representations of the rock cycle through a cartoon or short story. Ask them to write the life story of a boulder named Rocky including the processes which have changed and formed him during his long life. Provide outline or frame to make sure pupils describe the formation of all three types of rock. The best stories could be presented with images to younger children perhaps in the local primary school. LL GL Activities on rock cycle can be found at the following websites: http://mjksciteachingideas.com/rocks.html http://www.ukrigs.org.uk/esos/wiki/index.php5?title=SNA/KS3/Prep#Objective_B._The_rock_cycle_.2835_minutes.29 Rock Cycle Teacher Notes http://www.esta-uk.net/jesei/index2.htm http://www.esta-uk.net/jesei/index2.htm		
1 hour	The uses of rocks and minerals. The importance of coal to the economy.	To describe the distribution of coalfields in Spain. To consider how and why (because of human processes) the distribution of coalfields has changed and is changing. To recall that there are several reasons (economic, political and environmental) why our energy supply is not totally secure. To be aware that most of the electricity we use	Complete activities on "Mineral Elements and the Earth's Crust at JESI Webpage http://www.esta-uk.net/jesei/minerals/index.htm Provide students with blank maps and information on the areas where coal is mined in Spain. List uses of many common minerals. Uses of rocks and minerals from Rocks for Kids website. List uses of rocks from rocks for kids' website. Research different methods used to mine coal. Annotate diagrams of how we produce electricity from coal and how electricity is delivered to our homes using American Coal Foundation webpage materials: http://www.tecocoal.com/information/coalelectricity/ A number of lesson plans and resource guides on	40 common minerals and uses-http://www.larsonjewelers.com/40-common-minerals.aspx What is coal properties and uses-http://geology.com/rocks/coal.shtml Uses of rocks & minerals http://geology.about.com/od/mineral_resources/Mineral_Resources.htm http://www.rocksforkids.com/RFK/uses.html Lesson plans American Coal Foundation http://teachcoal.org/lesson-plans-middle-high-school Uses of rocks minerals http://www.rocksforkids.com/RFK/use	Match common minerals to their uses. Extended written work on importance of coal to the economy.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
		is currently generated at power stations by burning fossil fuels such as coal, oil and gas. To recall that we are consuming our natural fossil fuel resources very rapidly and they will eventually run out.	coal energy can be found athttp://www.efmr.org/edu/coal2009.pdf PowerPoint talks on coal, where it comes from and advantages and disadvantages of using it. Geological Society http://www.geolsoc.org.uk/gsl/info/lyellcentre Complete activities from Kentucky Coal Education website http://www.coaleducation.org/resource/default htm Making coal activity http://www.coaleducation.org/lessons/sec/coalfor .htm Interview a miner or someone who has worked in the coal industry. Ask pupils to prepare written questions before the visit.	s.htm www.ilo.org/public/english/dialogue/sector/sectors/mining2.htm Bite size pro/con coal-http://www.bbc.co.uk/schools/gcsebitesize/geography/energy_resources/energy_rev1.shtml Kentucky Coal Website http://teachcoal.org/faqs-about-coal#howmined	

Topic: Earth in the Solar System

Key words: Universe, milky way, solar system, star, galaxy, constellation, astrological unit, eclipse.

Previous learning experience: The Sun. Light and dark. Sources of light. Earth, Sun and the Moon. Changing position of the Sun. Movement of the Earth. The Sun at different times of the year.

Topic outline:
- The Universe, Milky Way and Solar System.
- Historical Models of the Solar System.
- Observing Celestial Bodies.
- Astrological Measurements.
- Day and Night.
- The Seasons.
- The Moon.

Key web pages: http://solarsystem.nasa.gov/docs/Sky_Time.pdf

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
2 hours	Difference between the universe, Milky Way and Solar System.	To recall that the universe is an area in space that contains many galaxies. A galaxy is a group of stars of 100 billion or more. A solar system is a sun/star that has an orbit (gravitational pull) and has planets or other matter orbiting it.	Card sort - Ask pupils to arrange cards in order of size (universe, satellite, moon, star, galaxy, solar system, sun, planet, earth etc.) Discuss results. Ask pupils to describe and define what is written on each card. Pupils could make a visual dictionary using descriptions and diagrams of a planet, moon, star a galaxy etc. Use analogy of Earth as a room in a house. All other rooms would represent the planets within our Solar System. The galaxy would be the neighbourhood with lots of houses - extend analogy to universe. Issue image of milky way galaxy, ask pupils to identify shape (barred spiral). Ask students to label the bar (at the galaxy's core) and the approximate position of our solar system (on the Orion arm). Using reference material, ask students to make a list of parts of the Milky Way Galaxy, and have them record their list and share answers (e.g. stars, *nebulas*, a *black hole*, galactic halo, star streams). Ensure that they have a basic understanding of each part of the Milky Way galaxy by asking the following questions: *What is a galaxy?* (an enormous group of stars) *How big is the Milky Way galaxy?* (average size, with about 200–400 billion stars) *How and where do stars form in the Milky Way?* (in giants clouds of gas and dust, called nebulas) *What lies in the core of the Milky Way?* (a black hole) *What is the galactic halo?* (a group of globular clusters outside the main body of the Milky Way) *What are galactic star streams?* (the remains of smaller galaxies and star clusters near the Milky Way that were ripped apart by the Milky Way's gravity).	Cards for sorting activity. Image of milky way galaxy and solar system. Blank diagram of solar system.	Worksheet on universe/ galaxy/solar system Crosswords for revising & assessing Solar System topic- http://www.eclipsecrossword.com/

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
			Elicit information from pupils' knowledge and understanding of the Solar System. Ask them to name the planets they know and the order in which they occur from the sun or get them to rearrange clue cards to work out order of planets from the sun.		
2 hours	Ideas about the Solar System have changed over time.	To describe some historical models of the position of the Earth in the Solar System.	Show students the star chart and ask them to name some constellations they are familiar with. Discuss myths and establish who named the constellations and invented the myths behind them? (ancient peoples) Establish that constellations were important to ancient cultures as the night sky acted like a calendar. Present, using secondary sources, some alternative models of the Solar System, *e.g. the ideas of the ancient civilisations of Egypt, India, Greece, and the contributions of Thales, Aristarchus of Samos and Copernicus.* Pupils should be asked to research into how constellations got their names. Divide pupils into groups and ask them to research an early model of the Solar System in order to describe to the rest of the class and explain how it differs from our present model. Pupils could be asked to participate in a class debate defending a particular model (*e.g. that the Earth is the centre of the universe)* providing evidence for their position. With the class, summarise the main strengths and weaknesses of each model and ask pupils to draw their own conclusions.	Historical models of the Solar System - http://galileo.rice.edu/science.html and/or http://csep10.phys.utk.edu/astr161/lect/retrograde/aristotle.html and/or http://www.skyscript.co.uk/copernicus.html Ptolemaic system simulator - http://astro.unl.edu/naap/ssm/animations/ptolemaic.swf	Pupils should describe an early model of the Solar System and how it differs from our present model. Argue a point of view in defence of a model of the Solar system, providing evidence for their position.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Observation of celestial bodies to overcome simplistic models and understand the universe as it actually is.	To understand the heliocentric model of the universe with orbiting planets. To learn how astronomers obtain information about the solar system and be aware of the equipment they use. To describe how information on the planets in our Solar System is obtained and used.	Brainstorm how scientists and astronomers obtain evidence of planets and other bodies in the solar system by use of telescopes, observatories, probes, satellites and spacecraft. Referring to work covered in last session, establish that the main challenge for scientists throughout history to understanding the solar system, was the establishment of a heliocentric model with orbiting planets, as this requires an understanding of what maintains the planets in motion at fixed distances around the Sun. Present evidence, *e.g. from time-lapse photography images*, to show how the stars appear to move across the night sky. Relate the movement of the Earth round the Sun to the changes in visible stars during the year, *e.g. with a model planetarium*. Pupils design a model to explain the apparent movement of the stars in the night sky. Pupils could research into the discovery of planets, who discovered them and how they were discovered. Raise the importance of the size and positioning of the instruments, *e.g. William Herschel, who discovered Uranus and built the largest mirror of his time in his kitchen*. Ask pupils to use secondary sources to find out about the discoveries of William and his sister Caroline, and how they changed ideas about the Solar System and the universe.	Pictures of telescopes and probes. Images of stars. Model planetarium Time lapse photography of stars at night www.theskyinmotion.com/ Or various clips available on youtube e.g.- www.youtube.com/watch?v=dpMKzb9l2tQ	Assessment of knowledge displayed during presentation of model. Assessment of research on discovery of planets.
2 hours	Some of the celestial objects visible to the human eye or	To name the planets in order. to recall information on	Refer to previous lesson and establish that our Solar System consists of the sun and other matter orbiting around it. Use planet clue cards to establish position of planets in relation to sun.	Label planets worksheet http://www.tes.co.uk/ResourceDetail.aspx?storyCode=6075901	Understand the relative positions of the different bodies that compose the solar system.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
	through optical instruments.	the structure of planets. To understand that the planets orbit the sun in similar ways to the Earth but that their orbits take different times to complete.	Show students pictures of each planet to let them become familiar with them. Pupils could devise a mnemonic to memorise the planets in order of size or distance from the Sun e.g. .My Very Easy Method Just Speeds Up Naming Planets or My Very Educated Mother Just Served Us Nachos. Brainstorm other information about the planets. Explain that the planets orbit the Sun in similar ways to the Earth, but that their orbits take different times to complete. Ask pupils to label the planets on a diagram showing the Sun, planets and asteroid belt and the natural satellites of the planets of the solar system. Ask pupils what conditions would be like on other planets. Encourage them to think about how it would be different from Earth, *e.g. surface, temperature, atmosphere, day length, year length*. Information could be represented in tables or bar-charts. Pupils could use information tables/data to complete reports/information sheets on the planets; alternatively students could produce their own tables from other information sources. (The bobthealien site could be used for this activity). LL Ask pupils to search secondary data sources on the planets, e.g. books, internet and CD-ROMs, and write a travel brochure for future visitors to the chosen planet. They could be asked to identify 10 questions you should know about a planet and find the answers. LL Pupils use internet links (e.g. the seasky) to research a variety of celestial objects and produce a brochure for space tourists advertising some of the sights they could see on a journey through space - stars, moons, planets, asteroids and comets, quasars, dark matter, nebulae, star clusters, galaxies, pulsars and black holes.	Planet clue cards file:///D:/Activities%20for%20solar/act09_cluecards.htm Build a scale model of the solar system- http://www.exploratorium.edu/ronh/solar_system/index.html Planets info Tables- www.bobthealien.co.uk/table.htm Celestial objects www.seasky.org/celestial-objects/celestial-objects.html	

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
2 hours	Scales and units for astrological measurements.	To learn the scales and units for the measurements of distances used by astrologers. To recall that An Astronomical Unit (AU) is approximately the mean distance between the Earth and the Sun. To understand that light travels through space (a vacuum) at a very high but finite speed (300,000kms/sec). To understand and learn that the finite speed of light means that very distant objects are observed as they were in the past, when the light we now see left them. (e.g. we see the sun eight minutes after the light left it and the nearest stars 2-5 years later). To learnthat a light year is the distance travelled by light in a year. To learn the distance to a star can be estimated from its relative brightness. To understand that light pollution and other atmospheric conditions interfere with observations of the night sky.	Use The Thousand Yard Model -The Earth as a Peppercorn - (see link opposite) to illustrate the relative size and spacing of the planets. Alternatively use toilet paper model if confined to indoors (see link opposite). Establish that while the Sun is an important star, it is certainly not the only one. Not only are there too many to count, the distances between us and the stars are beyond our imagination. Establish that Stars are so far away that standard units of measurement like miles and kilometres are awkward to measure these distances, therefore, scientists use what is known as the LIGHT YEAR. Establish that a light year is defined as the distance that light travels in one Earth year. Light moves very fast: *300,000 kilometres/second* or *180,000 miles/second*. In one second, light can travel around the Earth four times. In *31,500 seconds-one year-light will travel a distance of 9.46 trillion kilometres* which is 240 million times around Earth. Stars are millions and millions of kilometres away. If the star is 5 light years away, then the light we are seeing took five years to travel to our eyes. It also means that what we see happening at the current time is actually what happened five years ago. Have students solved these (or similar type) problems: A star is 5 light years away, how far is it in km? Issue worksheet with similar activities and problems to solve. Pupils can produce tables or bar-charts showing information on distances between planets and stars.	The Earth as a Peppercorn model- http://www.noao.edu/education/peppercorn/pcmain.html Toilet paper distance model- http://cse.ssl.berkeley.edu/AtHomeAstronomy/activity_10.html PowerPoint of planets and size- https://account.tes.co.uk/LogOn?rtn=http%3a%2f%2fwww.tes.co.uk%2fDownload.aspx%3fstorycode%3d6071544%26type%3dX%26id%3d6118126 Wikki distances from sun for each plane t- http://wiki.answers.com/Q/How_far_are_the_planets_from_the_Sun Chart outlining distances in light years between planets - http://www.tes.co.uk/ResourceDetail.aspx?storyCode=6126467	Explain the meaning of the Astronomical Unit (AU) and the light year. Assess simple speed, distance time questions and use of correct units.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
2 hours	Day and night The Earth's rotation around the Sun Months and years	To understand that the Earth rotates on its axis in a cyclical fashion. To understand how day and night occur as a result of the Earth's rotation. To use models to explain how day and night occur, involving the Earth's rotation, To use models to explain the passing of a month and of a year. To use models to explain why the sun appears to move across the sky during the day.	Using a kinaesthetic model where a lamp represents the sun and a pupil represents the Earth (see link opposite for nasa pack or use link for Cherilynn Morrow and Michael Zawaski pack) demonstrate the rotation of the Earth and occurrence of day and night. Question pupils to establish when it is day/ night, noon /midnight in various locations on Earth, and what time of day it is in their town at different points in the rotation. Discuss sunrise and sunset. Emphasize that it is the Earth's own shadow that makes the night side of the Earth dark. Establish that it takes 24 hours for the Earth to rotate completely. Allow all pupils to stand in a circle around the lamp each imagining they are the Earth. As they turn, each student will be able to experience night, sunset, day, noon, sunset, and, return to night. Ask students what part of the day/night cycle they are experiencing. Discussion on why there are time zones. Issue pupils with a globe and torch. Locate their country on the globe and place a sticker with town name. Using the equipment available, ask the pupils to present a demonstration explaining how the Earth rotates, resulting in day and night. Identify which countries are in daylight while your town is in darkness etc. Use the model to explain why the Sun appears to move across the sky during a day.	Kin aesthetic Astrology activities - http://solarsystem.nasa.gov/docs/Sky_Time.pdf	Use the model to explain how day and night occur, involving the Earth's rotation. Ask pupils to draw a diagram to illustrate what they have learned using the model with the lamp.
1 hour	Associating the seasons of the year to the movement of the Earth around the sun.	To recall that the Earth's axis is an imaginary line through the centre of the Earth between the South and North poles. To recall that this axis is tilted slightly compared to the way the Earth orbits the Sun. To understand that we get different seasons	Show video/animation of the seasons. Question pupils on why they think we have seasons. Many will associate temperature with proximity to the sun. Establish that we are closer to the Sun in January and Earth's distance from the sun plays a very small role in its temperature variation (lmadden seasonal temp link). Ask pupils to suggest ways in which the seasons differ from each other e.g. position of the Sun, climate, and hours of daylight. Ask for possible explanations.	*Activity to demonstrate seasonal temp change - http://staff.slcschools.org/lmadden/science/Link%20Files/6th_Grade_details/CoreHndbkStd2obj1and2lesson2.pdf Torch, paper Centimetre Grid overhead transparency, piece of cardboard or clipboard, clear tape, markers protractors. Video/animation, information cards	Pupils use Globe and Projector to illustrate Earth's Tilt and explain the Seasons. Test from BBC bitesize astronomy page http://www.bbc.co.uk/apps/ifl/schools/ks3bitesize/science/quizengine?quiz=astron

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
		(Winter, Spring, Summer and Autumn) because the Earth is tilted.	Use model/video/PowerPoint demonstration to establish that the axis of spin of the Earth is at an angle to the Sun and show how this affects the amount of Sun in each season in each hemisphere. Use activities (e.g. lmadden link opposite) to illustrate seasonal temperature change alternatively, help pupils to use a data logger to test the validity of the 'tilted Earth' explanation of the seasons, *e.g. by placing a tilted globe at a distance from a source of light/ heat and using a heat sensor to monitor the change in temperature as it is moved from the north to the south pole along a line of longitude.* Record and display the data as a graph for analysis and interpretation by pupils. Help pupils model the idea of the tilt of the Earth. Ask them to identify parts of the Earth which are experiencing different seasons, due to their relative position to the Sun.	about seasonal changes. BBC Bitesize Astronomy http://www.bbc.co.uk/schools/ks3bitesize/science/environment_earth_universe/astronomy_space/revise1.shtml	omy&templateStyle=science
1 hour	Relate the time of the daylight during the day to the 4 seasons.	To collect data about temperature and day length. Interpret first-hand and secondary data about temperature and day length.	Provide pupils with secondary data about seasonal changes (length of day, temperature etc.). Ask pupils to use sources of data to relate seasonal changes to the model of the Sun, Earth and Moon system that they have developed. Position the globe with Spain in a summer position relative to the light-source 'Sun'. Place a light sensor on one point and slowly rotate the globe. Collect data illustrating the differing hours of day length in summer and winter positions, and how this is dependent on the orientation of part of the globe to the 'Sun'. Establish the change in the location of the Sun is caused by the tilt of the Earth's axis which causes the Earth to face the Sun at an angle of 23 degrees. Where the Earth is located in its orbit around the Sun determines the length of the day. Since the Earth's location around the Sun is changing continuously, so too is the length of the days.	Activity to illustrate change in length of days. Year and seasons - http://www.youtube.com/watch?v=82p-DYgGFjI&feature=related Seasons - http://www.youtube.com/watch?v=WLRA87TKXLM&feature=related	Explain changes in Surface Temperature, Climate and Day Length which result from seasonal changes.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Understand the phases of the moon as a consequence of the relative position of the Earth, Sun and Moon. Recall that the moon is a natural satellite of the Earth, kept in orbit by the Earth's gravitational pull.	To understand that the sun is a light source but the Moon is not. To explain how we can see the moon in different forms depending on its position in relation to the Earth and the Sun. To sequence the phases of the Moon over a 28 day period. To explain how the views from the Earth or the Moon causes the phases in a regular sequence.	Ask pupils to recall the difference between light sources and reflective surfaces. Students write down definitions of luminous and non-luminous and sort various objects into the two categories. Discuss evidence that the Sun emits light (as a star) and that the Moon does not. Discuss their evidence. Explain that we only see the stars at night because the Sun is much nearer to us and appears brighter. Establish that the moon and Earth are seen by reflective light. Show an image of the Earth taken from the Moon. Pupils can make observations of the Moon at night and during the day, and record its changing phase and position in the sky and record their findings in a chart. Using a lamp, globe and model Moon, demonstrate phases of the Moon. Explain how due to the orbit of the Earth and Moon, the view from the Earth of the Moon causes the phases in a regular sequence. Show PowerPoint slides/videos demonstrating the phases of the Moon. Introduce vocabulary to describe phases of the Moon - Waxing Gibbous; Full moon; Waning Gibbous; Last half moon (last quarter); Waning crescent. Provide some pupils with images showing how the Moon changes shape over a 28-day period. Ask them to sequence these. Ask students to make phases of the Moon flick book Pupils produce a presentation explaining the phases of the Moon and explaining how the view from the Earth of the Moon causes the phases in a regular sequence using model/ simulations *e.g. half-black polystyrene sphere on a stick moved around at head height.* Newspaper reports on the phases of the Moon could be collected and discussed.	PowerPoint on phases of the Moon- http://www.tes.co.uk/teaching-resource/Phases-of-the-moon-3013562/ Lunar eclipse- http://www.enchantedlearning.com/subjects/astronomy/activities/label/lunareclipse/ Quiz site http://www.teachers-direct.co.uk/resources/quiz-busters/quiz-busters-game.aspx?game_id=30465 Phases of Moon - http://www.youtube.com/watch?v=0vXWXqGmPCk&feature=related	Worksheet on phases of the Moon- http://www.tes.co.uk/teaching-resource/Phases-of-the-moon-3010595/ Teacher/Peer assessment of presentations

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	How and why we get eclipses of the Sun and Moon.	To understand why solar and lunar eclipses occur. To describe sequence and model a solar and lunar eclipse system.	Show students a picture of a lunar eclipse – ask them to tell you what they think is happening (get small groups to discuss and offer explanations). Model a lunar eclipse using lamp, globe and Moon. Refer pupils to the solar eclipse of 1999. Challenge them to explain what caused this. Using diagrams and models, e.g. *involving a light source, football, tennis ball,* and ICT simulations to demonstrate solar eclipses. Clarify the importance of the slight angle of the Moon's orbit relative to that of the Earth, and use this to explain the rarity of total eclipses. Help pupils to adapt their own diagrams of these phenomena to the scientific model. Use following link for ideas on kinaesthetic lessons on lunar and solar eclipses. - http://www.solarviews.com/eng/edu/moonphas.htm Show pupils photographs, video clips, CD-ROMs and simulations to reinforce their knowledge. Provide a set of diagrams (see link opposite) showing stages of an eclipse, and ask pupils to put them in the correct sequence. Complete eclipses worksheets (see link). Provide students with a mixed up sequence of an eclipse and ask them to put in the correct order. Ask pupils in groups to present a presentation, using a model and diagrams to explain how eclipses of the Sun and Moon occur.	Pictures of lunar and solar eclipses, lamp, globe, Moon Sequence cards of eclipse. Eclipse worksheets. Writing Frame	Worksheet eclipse - http://www.tes.co.uk/teaching-resource/Eclipses-and-tides-6005584/U Assessment of creative writing.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
			Describe the evidence eclipses provide about the solar system, *e.g. relative sizes and distances of the Moon and the Sun,* and other phenomena, *e.g. roosting of* birds. LL Creative writing - ask pupils to write about what it would be like to experience a solar eclipse, describing the stages of the eclipse with accompanying pictures, *e.g. in the style of a news report.*		

3. Bands of Attainment for ESO 1

The bands of attainment described below are for ESO 1.

Band 1: 30% pupils will not have made so much progress and will have reached or may be struggling at this level.
Band 2: 60% pupils will have reached this level.
Band 3: 10 % pupils will have progressed further and will have reached this level.

Scientific Skills

Band 1
Pupils respond to suggestions about how to find things out and, with help, make their own suggestions about how to collect data to answer questions. They use simple texts and other sources of information such as the Internet, with help, to find information.

They use simple equipment provided and make observations related to their task. They observe and compare objects, living things and events. They describe their observations using scientific vocabulary and record them, using simple tables when appropriate.

They say whether what happened was what they expected. The can plot bar charts and line graphs with help.

Band 2
Pupils respond to suggestions and put forward their own ideas about how to find the answer to a question. They recognise why it is important to collect data to answer questions. They use simple texts and other sources of information such as the Internet, to find information. They make relevant observations and measure quantities, such as length or mass, using a range of simple equipment.

Where appropriate, they carry out a fair test with some help, recognising and explaining why it is fair.

They record their observations in a variety of ways. They provide explanations for observations and for simple patterns in recorded measurements. They communicate in a scientific way what they have found out and suggest improvements in their work.

Band 3
Pupils recognise that scientific ideas are based on evidence. In their own investigative work, they decide on an appropriate approach (for example, using a fair test) to answer a question. Where appropriate, they describe, or show in the way they perform their task, how to vary one factor while keeping others the same. Where appropriate, they make predictions. They select information from sources provided for them.

They select suitable equipment and make a series of observations and measurements that are adequate for the task.

They record their observations, comparisons and measurements using tables and bar charts. They can plot points to draw line graphs and will begin to use best fit lines in certain circumstances, and use these graphs to point out and interpret patterns in their data.

They begin to relate their conclusions to these patterns and to scientific knowledge and understanding, and to communicate them with appropriate scientific language.

They suggest improvements in their work, giving reasons.

Space

Band 1

Pupils know the position of the Earth in the Universe as well as the different types of celestial bodies.

Pupils can demonstrate they know the planets of the solar system and they are able to differentiate between them.

Pupils understand why the seasons occur.

They understand the causes of the eclipses of the Sun and Moon.

Their use and range of vocabulary is adequate.

Band 2

Pupils can demonstrate their knowledge of the relative positions of the different bodies that make up the solar system.

Pupils are able to name and locate some celestial bodies including constellations.

Pupils can compare the planets of the solar system in relation to the Earth.

Pupils understand why the seasons occur.

They understand the cause of eclipses and are able to illustrate the different positions of the Earth throughout the year.

Pupils understand how the eclipses of the Sun and Moon occur and they can draw the different lunar phases.

They are able to use a simple compass effectively.

Their use and range of vocabulary is more than adequate to relate and explain their findings.

Band 3

Pupils can demonstrate their knowledge of the main theories on the origin of the universe and the earth.

Pupils can demonstrate their knowledge of some of the methods of exploring the universe.

They are able to express an opinion about the importance of space investigations.

They understand the concept of the light year and astronomical unit and can make some simple calculations using those units.

Pupils can locate some stars or constellations in a planisphere.

They understand why the Moon always shows the same face.

They are able to use ICT to find information and can explain this effectively.

They have a good command of vocabulary and are able to use this well in order to relate and explain their findings.

Physics and Chemistry

Band 1

Pupils identify a range of common solids, liquids and gases and know about some of their properties.

They describe similarities and differences between materials.

Pupils use their knowledge and understanding of materials when they describe a variety of ways of sorting them into groups according to their properties. They know some simple ways of separating mixtures.

Their use and range of vocabulary is adequate.

Band 2

Pupils demonstrate knowledge and understanding of materials and their properties drawn from the work they have done in Primary 6 and ESO1. They describe differences between the

properties of different materials and explain how these differences are used to classify substances (for example, as solids, liquids, gases, and as acids and alkalis).

They recognise that materials are made from particles and can give a simple explanation of the different arrangements of the particles in solids, liquids and gases.

They can describe some methods (for example, filtration, and distillation) that are used to separate simple mixtures.

They use scientific terms (for example, evaporation, condensation) to describe changes.

Their use and range of vocabulary is more than adequate to relate and explain their findings.

Band 3

Pupils demonstrate an increasing knowledge and understanding of materials and their properties drawn from the work they have done in Primary 6 and ESO1.

They understand that the pH scale can be used to distinguish acids and alkalis.

They identify a range of contexts in which changes (for example, evaporation, and condensation) take place.

They use knowledge about how a specific mixture (for example, salt and water, sand and water) can be separated to suggest ways in which other similar mixtures might be separated.

They recognise that matter is made up of particles, and describe differences between the arrangement and movement of particles in solids, liquids and gases. They use the particle model of matter in explanations of phenomena (for example, dissolving and diffusion). They explain differences between elements, compounds and mixtures in terms of their constituent particles.

They recognise that elements and compounds can be represented by symbols and formulae.

They apply their knowledge of physical and chemical processes to explain the behaviour of materials in a variety of contexts.

They have a good command of vocabulary and are able to use this well in order to relate and explain their findings.

Geology

Band 1

Pupils know about the different layers of the Earth and the main meteorological phenomena.

Pupils understand and can describe rock specimens and recognise that these have different textures. They can also describe some of the effects of weathering over time and recognise sedimentary layers.

With help they will be able to identify a question for investigation into the movement of sediment.

They will be able to use ICT to make and record observations in relation to their question.

Their use and range of vocabulary is adequate.

Band 2

Pupils know about the composition of the layers of the Earth and understand the main meteorological phenomena and atmospheric pressure.

Pupils can describe rock specimens in terms of texture and can relate this to properties of rocks, such as porosity.

They understand and are able to describe the physical and chemical processes which cause weathering and transportation. They can relate these processes and their results to features of the environment and can describe and explain the processes by which sedimentary layers are produced.

They will be able to suggest a question to be investigated about the movement of sediment and, with help, can identify an appropriate approach.

They will be able to use ICT to make and record observations in relation to their suggested question.

Their use and range of vocabulary is more than adequate to relate and explain their findings.

Band 3

Pupils have a good understanding of the different layers of the Earth and meteorological phenomena and atmospheric pressure and are able to explain them.

They are able to appreciate the uniqueness of the planet Earth and its atmosphere, and can solve problems related to these characteristics.

Pupils understand and are able to relate chemical weathering processes to the reaction of particular grains to acids.

They are also able to relate sedimentary layers to the process by which they were produced.

They will be able to use evidence from several different sources in order to describe a sequence of geological events.

They will be able to use ICT to make and record their observations.

They have a good command of vocabulary and are able to use this well in order to relate and explain their findings.

Biology

Band 1

Pupils understand that animals and plants are made of cells that can form tissues and tissues can form organs. They describe similarities and differences between plant and animal cells.

They can classify living things into the main taxonomic groups (animals, plants, microorganisms).

They can match some humans' attitudes with some environmental effects. They understand the importance of protecting the environment.

Their use and range of vocabulary is adequate.

Band 2

Pupils recognise differences in cell shapes according to different functions. They identify specific organs in cell plants that are different from animal cells. They can explain the functions of the main parts in both plant and animal cells.

They demonstrate knowledge and understanding of characteristics of living things that help to classify them into the main taxonomic groups including the five kingdoms. They understand how to use a key for classification. They use a key to demonstrate why humans are animals.

They demonstrate an increasing knowledge and understanding of living things and interdependence drawn from the work they have done in Primary and ESO1.

They recognise that pollution can be caused by humans and the importance of protecting the environment.

They describe characteristics of habitats that support a diversity of plants and animals that are interdependent. They use different kind of graphs and diagrams to explain food chains and web chains in a habitat.

Their use and range of vocabulary is more than adequate to relate and explain their findings.

Band 3

Pupils use knowledge about cells to explain ways in which some cells are adapted to their functions. They relate cells and cell functions to life processes in a variety of organisms.

They demonstrate an increasing knowledge and understanding of living things taxonomy drawn from the work they have done in Primary and ESO1. They can make and use keys to classify living things into the major taxonomic groups including the five kingdoms.

They apply their knowledge of interdependence to explain how changes in habitats can affect the size of populations.

They recognise that feeding relationships can be explained in terms of energy flowing. They can quantify food chains using pyramids of numbers.

They use specific vocabulary to explain ways in which living things and the environment can be protected (for example, sustainable development). They can describe some of the effects of humans on the environment, such as acid rain or water pollution.

They have a good command of vocabulary and are able to use this well in order to relate and explain their findings.

4. ESO 2. Units of work

Topic: Materials and Energy

Key words: Element, compound, homogeneous mixture, heterogeneous mixture, material, heat, light, electrical energy, kinetic energy, potential energy, chemical energy, nuclear energy, sound energy transfer, fossil fuels, non-renewable energy resources, renewable energy resources, power station.

Previous learning experience: Pure substances and mixtures, elements and compounds, homogeneous and heterogeneous mixtures. Atoms and molecules, symbols. Classification of materials, Effects of temperature change on materials.

Topic outline:
- Matter and materials.
- Energy and types of energy.
- Energy transfer.
- Energy sources.

Key web pages:
http://www.powersleuth.org/teacher/energy-powers
http://www.eia.gov/kids/energy.cfm?page=1

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
2 hours	What is matter? What is matter made up of? Pure substances and mixtures.	To understand what matter is. To distinguish between pure substances (elements and compounds) and	Ask if a pencil case is matter? Does it have mass? Does it take up space? Is happiness matter? What is matter made up of? What are atoms made up of? Use diagrams to explain how to classify matter into pure substances and mixtures and then classify pure substances into elements and compounds. Pure substances have a fixed composition and therefore, can be represented with a formula.	http://www.bbc.co.uk/bitesize/ks3/science/energy_electricity_forces/energy_transfer_storage/revision/1/ Diagrams. Hodder B activity sheet B5G1	Assess understanding from questions. Pupils can associate diagrams to different types of substances. Pupils are able to classify substances into pure substances

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
	Materials.	mixtures (homogeneous and heterogeneous). To explain what a material is and to classify them according to different criteria.	Look at a stone of granite and a non-sparkly soft drink. What is heterogeneous? What is homogeneous? Why? Look at some substances (sulphur, copper sulphate, copper, zinc, common salt, vinegar, granite…) and classify them. Materials are what we use to make the things we need. Pinpoint that materials are not objects. Make a list of materials, and classify them into natural and man-made. Pupils can make a poster with images of materials that they find at home and classify them into elements, compounds, mixtures, natural or man-made.	Stones of granite, non-sparkly soft drink. Sulphur, copper, zinc, common salt, vinegar. List of materials.	(elements and compounds) and mixtures (homogeneous and heterogeneous). Wall poster about household materials.
3 hours	What is energy? Energy is measured in Joules. Types of energy (heat, light, electrical energy, kinetic energy, potential energy, chemical energy, sound, etc)	To link the concept of energy to change. To understand that an object may have energy due to its motion, position, etc.	Energy is the ability to make something happen. Show images to illustrate this concept and the different types of energy. Look at a nutritional table of any food wrapping in order to show students that food contains energy and that energy is expressed in Joules or calories. Show images of different objects or situations and ask students to identify the types of energy. Show images of different devices and ask students to identify what types of energy they produce.	Images to illustrate the different forms of energy: a people running, a candle burning, TV, computer, loudspeaker, food, fuel, etc. Food wrappings. Images such as people running, a candle burning, TV, computer, loudspeaker, food, fuel, etc.	Definition of energy. Pupils can identify and describe different types of energy.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
3 hours	Energy transfers.	To understand that energy can be transformed from one type to another. To understand that all devices work transforming one type of energy to another. To understand that electricity production is based on energy transfer.	Show materials or devices and/or images and ask: Where does the energy come from? What energy do they produce? Draw energy flow diagrams to represent these energy transfers. Draw the diagram of the energy transfer that is taking place. Show wasted energy and useful energy with slinky diagrams. Perform some energy transfers in the laboratory: (e.g. steam turbine, or attach a ring to a stand, balance a match with its head covered with aluminium foil on the ring and light it). Use images or diagrams of a power station (e.g. coal-burning power station) to explain that electricity is produced transforming one type of energy to another.	Various examples of electrical equipment, e.g.: radio, lamp, hair-dryer etc. and equipment using batteries. Photos, pictures, video footage of examples of energy transformation: e.g.: vehicles Different materials and objects to illustrate energy transfers, e.g. wax, Bunsen burner, rattle, guitar, etc Laboratory material. Matches, aluminium foil, turbine. Images or diagrams of different types of power station.	Pupils are able to identify and represent with diagrams the energy transfers that take place in different devices or situations. Description of how electricity may be obtained from fossil fuels, water, or nuclear fission.
2 hours	Energy sources.	To understand the difference between energy sources and types of energy. To classify energy resources into renewable and non-renewable and know their main advantages and disadvantages. To understand how fossil fuels are formed. To recognise the consequences of	Pinpoint the difference between energy sources and types of energy. Ask students to suggest energy sources and list their suggestions. Ask then which sources will run out and will not. Show a diagram or a video to demonstrate origins and uses of fossil fuels.	Worksheet to list renewable and non-renewable energy sources in separate columns. Diagram or video to illustrate origins and uses of fossil fuels:	Assess understanding from questions and worksheet. Pupils can explain a diagram showing how

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
		overusing fossil fuels and suggest alternatives. To understand how electricity is produced from renewable energy resources.	Use images to show different renewable energy sources. Pupils work in groups to research one of the renewable energy resources mentioned (how electricity is obtained, advantages and disadvantages) and make a poster or ppt that they present to the class (LL).	http://www.eia.gov/kids/energy.cfm?page=nonrenewable_home Images to illustrate renewable energy sources.	fossil fuels are formed. Information found about non-renewable energy resources and how it's been presented.

Topic: Chemical Reactions

Key words: Elements, periodic table, metals, non-metals, chemical formula, chemical change, physical change, fizzing, exothermic reaction, endothermic reaction, reactant, product, word equation, acid, alkali, neutral substance, hazard symbol, litmus, universal indicator ph scale, neutralisation, metal oxide, carbonate, test for gases, acid rain, reaction of metals and acids, reactivity series, combustion, fire triangle, greenhouse effect.

Previous learning experience: General properties of matter: mass and volume. Specific properties: density. Properties of solids, liquids and gases. Particle theory of solids, liquids and gases. Pure substances and mixtures. Atoms and molecules; elements and symbols.

Topic outline:
- Atoms, elements and the periodic table. Metals and non-metals.
- Chemical formula. Physical and chemical changes. Changes during a chemical reaction. Word equations.
- Acids and alkalis.
- Simple chemical reactions: neutralisation, reaction of metals and acids and combustion.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
3 hours	Atoms, elements, the periodic table. How can we tell if an element is metal or non-metal?	To recognise the most important and useful symbols of elements. To learn that the periodic table is a method of classifying elements. To understand the meaning of the words group and period. To understand that metals are found towards the left and non-metals towards the right of the table. To be able to describe the key differences between metals and non-metals.	Ask what is matter made up of? What are atoms made up of? What are elements? Every element has its own symbol and atomic number. The periodic table is the arrangement of the elements according to their atomic number. Rows are called periods, columns are called groups. Elements in the same group have similar chemical properties. All the elements can be classified as metals, non-metals or semi-metals. Where are metals and non-metals located in the periodic table? Provide students with some materials and tell them to classify them into metals or non-metals. Students can carry out tests in order to investigate the properties of metals and non-metals (malleability, heat and electricity conductivity, melting point, etc.).	Poster Periodic Table Element flash cards http://education.jlab.org/elementflashcards/ Worksheet to accompany the explanation. Hodder Science Gold B, page 26 Worksheets B2G2, B2G3, B2G4 History of the periodic table (LL). Metals such as iron, aluminium, zinc and non-metals such as sulphur, carbon. Hammer, 9-volt battery, a small appliance light bulb, pieces of insulated copper wire and laboratory material.	Asses understanding from worksheet. Classify elements into metals or non-metals based on their appearance. Table with properties.
1 hour	Chemical formula	To understand that a formula shows the number ratio and type of atoms which have joined. To be able to write a formula given the number ratio and be able to state the names and numbers of combined atoms given a formula.	Indicate the type and number of atoms that make up a substance from its formula. Deduce the formula of a substance from a model or a diagram and ask students to write their formula.	Formulas and diagrams of pure substances. Hodder B activity sheet B5G4	Asses understanding from worksheets.

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	Chemical and physical changes	To describe the differences between physical and chemical change.	Show an image of ice cubes melting and ask: Are new substances being formed? Is the change easy to reverse? Do the same with a chemical change such as baking a cake. Ask students to classify different changes into physical or chemical changes.	Images of physical and chemical changes. Physical and chemical changes activity: http://mysciencelessons.blogspot.com.es/2009/08/physical-chemical-change-activity.html Hodder activity sheet A11G1	Pupils can distinguish between physical and chemical change.
2 hours	Changes during a chemical reaction	To recognise when a chemical reaction takes place.	Students can carry out some experiments to observe the changes that may occur during a chemical reaction: Colour change: add 1 mL of 2 g/L Copper sulphate solution to 1 mL of household ammonia Fizzing: add 2 mL of 1 M HCl to bits of egg shell. Temperature changes: Explain the meaning of extothermic and endothermic reactions. Exothermic reaction: add 5 mL of 1 M HCl to 2 pellets of sodium hydroxide. Endothermic reaction: add 15 g of sodium bicarbonate to 25 ml of citric acid solution. Solution going cloudy: add 1 mL of 1% lead (II) nitrate solution to 1 mL of 1% potassium iodide solution.	2 g/L copper (II) sulphate solution, household ammonia, 1 M HCl solution; egg shell; sodium hydroxide; 1% lead (II) nitrate solution; 1% potassium iodide solution and laboratory material. Change of colour chemical reaction: http://chemistry.about.com/od/colordemonstrations/a/Easy-Blue-Color-Change-Demo.htm Endothermic reaction: http://chemistry.about.com/cs/howtos/ht/endothermic.htm	To list the changes that may occur during a chemical reaction
			Students can perform some changes in the lab (adding salt to vinegar and adding sodium bicarbonate to vinegar) and classify them into physical and chemical changes.	Salt, sodium bicarbonate and vinegar. Lab activity: physical and chemical changes: http://www.bilingualelearning.es/aula/course/view.php?id=126 Hodder Activity sheet A11G2	To identify when a chemical reaction is taking place.
	Reactants and products; Word equations	To represent chemical reactions by means of word equations	Explain the terms reactants, products and word equation using as examples some of the chemical reactions performed in previous lessons.	Word equations worksheet: http://misterguch.brinkster.net/equationworksheets.html	Construct word equations.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
4 hours	What are acids and alkalis?	To recognise common acids and alkalis.	Write a table with useful facts and examples of acids and alkalis (lemons, vinegar, soap, oven cleaner, washing powder, etc). Get pupils to classify some substances into acid or alkali.	Hodder Activity sheets A8G1, A8G2 Acids and alkalis games: http://scienceview.berkeley.edu/showcase/flash/juicebar.html	List of the acidic and alkaline substances at home.
	Safety with acids and alkalis.	To know the meaning of the hazard symbols and to understand the dangers.	Explain what a hazard symbol is. Pupils work in groups to match hazard symbols with their meanings.	Hodder Activity sheet A8G5	Pupils show understanding of the hazard symbols.
	Indicators and the pH scale.	To identify acids, alkalis and neutral substances using litmus indicator.	Ask students: Can we taste or feel acids and alkalis to find out what they are? Explain what an indicator is. Mention litmus indicator.	Litmus indicator, samples of household substances (bottled water, baking soda, vinegar, fruit juices, cola drinks, washing powder, detergent, etc.).	Table of results.
		To classify substances into strong or weak acids, strong or weak alkalis or neutral substances using the pH scale.	Students can use litmus indicator to test some samples. Indicators are useful for detecting acids and alkalis but they do not compare their different strengths. Explain what the pH scale is. Students can use universal indicator to find out the pH of common acids, alkalis and neutral substances.	Hodder Activity sheets A8G2, A8G4 Hodder Chapter 8 Summary Universal indicator and substances. Crossword quiz: http://www.docbrown.info/ks3chemistry/7Exw1print.htm	Table of results
2 hours	Neutralisation	To recognise the importance of neutralisation in our daily lives.	Explain that when an acid is added to a base they cancel each other out. This reaction is called neutralisation. Show image of this reaction in our daily lives (use of antacids, use of toothpaste, and treatment of a bee or a wasp sting).	Images of antacids, toothpaste, bee sting or wasp sting, etc. Worksheet to accompany the explanation.	Asses understanding from worksheet.
		To be able to describe the reactions of common acids with metal oxides and	Metal oxides are bases, so will they react with acids? acid+metal oxide salt + water The reaction between sulphuric acid and copper	Experiment: reacting copper (II) oxide with sulphuric acid: http://www.nuffieldfoundation.org/practical-chemistry/reacting-	Write word equations.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
		carbonates.	(II) oxide can be performed in the laboratory. Metal carbonates are also bases, will they react with acids? Acid + metal carbonate salt + water+carbon dioxide Mention that limescale, limestone, chalk and marble contain calcium carbonate. Ask how can limescale be removed from a saucepan? Link with acid rain.	copperii-oxide-sulfuric-acid Acid rain interactive animation: http://www.absorblearning.com/media/attachment.action?quick=vd&att=2248	
	Testing for CO_2	To recognise the presence of CO_2.	Explain and carry out the test for CO_2 reacting 5 M HCl with calcium carbonate.	5 M hidrochloric acid, calcium carbonate. Test for CO_2: http://earlieuk.wordpress.com/2011/02/18/how-to-collect-and-test-oxygen-hydrogen-and-carbon-dioxide/	Students can describe the test for CO_2
2 hours	How do metals react with acids?	To be able to describe the reactions of common acids with metals.	Explain that some metals react with acids to produce hydrogen gas: Acid + metal salt + hydrogen Demonstration of reactivity series: Students can investigate the difference in reactivity of some metals adding dilute sulphuric acid to calcium, magnesium, zinc, iron and lead.	Dilute sulphuric acid, calcium, magnesium, zinc, iron and lead. Hodder Activity sheet A11G3 Hodder Activity sheet C Chap 2 Summary	Write word equations. Report lab experiences.
	Testing for hydrogen	To recognise the presence of hydrogen.	Carry out the test for hydrogen Use a piece of zinc or magnesium and add 2 mL of 0, 4 M HCl.	Testing for hydrogen: http://www.youtube.com/watch?v=1PLH4H7Mjl8&feature=related	Students can describe the test for hydrogen.
2 hours	Combustion	To be able to describe the reaction of metals and hydrocarbons with oxygen. To appreciate that the products of burning fossil fuels may have damaging effects on the environment.	Explain that burning or combustion takes place when a substance reacts with oxygen. In this reaction oxides are formed: Metal + oxygen metal oxide hydrocarbon + oxygen carbon dioxide + water Explain that a hydrocarbon is a compound containing hydrogen and carbon only and that hydrocarbon derive from crude oil. Link with greenhouse effect.	Worksheet to accompany the explanation. Greenhouse effect and global warning video http://www.youtube.com/watch?v=dP-tg4atr5M&feature=related	Write word equations.

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	Testing for oxygen Fire triangle	To recognise the presence of oxygen. To understand burning in terms of the fire triangle	Ask students: Where will substances burn better: in air or in pure oxygen? Explain and carry out the test for oxygen. Show a fire triangle and explain that represents the three things fire requires. Use images to illustrate that to control a fire, at least one of them must be removed.	Test for oxygen: http://earlieuk.wordpress.com/2011/02/18/how-to-collect-and-test-oxygen-hydrogen-and-carbon-dioxide/ Hodder Activity sheets C2G4; A11G4 Hodder Activity sheet A11G5 Worksheet to accompany the explanation. Images to illustrate different ways of putting a fire out. Quizzes on simple chemical reactions, acids and alkalis: http://www.docbrown.info/ks3chemistry/ks3chemistry.htm http://www.bbc.co.uk/apps/ifl/schools/ks3bitesize/science/quizengine?quiz=acids&templateStyle=science	Write a report about Greenhouse effects. Students can describe the test for oxygen. Asses understanding from worksheets. Explain different ways of putting a fire out.

Topic: Energy and Living things: Vital Functions and the Use of Energy

Key words: Balanced diet, herbivore, carnivore, omnivore, malnutrition, broken down, ingestion, digestion, absorption, egestion, enzymes, photosynthesis, chlorophyll, glucose, limiting factor, stomata, transpiration, nutrient, fertilizer, competition, weed killer, pesticide, decline, organic, cellular respiration, plasma, red blood cells, gaseous exchange, alveoli, bronchi, bronchioles, trachea, pulmonary diseases, asexual, sexual, fertilization, pollination, stimuli, receptors, nervous system, effectors, tropism.

Previous learning experience: Life processes in living things. Organ systems in humans and animals. Plants: feeding and reproduction.

Topic outline:
- Animal nutrition.
- Plant nutrition.
- Respiration in animals and plants.
- Reproduction.
- Coordination, sensitivity and movement in plants and animals.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities.	Suggested Resources.	Assessment
1 hour	Revision of Mrs Gren. Introduce the concept that all things need energy to life.	What can all living things do? To dentify how animals and plants make energy and then identify what this energy is used for.	Show photos of living things moving, respiring, senses, growing, reproduction, excretion and Make a link between nutrition providing glucose for respiration that releases energy for animals and plants to live.	PPT.	Question and answer the students orally.
1 hour	Animal Nutrition. The 7 food groups: Fats, carbohydrate proteins, vitamins minerals, fiber and water.	To identify some reasons why food is important. Name the 7 food groups. To understand that a nutrient contains a particular bimolecular structure.	Get pupils to classify different foods into the 7 food groups. Pupils understand that the majority of food contains a variety of nutrients. Introduce the 4 main elements in fats, proteins and carbohydrates: carbon, hydrogen, oxygen and nitrogen.	Use real examples of food rich in a particular food group and get the pupils to decide which group it belongs to, e.g. butter to the fat group. Play the nutrition game; http://kidshealth.org/kid/closet/games/game_nutrition.html	Students keep a food diary for a day recording everything they have eaten and drunk. They then think about the nutrients available in the food eaten.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities.	Suggested Resources.	Assessment
	Balanced diet.	To identify foods which are rich in particular nutrients. To learn each food group should be eaten in the correct amount. Unbalanced diet can lead to malnutrition.	Pupils understand that the intake of some food groups should be greater than others. More fiber less fats. Malnutrition can lead to obesity as well as starvation.	Show pupils the food group pyramid. Students investigate diets of the world and make posters that can be displayed.	Pupils compare their diet s with each other. Do they think they have a balanced diet? Pupils orally present their posters to each other and even taste particular food from other countries.
1 hour	Heterotrophic nutrition. The human digestive system.	To define what are herbivores, carnivores, omnivores. To understand the flow of energy from one creature to another. Description of the system and explanation of the five stages in the process of digestion.	Classification of animals depending on what they eat. Study some differences in their mouths using photos of carnivores' and herbivores' teeth. Look at the differences in the digestive system of herbivore animals and carnivore animals. Show that all the animals depend on other living creatures to find energy. Label a diagram of the digestive system and state where each of the 5 stages occurs. (Ingestion happens in the mouth etc.) Explain that digestion is the breakdown of large insoluble molecules into small soluble molecules. Only soluble molecules can be absorbed by the body. Investigate a change in taste when chewing bread.	Whose teeth are they? http://www.bbc.co.uk/schools/scienceclips/ages/7_8/teeth_eating.shtml Use ppts, and worksheets. Hodder Science Gold B (Chapter 1) Book and Activity pack (pages 108,112). Pupils chew bread for 10 minutes to see the effect of amylase on starch. The taste of the bread gradually becomes sweeter.	Pupils can identify if an animal is an herbivore, carnivore or omnivore. Pupils complete a nutrition crossword.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities.	Suggested Resources.	Assessment
1 hour	Respiration Word and symbol equations Aerobic versus anaerobic. Testing exhaled air for carbon dioxide. Look at how combustion is similar to respiration.	What do scientists mean when they talk about respiration? To write equations to show what happens during respiration. To compare aerobic and anaerobic respiration. To explain what is meant by an oxygen debt. To use lime water as a test for Carbon dioxide. To compare the reactants and products of combustion with that of respiration.	Explain that all living cells respire releasing energy from glucose. Ask pupils where the glucose comes from and how is it transported to the mitochondria of the cells. (For animals and plants). Students learn to write word and chemical equation for respiration. Relate how this energy from respiration is used for MRS GREN. Explain what happens when there isn't enough oxygen (anaerobic respiration.) That anaerobic produces lactic acid and an oxygen debt. Pupils breathe out through a straw into a test-tube of limewater and observe what happens. Demonstrate combustion using a burning candle in different volumes of air. Ask pupils what happens to the candle when there isn't enough oxygen? How's this reaction similar to respiration.	Diagrams showing the reactants and products of respiration. International science book 2. P36 – 40. Hodder K Morrison BBC bitesize respiration http://www.bbc.co.uk/schools/gcsebitesize/pe/appliedanatomy/respiratory/1_anatomy_respiratorysys_act.shtml lime water, test tubes, straws. Diagram of the fire triangle. Candle, tall glass, plate.	Students can write equations for respiration. Students can draw a table that compares and contrasts the difference between aerobic and anaerobic respiration. Students know that a test for carbon dioxide is lime water. Pupils' explain what is happening in the experiment and relate it to respiration.
1 hour	Nutrition in Plants.	To revise the process of photosynthesis. To identify the sources of raw materials in photosynthesis and a shortage results in a limiting factor To construct the word equation for photosynthesis	Read the text 'Discovering Photosynthesis.' (LL) Carry out an investigation to establish the importance of the different factors needed for photosynthesis. (e.g.: different seeds in different conditions –no light, no water, and no soil...- and see what happens). Look at graphs to see how the rate of photosynthesis can be affected by various limiting factors.	Hodder Science Gold C Book C (pages 84, 85) Help a plant grow, BBC interactive activity, http://www.bbc.co.uk/schools/scienceclips/ages/7_8/plants_grow.shtml	Students answer the comprehension questions on p 85. (LL) Pupils can understand graphical information

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities.	Suggested Resources.	Assessment
		To identify that the carbon dioxide level is lower in daylight To conclude the photosynthesis takes place when there is daylight To recognise that plants need mineral salts for growth.	Photosynthesis will only take place when there is light however respiration is always happening. Pupils investigate what nutrients plants need and why it needs it. How plant growth can increased by using fertilizers	Hodder Science Gold C Book C (pages 83, figure 3.)	that shows the rate of photosynthesis. Students can explain why fertilisers are good for increasing food production.
1 hour	Reproduction As a vital function.	To examine why living things need to reproduce? Asexual reproduction Sexual reproduction	Students brainstorm why all species need to reproduce. Define asexual reproduction. Look at examples of asexual reproduction, such as binary fission in bacteria, spore formation in fungi and tuber development in potatoes. Think about the advantages and disadvantages of asexual reproduction. Define sexual reproduction. Look at examples of sexual reproduction in animals. What are the advantages and disadvantages of sexual reproduction?	Hodder Science Gold C Book C (pages 89). Use a ppt.	Students can compare axesual reproduction with sexual reproduction using examples.
1 hour	Sexual reproduction in a flowering plant.	To identify and label the different parts of a flower.	Students dissect a flower and identify the different parts. They then make a labeled drawing of their dissection.	International Science book 2 Hodder (p49) Interactive BBC activity. http://www.bbc.co.uk/schools/ks2bitesize/science/living_things/plant_life_cycles/play.shtml	Pupils can match parts of a flower with the appropriate function.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities.	Suggested Resources.	Assessment
3 hours	Coordination sensitivity and movement.	To understand that the nervous system works following the scheme Stimuli – Responses To identify the sense organs in animals as the organs that perceive stimuli. To identify the motor system in animals as the responsible for producing responses (movements). To identify the endocrine system. To recognize the overall function of the nervous system. To differentiate plant sensitivity and movement from animal ones.	Give example of the pizza delivery man. Get the pupils to think about what senses are stimulated, from hearing the door bell, seeing the pizza in the box, smelling the pizza, touching the pizza and tasting the pizza. Compare the nervous system to the postal service, receiving and delivering messages. Explain that some are voluntary reactions and others are involuntary. Hormones are chemicals that are secreted by a gland cause a response. For example adrenalin is secreted by the adrenal glands and prepares the body to cope with danger.Draw a table comparing the differences between the motor system and the endocrine system. Discuss with the students how plants can feel changes in their surroundings if they do not have sense organs. Develop the idea of plant hormones working to coordinate and elaborate responses like the special movements they do (growing towards the light or as a climber up a pole). Extended practical to investigate how light can affect the direction the plant grows.	BBC activity; The nervous system. http://www.bbc.co.uk/schools/gcsebitesize/science/aqa/nervesandhormones/thenervoussystemact.shtml Cress seeds, shoe boxes, cotton wool, lamps.	Pupils can match sense organs to senses. Pupils can label a diagram of a reflex arc. Pupils can explain the difference between a voluntary and an involuntary reflex action. Pupils' report of the investigation.

Topic: Ecosystems and Energy

Key words: Biosphere, biome, ecosystem, biotic, abiotic, food chain, food web, auto trophic, hetro trophic, primary, secondary and tertiary consumers, producers, decomposers, herbivores, carnivores, omnivores, pyramids of numbers and biomass, predator, prey, population, pollution.

Previous learning experience: Understand that animals eat plants and other animals and this can be shown in a food chain. Many food chains can be shown as a food web. That plants and animals can adapt and compete for resources. Pollution can upset food chains.

Topic outline:

- The biosphere and biomes.
- Ecosystems and energy.
- Energy flow through ecosystems.
- Pyramids of numbers and of biomass.
- The human impact on ecosystems.

Key web page: http://www.bbc.co.uk/bitesize/ks3/science/organisms_behaviour_health/food_chains/revision/1/

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
2 hours	What is the Biosphere? Explain that the biosphere is divided into different biomes.	To understand the terms Biosphere and Biome.	Show photos of living things from all parts of the world, then show photos of flora and fauna from one particular biome. Elicit what they've in common e.g. they all live / grow in the desert. Explain what a biome is. Pupils work in groups to research a biome and make a poster or ppt that they present to the class.	PPT of photos. Definitions of words. Encarta http://kids.nceas.ucsb.edu/biomes/index.html	Information found about biomes and how it's been presented.
	Explain that there are ecosystems.within biomes Abiotic factors	To understand the idea of an ecosystem. To explain what the	Show a diagram of an ecosystem and get pupils to identify the abiotic and biotic factors. Ask how these factors inter relate with each other. E.g. the light is needed by the pants for photosynthesis. Get pupils to find abiotic and biotic	Photo of an ecosystem. Worksheet to accompany the photo of an ecosystem:	How pupils are able to respond to the worksheet questions.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
	Biotic factors	abiotic and biotic factors of an ecosystem are and their relationship with each other.	relationships. Pupils look at the factors which influence the distribution of the living things in an ecosystem.	Poster of a specific ecosystems showing how all the components interact.	Pupils clearly understand what an ecosystem is. Pupils demonstrate understanding of the components of an ecosystem.
1 hour	Food Chains and Food Webs.	To learn and define relevant vocabulary. To show how energy enters a food web/chain. To understand trophic levels and the dynamics of a food chain. To understand that a lot of energy is lost at each trophic level, keeping food chains relatively short.	Use the terminology of Trophic Levels (producers, primary, secondary, tertiary consumers and decomposers). Elicit what is a food chain's source of energy? Look at food chains from different biomes. Observe that the amount of light available controls the amount of energy in the food chain. Less light results in less plants and so less energy in the food chain. Unlike nutrient cycles, energy is lost to the environment by respiration, movement and heat and is not returned to the food chain.	PPT or video. Interactive Activity: Food Chains. http://www.bbc.co.uk/schools/ks3bitesize/science/organisms_behaviour_health/food_chains/activity.shtml	Pupils can identify species from a food chain at specific trophic levels. E.g. name a secondary consumer. Pupils can analyse data about energy flow through a food chain and suggest reasons why the data goes up or down.
1 hour	Pyramids of energy and pyramids of numbers.	To show why there is more biomass for the producers than the herbivores and more biomass for the herbivores than the carnivores.	Pupils look at pyramids of numbers and biomass and answer worksheet questions.	Hodder Science Gold Pupil's Book B pages 120 – 121. Show the National Geographic presentation about pollution of food chains. http://www.natgeoeducationvideo.com/film/1239/pollution-of-the-food-chains	Pupils can recognize the difference between a pyramid of biomass and a pyramid of numbers.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
2 hours	The human impact on ecosystems.	To understand that human activity has an impact on the environment	Outline the effects of human activity on ecosystems e.g. over fishing the rivers will un balance the food chain. Agriculture and the problems of the overuse of fertilisers and pesticides. Deforestation results in extinction, desertification and flooding. The burning of fuels, CO2 pollution.	Interactive activity, changes in the environment. http://www.bbc.co.uk/schools/ks3bitesize/science/environment_earth_universe/changes_in_environment/activity.shtml Role Play, save the turtle interactive on line game http://games.noaa.gov/seaturtle/game/fisheries.html	Pupils produce an awareness leaflet that encourages everyone to protect our environment.

Topic: Forces

Key words: Weight, friction, air resistance, driving force, up thrust, electric forces, magnetic forces, upward force, distance, time, speed, balanced forces, unbalanced forces.

Previous learning experience: Recognise the presence of forces in daily activities. Know different types of forces (gravitational, magnetic, friction).

Topic outline:
- Forces and their effects.
- Type of forces.
- Mass and weight.
- Speed.
- Balanced and unbalanced forces.

Key web page: http://lgfl.skoool.co.uk/keystage3.aspx?id=93

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	What are forces? What can forces do? Forces are expressed in Newtons. Forces are represented with arrows.	To understand that forces are a push or a pull. To identify the effects of forces. To represent forces with arrows which show the direction in which forces are acting.	Show images of daily activities where forces are involved and ask : What force is acting? Is it a pull or push? Which is the effect of the force? In which direction is the force acting? Students can stretch a spring, squash a piece of plasticine, push or pull a toy car and represent each situation with a force diagram.	Images showing a mother holding a baby, a tennis player hitting a ball, a football player kicking a ball, someone squashing a balloon. Activity: Pull or push http://www.ngfl-cymru.org.uk/vtc/identify_forces/eng/Introduction/act1.swf Spring, plasticine, toy car. Worksheet to accompany the practical activity of stretching a spring, squashing a piece of plasticine.	How pupils are able to respond to the activity. How pupils are able to respond to the worksheet questions. Drawing force diagrams to represent situations where forces are involved.
3 hours	Type of forces: contact (friction, air resistance, upward force, driving force and upthrust) and non-contact (gravitational, electric and magnetic forces).	To recognise different types of forces (friction, drag, weight, electric forces, etc.); classify them into contact or non-contact forces and for the case of contact forces into forces of attraction or repulsion.	Rub a balloon with your own hair and bring it near small pieces of paper. Approach two magnets in two different ways (approaching different poles and approaching like poles). Ask if these forces act from a distance? What type of forces are they (magnetic, electric, etc.)? Do they attract or repel? Represent the latter examples using force diagrams. Identify and draw the forces acting between the Earth and the Moon, parachuting on the Earth, a bicycle moving and an object floating in water.	Balloons, paper, magnets. Worksheet to accompany the practical activity Hodder Gold Activity sheet A6-G2 Force diagrams http://www.wisc-online.com/Objects/ViewObject.aspx?ID=tp1502 Interactive explanation about magnetic forces http://www.engineeringinteract.org/resources/parkworldplot/flash/concepts/magneticforces.htm	How pupils are able to respond to the worksheet questions. Draw and label all the forces acting in daily situations using force diagrams.
2 hours	Differences between mass and weight: Weight is a gravitational force and changes depending on the planet. Mass is the amount of	To distinguish between mass and weight. To understand that the mass of a body does not change regardless of where it is in space, while the weight changes. To learn how to use a	Display a table showing the differences between mass and weight: concept, units, instrument, if it changes or not depending on the planet. Work out and compare their weight on the Earth and on the Moon knowing their mass and applying $W=m \cdot g$. Measure and record the weight of objects in two different ways: a) measuring the weight of the object with a force meter; b) measuring the mass of	Table with the differences between mass and weight. Different objects, force meter, balance. Hodder Gold Activity sheet A6-G5; C6-G1 Video about mass and weight http://www.youtube.com/watch?v=ToMs7RaL11U	Differences between mass and weight. Pupils can explain why the weight in the Moon is lower than the one on the Earth.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
	matter. Units: N, kg Instruments: force meter, balance.	force meter.	the object with a balance and then working out its weight with the equation W=m·g. Compare the results obtained using the two methods.	Experiment about mass and weight http://www.slideshare.net/emmasanchezclark/la20-mass-and-weight-s-12564790	Accurate measurements and conclusions of the experiment.
2 hours	What is speed?	To understand the meaning of the term speed.	Speed is a measurement of how fast an object is moving.		
	Units of speed.	To recognise different units to measure speed.	Speed is measured in m/s, km/h and miles/h.		
	Working out speed.	To understand the relationship between distance, time and speed and use it to work out one of these magnitudes.	Explain that if we know the distance travelled and the time taken we can calculate speed using the formula: v=S/t Introduce the students to the triangle formula and explain how it works. Give some examples for them to work out (speed worksheet). Students work in groups to measure the walking distance for each student in their group.	Speed worksheet: http://hornetnestbio.pbworks.com/f/Speed+Worksheet.doc Measuring walking distance activity: http://www.batesville.k12.in.us/physics/phynet/mechanics/kinematics/labs/meas_ave_speed_2.htm	Assess understanding form worksheet. Table of results.
	Distance-time graphs.	To interpret and plot distance-time graphs.	Explain that speed can be shown in a graph. Show a distance-time graph of an object moving at a constant speed. Emphasise that the straight line indicates that the speed is constant and that the steeper the slope of the line the faster the speed is. Show a journey on a distance-time graph and discuss the journey.	Good resources for explaining distance-time graphs : http://lgfl.skoool.co.uk/content/keystage3/Physics/pc/learningsteps/DTGLC/launch.html http://www.gcse.com/fm/dtg.htm Worksheet to accompany the explanation.	Assess understanding form worksheet.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
4 hours	Balanced and unbalanced forces.	To identify if forces are balanced or not in a range of situations. To work out and draw the net force acting on an object if the forces are not balanced. To understand that balanced forces do not produce changes in motion whereas unbalanced forces do.	Show force diagrams representing different situations and ask: To label the forces shown. Are the forces balanced? If the forces are not balanced can you work out and draw the net force? Why does a book on a table not move? What happens when the two teams in tug-of-war pull with equal force? Attach a force meter to an object and pull it at a constant speed and direction; ask what forces are acting and if they are balanced. What happens when one team in tug-of-war pulls with a greater force? What happens when you ride a bicycle and you start pedalling very fast? And if you stop pedalling? Predict the state of motion for the force diagrams used at the beginning of the section.	Worksheet to accompany the explanation. Different objects, force meter. Hodder Gold Activity sheet A6-G3-G4-G5; Activity sheet C9G1-G3; Force and motion summary; C6-G2-Gravity and Space summary. Test about forces and motion: http://www.bbc.co.uk/scotland/learning/bitesize/standard/physics/transport/quiz/forces_at_work/ General review and test: http://www.bbc.co.uk/schools/ks3bitesize/science/energy_electricity_forces/forces/activity.shtml	How pupils are able to respond to the worksheet questions. To explain changes in objects' motion in terms of unbalanced forces. Prediction of the state of motion of objects in a range of situations. Poster of a daily situation where forces are acting: labelling the forces and explaining its motion.

Topic: Light

Key words: Opaque, transparent, translucent, lens, reflection, source, smooth, rough, angle of incidence, angle of reflection, invert, normal line, refraction, dispersed, filter, prism, spectrum, primary colours, secondary colours, retina.

Previous learning experience: Know that light travels from a source. Can distinguish between opaque, transparent and translucent materials and relate shadow formation to opaque materials. Know that light is reflected from shiny surfaces. Know that we see things only when light from them enters our eyes.

Topic outline:

1. Light travels at a very high speed, much faster than sound.
2. Light travels in a straight line.
3. The path of light can be represented by rays.
4. Materials may be transparent, translucent or opaque.
5. Light may be absorbed, transmitted or reflected when it hits an object.
6. Light is reflected from plane surfaces in a predictable way.

Key web page:

A good general reference for many of the sections of this unit is http://starphysics.dit.ie/html/OPTICS/wavelight.htm

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Speed of light. Light travels in straight lines.	To understand that light travels extremely fast and that light travels faster than sound. To calculate the speed of light. Light travels from a source in a straight line.	How fast does light travel? How long does it take light to reach us from the Moon? The Sun? Distant stars? Why do we see lightning before we hear the thunder? Mention the speed of sound. How do we know light travels in straight lines? Laser pointers are a good demonstration. Or use a torch to show shadows: light does not bend round corners.	Thunder and lightning or the starting pistol at a start of a race. What do you see or hear first? Laser pens demonstrate that light travels in straight lines. Pictures of luminous objects that are light sources.	Q & A of key concepts. Simple calculations of the speed of light.
1 hour	Understand key words.	To be able to use words precisely when describing the effects of materials, e.g. transparent, translucent, opaque, reflect, absorb To understand that some light may be absorbed when it hits an object.	A lesson to introduce the main vocabulary concerned with light. Demonstrate how different materials can be transparent, translucent or opaque. Which materials transmit light? (Why do they?) Which materials absorb light and which reflect it? This could be a practical, but it is better if the amount of reflected light can be measured using a light sensor. You could discuss what happens to the absorbed light energy.	Practical activity that explores light passing through different materials. Use a torch with different types of paper. A variety of transparent, translucent and opaque materials. Hodder B 9.1 Hodder Activity B9G4 but using a ray box (or laser pointer for a demonstration).	Literacy worksheets that check students understanding of the key words.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Reflection of light and drawing ray line diagrams.	To learn that light rays travel in straight lines. We can represent rays using a ruler and pencil. Understand that the angle of incidence = the angle of reflection in a plane mirror. To learn how to plan an investigation and make predictions.	Light rays can be represented using straight lines. Discuss how we see things in the classroom. Where does the light come from? How does it get into the corners of the room? Use work sheets to draw light rays correctly from light source (e.g. a light bulb or the Sun) to the object, from which it is reflected into the eye of the observer. How is light reflected from a plane mirror? Practical on reflection: Using beams of light from a ray box or torch draw in the incident ray, and reflected ray. Measure the angles of incidence and reflection. Compare for different angles. Look at the reflection in the mirror: when you move your right arm which arm moves in the reflection? How far behind the mirror is the reflection? How can you measure this?	Work sheets for ray diagrams. Hodder Activity B9G3 Hodder B 9.2 Ray boxes, or torches Small rectangular plane mirrors Protractors Rulers Hodder B 9.3	Good ray diagrams using a pencil, protractor and ruler. Practical assessment: Observations (results of investigation) Conclusion (Looking for a pattern and a mathematical relationship).

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Practical application of reflecting light. Periscopes, concave and convex mirrors.	To make a periscope. To understand how car headlights work.	Design and build your periscope. What happens when you use concave mirrors? Demonstrate or discuss the uses of parabolic mirrors: in car headlights, in astronomical telescopes, to focus the Sun's rays. Using convex mirrors on car side mirrors.	Mirrors; cardboard tubes; cellotape PPT that explores and explains concave and convex mirrors (or even shiny spoons) Car side mirror? Reflecting astronomical telescope?	Complete a design sheet before construction. Peer assessment of group work. Which periscope is the best, why? Wall display of students' work showing the use of mirrors in today's world.
1 hour	Refraction	To learn that light changes direction at a boundary between two different media. To be able to identify patterns in observation.	Demonstration: Why does a drinking straw seem to bend at the interface between air and water? Give explanations using visual diagrams to aid learning. Discuss why fish are not where they appear to be when you look at them from an angle, and the end of a swimming pool looks shallower than it really is.	Glass beaker filled with water straw or pencil. Use concept cartoons to get students thinking. Hodder B 9.4	Q & A pupils' knowledge of this concept. Students are able to write an explanation about refraction whilst prompted by a drawing.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	The dispersion of white light. Primary and secondary colours.	To use a prism to disperse white light and identify the 7 colours of the spectrum. To show how secondary colours are produced by projecting primary colours on a screen in different combinations.	Using a prism to produce a spectrum. Use the mnemonic; Richard of York gained battle in vain. Recombine the colours using a second prism to show how white light is produced again. Simulations from the internet often show this more clearly. Explain how coloured filters change white light. Understand the meaning of primary and secondary colours. Investigate how coloured light can be combined to produce new colours.	2 Prisms per group Ray boxes Hodder B 9.5 http://micro.magnet.fsu.edu/primer/java/scienceopticsu/newton/ Use computer simulations programmes to demonstrate this concept.	Name the 7 colours in the spectrum. Complete worksheets.
2 hours	The reflection and the absorption of light. Colours in the world around us.	What do different colours look like in different colours of light? To explain the following; Rainbows, TV screens, colour printing, colour blindness.	To know how coloured objects appear in white light and in different colours of light. To be able to identify and explain patterns in their observations using appropriate vocabulary, e.g. reflect, absorb, transmit. In small groups pupils prepare presentations to explain one of the concepts to the rest of the class. Rainbows: how are they made? TV screens: what colour are the dots on the screen? Colour printing in newspapers and magazines. How do our eyes see colour? Colour blindness testing the students.	Projecting colours from a slide projector in a totally dark room. Pieces of coloured paper or coloured pencils. Pupils research their topic and orally explain the theory to the class making using of any visual aids to help their presentations.	Quiz pupils predict the colour of objects in different coloured lights. Pupils ability to research and work in a small group.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	The structure and function of the eye.	To understand how the eye focuses light on to the retina.	Describe the structure of the eye in cross section. Show how the cornea will bend the light rays and describe how the lens focuses these rays onto the retina. What happens to the lens as the object comes closer? Compare the eye to a camera. Discuss the function of the iris. The retina changes the light energy into nerve messages and sends them to the brain (compare to Video camera and TV?) Making a pin-hole camera can be fun.	http://www.bbc.co.uk/schools/gcsebitesize/science/ocr_gateway_pre_2011/ourselves/3_keeping_in_touch2.shtml Label diagram of the cross section of an eye. http://www.exploratorium.edu/science_explorer/pringles_pinhole.html	Accurate ray diagrams showing light rays being focused on the retina.

Topic: Sound

Key words: Pitch, amplitude, frequency, hertz, oscilloscope, megahertz, ultrasound, vibration, decibel scale, deaf.

Previous learning experience: Identifying vibrations as sources of sound. How to change the pitch and loudness of sound in musical instruments. Be able to recognize some sound phenomena such as echoes and reverberation.

Topic outline:

- Sound is produced by vibrations.
- Sound can only travel through solids, liquids and gases; it can't travel through a vacuum.
- Sound travels at different speeds in different mediums.
- A machine called an oscilloscope can be used to represent sound waves.
- Amplitude of a sound is related to the loudness of a sound.
- Frequency of a sound is related to the pitch of a sound.
- How humans can hear.
- Measuring sound levels and how very loud sounds can damage hearing.

Key web page: http://www.ltscotland.org.uk/5to14/interactive/science/sound.asage our hearing.

Duration	Lesson contents	Learning objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Sound is produced by vibrations. Sound moves through different materials as waves.	To understand how vibrations move through materials in the form of a wave. Understand that sound causes vibrations.	Demonstrate how sound makes the air vibrate.	International Science book 2 p126. Karen Morrison, Hodder.	Using the word particles describe sound and how it travels.
1 hour	A wave is made of an air compression and rarefaction. Sound can't move through a vacuum.	To explain that a sound wave is made of air particles pushed together and spread apart.	Show how a loudspeaker moves forwards and backwards creating the air vibrations.		
1 hour	Establish that sound needs a medium to travel through.	To explain in terms of the particle model why sound needs a medium.	Demonstrate that sound waves need a medium to travel through by placing a mobile phone in a bell jar attached to a pump. Demonstrate transmission of sound through solids and liquids, e.g. sound passing through a wooden bench, a length of metal rod, a string telephone. Ask pupils why this may be so, reminding them of the particle model of solids, liquids and gases.	Bell jar, electric bell and vacuum pump if available. Hodder Activity B12G2 Hodder B 12.4 Yoghurt pots and string for a string telephone http://wow.osu.edu/Sound/stringtele.htm	Ask pupils to explain why you can't hear the phone ringing when a vacuum is created in the jar.

Duration	Lesson contents	Learning objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	The speed of sound.	To think how fast sound travels in comparison to light.	About three seconds per km, mention thunder and lightning again. What happens if a plane travels faster than the speed of sound? (Match numbers) Sonic boom. How could you measure it? Measure the time between a loud noise and an echo – but you need about 100m at least to get a reasonable result.	Stop watch	Pupils plan and carry out an investigation to measure the speed of sound.
1 hour	To be able to describe different sounds using appropriate terms, e.g. high, low and soft. The oscilloscope	To establish the difference between: Loud and quiet (amplitude) High and low pitch (high notes and low notes). To be able to draw or describe how the pitch and loudness are changed in different musical instruments. To extend pupils' ideas about sounds and vibrations using an oscilloscope connected to a signal generator to present a 'picture' of a sound wave.	Students can make their own musical instruments: They must describe what they did and how they change the pitch of the notes. Explain that the wave on the screen is a representation of a sound wave. Pupils' could see their sound waves whilst speaking into the oscilloscope.	Stretched strings or rubber bands. Test tubes with different amounts of water. Drums etc: they could record themselves! Only possible if an oscilloscope and signal generator are available. Just an oscilloscope and microphone can be used, with a suitable musical instrument or even singing notes.	Students' originality and musicality.

Duration	Lesson contents	Learning objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Analysis of different waves with varying wavelength and amplitude.	To be able to compare and interpret wave forms in terms of pitch and loudness.	Introduce and explain the terms 'amplitude' and 'frequency', and relate these to loudness and pitch of a sound by demonstrating how the wave form changes with different sounds. Provide representations of different sound waves and ask pupils to identify, e.g. the loudest, lowest.	Pupils practice drawing sound waves for different amplitude and pitch. Pupils compare the sound produced from different sound waves. International Science book 2 p129. Karen Morrison Hodder	Pupils understand that high pitch means high frequency and high amplitude indicates loudness. They can interpret a sound wave.
1 hour	How humans hear	To be able to identify the parts of the ear on a diagram or model. To describe, e.g. by annotating a diagram, how vibrations in the air are transmitted and translated into electrical signals, which pass to the brain.	The ear. How the ear transmits sound from the air, through the vibrating eardrum. How the ear bones (hammer, anvil and stirrup) amplify the sound. How the cochlea converts the sound vibrations to nerve messages.	Annotated diagram explaining how sound gets from the air to the brain.	Pupils can annotate a diagram of an ear.
1 hour	Units used to measure sound.	To learn that frequency of a sound is measured in hertz. To learn that amplitude is measured	If you have a signal generator find out the highest frequency that the students can hear (about 20000Hz). Define Hertz as vibrations per second. How rapidly do mosquitoes (1000Hz) and bees (40Hz) beat their wings? Why is the teacher not able to hear the highest frequencies? Discuss bats and dolphins – what frequencies do they use? What do they use them for? Dogs and dog whistles. Students can relate loudness to the decibel scale.	Wonderful game about frequencies http://www.visualprosthesis.com/javoice.htm Show a table of typical values on the decibel scale or make a 'loudness line'. A decibel meter if available. Get pupils to spend two minutes in silence, then they write down all the noises they could hear, such as, traffic, birds or a phone	Understand what Hertz means. Understand that there is a limit to human hearing but many other animals can hear higher frequencies. Understand that the loudness of sound is measured in decibels.

Duration	Lesson contents	Learning objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
	Loud sounds can affect hearing.	in decibels (dB). To understand that sounds above 90dB can cause hearing damage.	Using a decibel meter pupils can measure sound levels around the school. People who can no longer hear are deaf. Some people are born deaf however; deafness can be caused by being in a noisy environment. The use of ear protectors in the work place. Get pupils to research what life would be like if deaf, how would they hear the phone ring or listen to their favorite song?	ringing.	Understand that loud sounds over a long time can cause deafness. Pupils write about what it would be like to not hear for a day.

Topic: Heat and Temperature

Key words: Internal energy, temperature heat, thermometer, expansion, contraction, heat transfer, conduction, conductor, insulator, convection, radiation.

Previous learning experience: How the particle theory can be used to explain the properties of solids, liquids and gases, including changes of state, gas pressure and diffusion.

Topic outline:
- Temperature.
- Heat and temperature.
- Expansion on heating.
- Heat transfer: conduction, convection and radiation.

Key web page: http://www.powersleuth.org/teacher/energy-heats

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
2 hours	What is temperature? How do we measure temperature?	To understand the concept of temperature. To understand the need for the Celsius scale. To learn that the temperature is measured in °C.	Show an animation that represents the molecular movement at different temperatures. Elicit what they have in common and which are their differences. Introduce the concept of internal energy and its relationship with temperature. Demonstration of perception of temperature using hot and cold water. Show liquid-in-glass thermometers and explain how they work and how they are calibrated. Mention other temperature scales.	Molecular movement animations: http://www.dynamicscience.com.au/tester/solutions/chemistry/partc.gif Hodder Activity B3G1 is a good way to show that our senses are not a good way to measure temperature. Thermometers Worksheet to accompany the explanation.	Pupils are able to match given temperatures to the correct diagrams. Conclusions of the experiment. Asses understanding from worksheet.
1 hour	What is heat? Are heat and temperature the same thing?	To be able to describe the flow of heat in an everyday situation of temperature change.	Ask pupils what happens when we put together a hot and a cold object? Heat is the energy that flows from a hot to a cold object. Pinpoint that heat is an energy that flows, i.e. an object does not have heat, but an object radiates or absorbs heat. Pupils can predict and observe the temperatures change when they mix volumes of hot and cold water. To illustrate that heat and temperature are not the same, pupils can heat, during the same length of time, with the same heater, different quantities of water.	Hot and cold water. Beakers of different sizes. Thermometer. Electric heater (a Bunsen burner is not good as it is hard to regulate the heat). Investigation to monitor the final temperature when volumes of hot and cold water are mixed: http://www.powersleuth.org/teacher/energy-heats/lesson3-overview Hodder activity B3G2 Hodder b 3.1 and 3.2	Assess how pupils predict the result of mixing water of different temperatures and how they explain the result. Pupils are able to explain the difference between heat and temperature.
1 hour	Expansion on heating	To describe in terms of particles that substances expand when heated, that liquids expand more than solids and gases more than liquids.	Demonstrate expansion of solids, liquids and gases on heating. Solids: ball and ring experiment Liquids: heat a boiling tube of coloured water with a bung and glass tube, watch the water expand. Gases: heat a flask with bung and glass tube with the end in water, watch the bubbles come out.	Ball and ring. Boiling tube and coloured water with a vertical tube in a bung. Flask with a vertical glass tube fitted to the bung. Beaker of water.	Record observations of what they see in the demonstrations (or class practical).

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
			Ask students what would happen if the flask filled with air or liquid was completely sealed. Ask pupils why they expand. Elicit the idea that the particles are moving faster, so they push each other further apart. Pinpoint that the particles do not expand, it is the distance between particles that increases. Why gases expand the most? Expansion depends on the attraction forces between particles; the attraction forces of gas particles are very weak so they can move well further apart.		Explain the observations in terms of particles.
1 hour	Heat transfer Conduction	To understand that heat can be transferred in different ways. To understand that conduction is the way by which heat travels through a solid.	Show images involving heat transfer and ask: Is heat moving? Where does the heat come from and where does it go? Introduce the idea of source of heat. Is heat moving in the same way in all the photos? Elicit the idea that heat can be transferred in different ways: by direct contact between two objects or from a distance. Demonstrate heat transfer by conduction: Stick wax dots of equal sizes to a metal rod at different distances from an end. Heat one end of the rod. Ask students to predict which dots of wax will melt first and why. Ask them what will happen if we use a wooden or glass rod instead of a metal one.	Different images showing daily situations where heat transfer takes place. Metal rod, wax, electric heater.	Assess understanding from questions. Record observations of what they see in the demonstration.
2 hours	Conductors and insulators	To classify materials as conductors or insulator of heat. To understand the difference between a conductor and an insulator.	Demonstrate how heat passes quickly through a good conductor such as a metal but slowly through an insulator such as wood or glass. Stick pins to rods using wax, see which fall off first when the rods are heated from one end. Students can perform one of these investigations: Who can keep the cup of “coffee” (water) hottest for longest?	Pins, wax, similar thickness rods of good heat conductors such as different metals and poor heat conductors such as glass, wood, plastic. Hodder Activity B3G4 Ice cubes or hot water. Insulating materials. Thermometers.	Observations. Conclusions about thermal conductors. Observation: making a table of the results and a cooling curve graph.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
			Or Who can stop the ice cube from melting for longest? Or Which gloves keep the water hottest? – Good to do in winter.	Hodder B 3.3. Investigating insulation: http://www.gecdsb.on.ca/staff/teachers/ecoSchools/Curriculum/EnergyConserv/Energy-Sec/KeepItWarm-Gr9.pdf	Analysis of the results in terms of heat transfer.
		To learn that air is a very good insulator.	Provide insulating material. Develop the idea that air is a very good insulator, which is why we wear woolen clothes and have fluffy duvets.	Hodder Activity B3G5	
1 hour	Particle model of thermal conduction.	To understand how heat is transferred by conduction from particle to particle. To be able to explain why solid metals are good conductors and why fluids are poor conductors of heat.	Remind pupils that solids are made of particles called atoms and molecules. When a solid is heated, the particles move around their position in the solid more, they knock against their neighbours transferring energy. Get pupils to act this model of conduction: ask them to link arms firmly in a line (simulates a solid), and then one pupil provides energy ('heats the line') by gently pushing and pulling the end of the line. The energy (movement) is conducted along the line. This happens less well if they are merely holding hands (liquid) and not at all if they are not linked (gas).	Animation about particle model of thermal conduction: http://www.kangwon.ac.kr/~sericc/sci_lab/physics/conduction/conduction.html Animation that illustrates the different particle behaviour of conductors and insulators: http://www.educaplus.org/play-324-Transmisión-del-calor-por-conducción.html?PHPSESSID=a2f08a5a8ef795fd1a5fa688fd4fed72	Written explanation of heat transfer by conduction.
1 hour	Convention	To learn how heat is transferred in fluids. To understand how heat transfer by convection takes place.	Heat travels by conduction through solids, but how does heat transfer through fluids? Demonstrate heat transfer by convection: Place some potassium permanganate crystals or sawdust in a beaker of water, heat gently and watch the colour or the sawdust rising to the top and then falling as it cools. Ask students why the particles rise and then fall down. Make a snake spiral or a windmill, hold over a candle flame, and watch it turning. Discuss why hot air rises. Why do hot air balloons fly?	Hodder B 3.4 Potassium permanganate or sawdust, beaker, water, Bunsen burner. Hodder B 3.4 Paper, source of heat such as candle flame or electric heater. Paper spiral pattern: http://www.powersleuth.org/docs/EHM%20Les%205%20Spiral%20HO.pdf Animations that ilustrate convection: http://www.educaplus.org/play-320-Transmisi%C3%B3n-del-calor-por-convecci%C3%B3n.html	Written explanation of heat transfer by convection.

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
		To understand that convection cannot take place in solids.	If a liquid or gas is heated it expands, becomes less dense and rises. Cooler, denser liquid or gas sinks to take its place. Pinpoint that in convection the particles move carrying the heat with them; therefore convention cannot take place in solids because the particles do not move relative to each other.	http://www.kscience.co.uk/animations/convection.htm	
1 hour	Radiation	To distinguish between transfer of thermal energy via conduction and convection and transfer by radiation, with reference to requirement for a medium.	Show an image of the Sun and the Earth and ask: How does the heat reach us from the Sun? Does space have matter? Can heat travel through conduction or convention in space? A third method of heat transfer must exist. Radiation is the transfer of heat from a hot object without a need for a medium. Show some images involving heat transfer and ask students what type of heat transfer takes place.	Image showing the Sun and the Earth. Heat transfer scenes: http://www.powersleuth.org/docs/EHM%20Les%205%20Photos%20HO.pdf Hodder Activity Chapter 3 Summary Hodder B 3.5	An explanation of the differences between conduction, convection and radiation. Students can identify the type of heat transfer involved in different situations.
2 hours	Saving energy	To be able to describe and explain how a house can be fitted out to reduce heat loss.	Students can apply their knowledge of conduction, convection and radiation to design an energy efficient house. What are the advantages of double-glazing? Roof insulation? Wall insulation? How do radiators warm up a house?	http://www.darvill.clara.net/worksheets/KeepingBuildingsWarm.do	A poster, model or presentation of an energy efficient house.

Topic: The Earth's Internal Energy

Key words: Earthquakes, epicenter, volcanic eruptions, magma, volcano, lava, crater, igneous rocks, metamorphic rocks.

Previous learning experience: Structure of the earth. Parts of a volcano. The rock cycle. Different types of rocks. Tectonic plates.

Topic outline:

- To learn about the phenomena caused by the Earth's internal energy.
- To discover the relationship between pressure, temperature and the resulting seismic activity.
- To learn the parts of a volcano and the materials made during an eruption.
- To study the processes associated with earthquakes.

Key web page: http://www.bbc.co.uk/schools/gcsebitesize/geography/natural_hazards/managing_hazards_rev1.shtml

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	The layers of the earth and why the inner core is so hot.	To be able to draw the layers of the earth and understand the characteristics of the earth's core.	Pupils research the inner structure of the earth and draw a diagram that includes the thickness, composition and temperature for each layer.	http://www.bbc.co.uk/schools/gcsebitesize/science/ocr_gateway/chemical_resources/earth_structurerev1.shtml	Individual diagrams, showing relevant information.
1 hour	What are tectonic plates?	To be able to define tectonic plates and name examples of plates.	Explain what tectonic plates are and then get pupils to label the plates on a world map. Interactive BBC activity.	Copy of a world map. BBC Plate tectonics activity http://www.bbc.co.uk/schools/gcsebitesize/science/ocr_gateway/chemical_resources/earth_structurerev1.shtml	Ask comprehension questions about the map. E.g. How many tectonic plates are there?

Duration	Lesson Contents	Learning Objectives	Suggested classroom and homework activities	Suggested Resources	Assessment
1 hour	Volcanic eruptions	To understand what a volcano is and why they erupt.	Pupils chose a volcano and research it as a project. They can present their work orally, as a Ppt, as a poster or as a written project.	http://www.bbc.co.uk/schools/gcsebitesize/geography/natural_hazards/volcanoes_rev1.shtml	The detail and content of the project.
1 hour	How earth quakes are produced.	To understand the terms: Seismic waves, Tsunami, Richter scale, Epicenter and hypocenter.	Watch a video about earthquakes and pupils answer questions on a worksheet whilst watching it.	http://www.bbc.co.uk/schools/gcsebitesize/geography/natural_hazards/earthquakes_video.shtml	Pupils' answers to the work sheet.
1 hour	Igneous and metamorphic rocks	To learn how each type of rock is formed showing examples.	Pupils try to identify different rock samples.	Rock samples with characteristic cards.	Pupils can identify different rock samples.

5. Bands of Attainment for ESO 2

The bands of attainment described below are for the end of ESO 2.

Band 1: 30% pupils will not have made so much progress and will have reached or may be struggling at this level.
Band 2: 60% pupils will have reached this level.
Band 3: 10 % pupils will have progressed further and will have reached this level.

Scientific Skills

Band 1
Pupils respond to suggestions and put forward their own ideas about how to find the answer to a question. They recognise why it is important to collect data to answer questions. They use simple texts and other sources of information such as the Internet, to find information. They make relevant observations and measure quantities, such as length or mass, using a range of simple equipment.

Where appropriate, they carry out a fair test with some help, recognising and explaining why it is fair.

They record their observations in a variety of ways. They provide explanations for observations and for simple patterns in recorded measurements. They communicate in a scientific way what they have found out and suggest improvements in their work.

Their use and range of vocabulary is adequate.

Band 2
Pupils recognise that scientific ideas are based on evidence. In their own investigative work, they decide on an appropriate approach (for example, using a fair test) to answer a question. Where appropriate, they describe, or show in the way they perform their task, how to vary one factor while keeping others the same. Where appropriate, they make predictions. They select information from a range of sources of information. When the investigation involves a fair test, they identify key factors to be considered.

They make a series of observations, comparisons or measurements with precision appropriate to the task.

They record their observations, comparisons and measurements using tables and bar charts. They can plot points to draw line graphs and may begin to use best fit lines in certain circumstances, and use these graphs to point out and interpret patterns in their data.

They begin to repeat observations and measurements and to offer simple explanations for any differences they encounter.

They begin to relate their conclusions to these patterns and to scientific knowledge and understanding, and to communicate them with appropriate scientific language

They make practical suggestions about how their working methods could be improved. They use appropriate scientific language and conventions to communicate quantitative and qualitative data.

Their use and range of vocabulary is more than adequate to relate and explain their findings.

Band 3
Pupils describe evidence for some accepted scientific ideas and explain how the interpretation of evidence by scientists leads to the development and acceptance of new ideas. In their own investigative work, they use scientific knowledge and understanding to identify an appropriate approach.

They synthesise information from a range of sources, and identify possible limitations in secondary data. They make enough measurements, comparisons and observations for the task. They measure a variety of quantities with precision, using instruments with fine scale divisions.

They choose scales for graphs and diagrams that enable them to show data and features effectively. They identify when they need to repeat measurements, comparisons and observations in order to obtain reliable data. They identify measurements and observations that do not fit the main pattern shown. Where appropriate, they represent data in graphs, using lines of best fit.

They draw conclusions that are consistent with the evidence and use scientific knowledge and understanding to explain them. They make reasoned suggestions about how their working methods could be improved.

They select and use appropriate methods for communicating qualitative and quantitative data using scientific language and conventions.

They have a good command of vocabulary and are able to use this well in order to relate and explain their findings.

Space

Band 1

Pupils know the position of the Earth in the Universe as well as the different types of celestial bodies.

Pupils can demonstrate they know the planets of the solar system and they are able to differentiate between them.

Pupils understand why the seasons occur.

They understand the causes of the eclipses of the Sun and Moon.

Their use and range of vocabulary is adequate.

Band 2

Pupils can demonstrate their knowledge of the relative positions of the different bodies that make up the solar system.

Pupils are able to name and locate some celestial bodies including constellations.

Pupils can compare the planets of the solar system in relation to the Earth.

Pupils understand why the seasons occur.

They understand the cause of eclipses and are able to illustrate the different positions of the Earth throughout the year.

Pupils understand how the eclipses of the Sun and Moon occur and they can draw the different lunar phases.

They are able to use a simple compass effectively.

Their use and range of vocabulary is more than adequate to relate and explain their findings.

Band 3

Pupils can demonstrate their knowledge of the main theories on the origin of the universe and the earth.

Pupils can demonstrate their knowledge of some of the methods of exploring the universe.

They are able to express an opinion about the importance of space investigations.

They understand the concept of the light year and astronomical unit and can make some simple calculations using those units.

Pupils can locate some stars or constellations in a planisphere.

They understand why the Moon always shows the same face.

They are able to use ICT to find information and can explain this effectively.

They have a good command of vocabulary and are able to use this well in order to relate and explain their findings.

Physics and Chemistry

Band 1

They identify the differences between physical and chemical changes, reversible and irreversible.

Can recognise the symbols of the main elements in the Periodic table and its classification as metals and non- metals.

They identify when a chemical reaction occurs and they understand the concept of reactants and products in chemical reactions.

They are able to write simple word equations.

They recognise the importance of oxygen in combustion.

They know that forces act in a particular direction and this can be indicated with arrows.

They understand that forces change the speed, direction or shape of an object.

They can identify contact and non contact forces, vertical and horizontal forces, e.g. friction, upthrust and weight.

They recognise that friction opposes motion, upthrust pushes upwards, and weight pushes downwards.

They can describe how light is reflected at plane surfaces and describe reflected images.

They are able to describe the effect of a prism on white light and recognise that filters and coloured objects absorb some colours and transmit or reflect others.

The can relate sound to vibration and identify a range of sources or vibrations.

They recognise that sound travels but cannot travel through a vacuum.

They can explain that sound waves cause our eardrums to vibrate and that this enables us to hear.

They can state that loud sounds can damage hearing.

They can give examples of some common temperatures.

They are able to describe some uses of good conductors and insulators.

They can describe how insulators can reduce heat loss.

They can describe how substances expand and change state.

Their use and range of vocabulary is adequate.

Band 2

Pupils differentiate clearly between physical and chemical changes and are able to give examples of each.

Pupils recognise the symbols of the majority of elements of the Periodic Table, their division into metals and non-metals and some of their properties.

Pupils understand the concept of atomic number and atomic mass.

They can describe simple chemical reactions with acids in which a gas is made.

Understand burning as a chemical reaction involving a gas, air or oxygen.

Be able to use word equations as shorthand descriptions of reactions.

They learn techniques for testing for oxygen, hydrogen and carbon dioxide gases.

They have experience of effects of a variety of forces e.g. magnetic, gravity friction, air resistance.

They know how to measure distance and how to use a force meter to measure force in Newtons.

They can identify directions in which forces act and describe situations in which forces are balanced.

They distinguish between mass and weight, giving examples.

They understand situations in which friction is useful.

They can make predictions about upthrust, test these and relate their findings in a scientific report.

They make suitable and precise observations, including repeats to check reliability and use these to plot graphs, e.g. speed/time.

They recognise that light travels in straight lines at very high speed.

The can represent the path of light by rays.

They are able to describe how light is reflected and refracted at plane surfaces.

They can explain the origin of colour in the dispersion of white light and describe the effects of coloured filters and different coloured lights on the appearance of coloured objects.

They can give an example of how colour is important in everyday life.

They can relate changes in pitch and loudness of sounds to changes in vibrations.

They will be able to explain how musical instruments can make these changes and relate these to the oscilloscope representations of waves.

They recognise that sound needs a medium to travel through and that it travels at different speeds through different media.

They are able to explain simply how the ear works and give examples of hearing ranges.

They can describe ways in which hearing can be impaired and how noise pollution can be reduced.

They will give examples of common temperatures on the Celsius scale.

They can distinguish between heat and temperature and describe energy flow as the result of temperature difference.

They can describe some uses of good conductors and insulators and examples of conduction in solids and convection in liquids and gases.

They can explain conduction and convection, expansion and change of state in terms of the particle model.

Their use and range of vocabulary is more than adequate to relate and explain their findings.

Band 3

Pupils demonstrate deeper knowledge about the organisation of the Periodic Table into groups and rows.

They understand the concept of atomic number and atomic mass, as well as the particles inside the nucleus and are able to locate elements on the Periodic Table by knowing their atomic number.

They understand the most important properties of the chemical elements.

They identify that some new materials are formed during a chemical reaction and generalise that hydrogen is formed when acids react with metals, carbon dioxide when acids react with carbonates, and oxides when materials burn.

Pupils can describe tests for oxygen, carbon dioxide and hydrogen and describe burning as a reaction with oxygen.

They predict that carbon dioxide and water will be made when hydrocarbon burns and use word equation to represent reactions in which materials burn.

They suggest and evaluate explanations of observations.

They have a good command of vocabulary and are able to use this well in order to relate and explain their findings.

Pupils demonstrate an increased knowledge and understanding about forces and their effects mentioned in band 2.

They can describe how weight is caused by gravity and how gravity is different on the Earth to that on the Moon.

They can calculate weight of an object on another planet if they know the gravity of the planet.

They are able to make fair comparisons in their investigation of friction and interpret their results on floating using knowledge of balanced forces to explain conclusions.

They can explain how the scales they chose and the lines they drew on graphs enabled them to show data effectively.

They understand how forces can combine to give a resultant effect which depends on both the size and directions of the forces.

They can draw conclusions from their data, informed by scientific understanding about reflection and refraction of light at plane surfaces.

They can calculate the time for light to travel, *e.g. from the Sun*.

They can explain the appearance of coloured objects in coloured lights

They can relate pitch to frequency of sounds and loudness to amplitude.

They are able to use particle theory to explain how sound travels through materials.

They can use a model of the ear to discuss possible causes of hearing impairment.

They will give examples of a wide range of temperatures on the Celsius scale.

Then can compare conductivity of materials and relate this to their uses.

They can use the particle model to explain change of state relating this to the forces between particles.

They have a good command of vocabulary and are able to use this well in order to relate and explain their findings.

Geology

Band 1

Pupils know about the different layers of the Earth and the main meteorological phenomena.

Pupils understand and can describe rock specimens and recognise that these have different textures. They can also describe some of the effects of weathering over time and recognise sedimentary layers.

With help they will be able to identify a question for investigation into the movement of sediment.

They use physical ideas to explain Seismic waves.

They relate changes of state to energy transfers in the formation of igneous rocks.

They will be able to use ICT to make and record observations in relation to their question.

Their use and range of vocabulary is adequate.

Band 2

Pupils know about the composition of the layers of the Earth and understand the main meteorological phenomena and atmospheric pressure.

Pupils can describe rock specimens in terms of texture and can relate this to properties of rocks, such as porosity.

They understand and are able to describe the physical and chemical processes which cause weathering and transportation. They can relate these processes and their results to features of the environment and can describe and explain the processes by which sedimentary layers are produced.

They will be able to suggest a question to be investigated about the movement of sediment and, with help, can identify an appropriate approach.

They use simple models to explain effects that are caused by the movement of continents.

They apply their knowledge of physical and chemical processes to explain the behaviour of materials in a variety of contexts (for example, the way in which natural limestone is changed through the action of rainwater, ways in which rocks are weathered).

They will be able to use ICT to make and record observations in relation to their suggested question.

Their use and range of vocabulary is more than adequate to relate and explain their findings.

Band 3

Pupils have a good understanding of the different layers of the Earth and meteorological phenomena and atmospheric pressure and are able to explain them.

They are able to appreciate the uniqueness of the planet Earth and its atmosphere, and can solve problems related to these characteristics.

Pupils understand and are able to relate chemical weathering processes to the reaction of particular grains to acids.

They are also able to relate sedimentary layers to the process by which they were produced.

They will be able to use evidence from several different sources in order to describe a sequence of geological events.

They apply abstract ideas in explanations of the movement of continents and its effects.

Pupils demonstrate an extensive knowledge and understanding drawn from the Geology topics, which they use to describe and explain the changes of rocks and the movement of continents.

They will be able to use ICT to make and record their observations.

They have a good command of vocabulary and are able to use this well in order to relate and explain their findings.

Biology

Band 1

Pupils demonstrate knowledge and understanding of life processes and living things drawn from the first cycle of ESO programme of study.

Pupils understand that complex organisms have specialised systems. They can match the different systems with their function.

They can use schematic drawings to explain how the different living organisms get food.

They can describe how respiration takes place both in animals and in plants and they can accept that it occurs in cells.

They can classify living things in an ecosystem as producers and consumers and they can complete a simple food web.

They understand that in an ecosystem energy comes from the sun.

They can find evident adaptation features in living things (colour, shape ...).

They can match some humans' attitudes with some environmental effects.

Their use and range of vocabulary is adequate.

Band 2

Pupils demonstrate an increasing knowledge and understanding of life processes and living things drawn from the first cycle of ESO programme of study.

They describe the main functions of organs of the human body and of the plant. They explain how these functions are essential to the organism.

They distinguish between autotrophic nutrition and heterotrophic nutrition.

They use appropriate scientific terminology when they describe life processes in animals and plants (for example, respiration or photosynthesis). They understand that these processes take place in cells and are related to energy transfer.

They describe characteristics of habitats that support a diversity of plants and animals that are interdependent. They explain that different organisms are found in different habitats because of differences in environmental factors. They describe how living things adapt to these factors. They can describe how energy flows in an ecosystem.

They use different kind of graphs and diagrams to explain food chains and food webs in a habitat.

Their use and range of vocabulary is more than adequate to relate and explain their findings.

Band 3

Pupils use knowledge and understanding of life processes and living things drawn from the first cycle of ESO programme of study to make links between life processes in animals and plants and the organ systems involved.

They can explain the differences between autotrophic nutrition and heterotrophic nutrition.

They are able to use different graphs and schemes to demonstrate their knowledge about how respiration and photosynthesis occur in cells and how energy is transferred.

They apply their knowledge of interdependence to explain how changes in habitats can affect the size of populations. They understand that living things need time to adapt themselves to changes in their habitats.

They recognise that feeding relationships can be explained in terms of energy flowing. They can quantify food chains using pyramids of numbers. They understand that there is a matter cycle in an ecosystem, but there is not an energy cycle because part of it is constantly "lost" as heat.

They can describe some of the effects of humans on the environment, such as acid rain or water pollution.

They have a good command of vocabulary and are able to use this well in order to relate and explain their findings.

6. Development of scientific ways of thinking

It is possible to give an outline of how we expect the pupils to develop scientifically throughout the course, although they will not all develop at the same rate. It is important for teachers to be aware that there will be a mixture of levels in any class and to try to ensure that their questions and the work set is differentiated to encompass this variety:

Lower levels of attainment

Pupils will be able to recall information, use some basic scientific vocabulary, describe what happens and answer basic questions about why something happened.

For example they may know that plants need light and carbon dioxide to carry out photosynthesis.

Middle levels of attainment

Pupils will begin to use abstract ideas and models in their answers: energy, forces, particles and cells.

They will be able to explain their observations: This happens because...

Plants need carbon dioxide and water because they are made into carbohydrates for food.

Light energy is needed to make carbohydrates.

For example they will be able to say that photosynthesis takes place in green plant cells because they contain chlorophyll which traps the light energy and converts it into chemical energy.

Higher levels of attainment
They will be able to apply abstract ideas, models and theories to explain phenomena.

They will be able to find patterns in their observations and begin to explain their conclusions in a logical and reasoned way.

For example if they are at this level they will be able to see photosynthesis in terms of particles, energy and cells. They will begin to appreciate the role of photosynthesis in ecology as the basis of all food chains and to use quantitative relationships in explanations, evaluate practical work and to make predictions based on their knowledge. They will understand that certain environmental conditions limit the rate of photosynthesis and apply this to how the green hose effect might affect plant growth.

This mental development is probably more important than the simple acquisition of scientific facts or content. Any pupil can learn facts parrot fashion but they need to be at an appropriate level of understanding or maturity to be able to truly understand what they are learning. It is of little use to teach an ESO1 pupil about detailed atomic structure with protons, neutrons and electron shells; they will be able to learn it but they will not be able to have a reasonable true understanding of the significance of the model until they are 14 or 15 years old, perhaps never. But they will be able to grasp the idea of particles making up solids, liquids and gases and be able to understand that these particles may be atoms. It is the teacher's job to advance their pupils' learning in careful steps in keeping with their level of understanding, rather than fill them up with scientific facts to be regurgitated in an exam.

7. Bibliography and web sites

We have recommended the Hodder Gold series as it has simpler English. However the content is exactly the same as the other series of books shown below.

www.hodderheadline.co.uk and www.johnmurray.co.uk

Hodder Science Gold A
Hodder Murray ISBN 0 340 80438 6
Modern and up-to-date book with simpler English which covers about 70% of the course.

Hodder Science Gold B
Hodder Murray ISBN 0 340 80439 4
Gold A and Gold B together cover most of the ESO1 course.
If only one book is to be bought then it should be Gold A. It would be useful to have Gold B as a teacher resource copy.

Hodder Science Gold C
Hodder Murray ISBN 0 340 80440 8
Gold B and Gold C together cover most of the ESO2 course.

Hodder Science Gold Activity Pack
Hodder Murray ISBN 0 340 84830 8
Practical activities, worksheets and class-work activities.

There are many new courses from the different publishers which are all based on exactly the same content (see QCA schemes of work in website list). They all include pupil books and resource materials such as worksheets, CD ROMs, and Assessment materials. Here are some of them:

Exploring Science from Longman	www.longman.co.uk
Scientifica from Nelson Thornes	www.nelsonthornes.com
Framework Science from Oxford	www.oxfordsecondary.co.uk
Spectrum Science from Cambridge	www.cambridge.org/education

The newest course is *Scientifica* from Nelson Thornes
http://www.nelsonthornes.com/courses/scientifica/index.htm

It has been highly recommended and could be considered as an alternative to Hodder Gold as the materials in the Student Books are at two levels e.g. Pupil Book 8 (levels 4-7)
Or Pupil Book 8 Essentials (levels 3-6) which is similar to the Hodder Gold

The ICT Power Packs include PowerPoint presentations for each lesson as well as video clips and other resources.
The Workbooks are for students to write in and are cheap.

Student Book 7(Levels 4-7)	0 7487 7980 9
Teacher Book 7 (Levels 4-7)	0 7487 7984 1
Student Book 7 Essentials (Levels 3-6)	0 7487 7981 7
Teacher Book 7 Essentials (Levels 3-6)	0 7487 7987 6
Teacher Resource Pack 7	0 7487 8010 6
Assessment Resource Bank 7	0 7487 8015 7
Special Resource Pack 7	0 7487 9199 X
Workbook 7	0 7487 9184 1
Scientifica Presents Time Surfers Reader Year 7	0 7487 9013 6
Student Book 8 (Levels 4-7)	0 7487 7988 4
Teacher Book 8 (Levels 4-7)	0 7487 7992 2
Student Book 8 Essentials (Levels 3-6)	0 7487 7989 2
Teacher Book 8 Essentials (Levels 3-6)	0 7487 7995 7
Teacher Resource Pack 8	0 7487 8026 2
Assessment Resource Bank 8	0 7487 8030 0
Special Resource Pack 8	0 7487 9202 3
Workbook 8	0 7487 9185 X
Scientifica Presents Amazement Park Reader Year 8	0 7487 9014 4
Student Book 9 (Levels 4-7)	0 7487 7996 5
Teacher Book 9 (Levels 4-7)	0 7487 8000 9
Student Book 9 Essentials (Levels 3-6)	0 7487 7997 3
Teacher Book 9 Essentials (Levels 3-6)	0 7487 8003 3
Teacher Resource Pack 9	0 7487 8035 1
Assessment Resource Bank 9	0 7487 8040 8
Special Resource Pack 9	0 7487 9205 8
Workbook 9	0 7487 9186 8
Scientifica Presents People Like Us Reader Year 9	0 7487 9015 2

ICT Power Pack 7 CD-ROM	0 7487 8017 3
ICT Power Pack 8 CD-ROM	0 7487 8027 0
ICT Power Pack 9 CD-ROM	0 7487 8037 8

Not many books cover the whole course in a single text but here are some of them:

Core Science 1 – Key Concepts
Cambridge ISBN 0 521 58850 2

Covers nearly all of the ESO1 curriculum. Rather old fashioned style but straightforward. This is the only book that covers all the main topics.

Core Science1 - Supplementary Materials
Cambridge ISBN 0 521 588480
Photocopiable practical activities, exams, worksheets, and answers to questions.

Core Science 2 – Consolidation
Cambridge ISBN 0 521 58849 9
Covers nearly all of the ESO2 curriculum. It revisits many topics and adds to them. Good for revision of the whole cycle.
www.cgpbooks.co.uk

Key Stage Three Foundation Science Revision Guide (SFR30)
CGP ISBN 1 84146 240 3 (They have special price for schools orders)
This is not a text book but covers all the material which the pupils are expected to know in ESO1 and ESO2.
It is cheap and very good.

KS3 Science Summary Book 2nd Edition Briann Arnol
ISBN: 0340871741
Publisher: Hodder & Stoughton

Key Stage Three Foundation Workbook (SFR 30)
CGP ISBN 1 84146 249 7

Key Stage Three Foundation Answers for Workbook (SFA 30)
CGP ISBN none
Workbook for the pupils to write in and the answers to the questions.

International Science Course books 1, 2 and 3
Hodder Education ISBN: 9780340966037 Karen Morrison
A three-level science series covering the lower secondary grades and designed for children in English-medium schools, for who English is not the first language. Perfect preparation for the IGCSE and equivalent courses.

Science 1 and 2 Natural Science
Santillana
These books have improved but are still very factual. They cover most of the content of the course; however they are not particularly suited to this integrated curriculum. It would be useful for teacher reference.

Linguaframe Science ESO 1 and 2
Good value for money and is written in a clear simple way with many diagrams and illustrations, however it does lack practical activities.

Useful web sites

http://www.qca.org.uk/ages3-14/subjects/science.html
The official website of the QCA. This has all the information, schemes of work, lesson plans etc of the National Curriculum at all levels. Also links to resources. Very useful reference guide.

http://www.bbc.co.uk/schools/ks3bitesize/science/

Includes games and revision activities for students aged 11-14 as well as teacher's notes, lesson plans etc. attractive and user-friendly.

http://lgfl.skoool.co.uk/keystage3.aspx?id=80
A great interactive website for, biology, physics and chemistry.

http://www.tes.co.uk/secondary-teaching-resources/
A web bank of resources to share, written by teachers in all subject areas.

http://ngfl.northumberland.gov.uk/science/defa ult.htm
Includes self-assessment resources for students as well as online activities (e.g. ecosystem simulation) with accompanying worksheets on some topics. Assessment criteria Y7, Y8 y Y9.Small but quite useful.

http://www.teachernet.gov.uk
You can subscribe to get the complete resources (a bit expensive); there is general information about trips around England and a useful link:

http://www.sciencenet.org.uk/education/teachers/ks3teachers.html
This site is still under construction but so far looks quite promising. The part of education continues under construction but you can find interesting reports in the section of news (articles and features) to your improvement.

http://www.sciencenet.org.uk/education/students/ks3students.html
A site for students, this is currently under construction but looks promising.

http://www.ase.org.uk/
The official website of the ASE, this includes links, reference materials and links to resources. The contents of the various CDs on sale from the ASE can be viewed online. Attractive layout, with a lot of content, it needs some time to explore.

http://www.solarsystem.org.uk/planet10/
There are several resources here but a particularly good one is Planet 10, where the pupils can design their own planet and launch it into the Solar System and see if it survives.

www.bbc.co.uk/education/rocks/rockcycle.shtm
An excellent resource on the rock cycle where you can click on each of the stages of the cycle and they give activities and experiments to do.
It is worth looking around this whole BBC site as they are continually expanding the education sections.

www.schoolscience.co.uk/teachers/chemclub/index.html
This site is the Salter's Chemistry club site. There are a large number of downloadable chemistry experiments, all of them interesting, for all levels and with excellent background information.

http://www-saps.plantsci.cam.ac.uk/links_intro.htm
http://www-saps.plantsci.cam.ac.uk/
SAPS stands for Science and Plants for Schools and has a lot of interesting ideas for practical work. The links_intro page has links to particular parts of the syllabus and will be very useful.

http://ngfl.northumberland.gov.uk/t4l/blueberry/homemain.htm

Blueberry Farm is an excellent interactive site which allows pupils to see how pesticides and herbicides affect the environment. It could be used in the pollution section of the syllabus.

http://www.planet-science.com/sciteach/home.html
Huge amounts of free resources are available here. There are many ideas for teaching, including science jokes for children!

http://www.ks3bradford.co.uk/science.htm
A selection of sites and animations (e.g. kinetic theory) for this level.

http://www.hhmi.org/coolscience/critters/critters.html
A useful site about classification of vertebrates.

www.schoolscience.co.uk/periodictable.html
An interactive Periodic Table

Space

http://www.bnsc.gov.uk/learningzone.aspx?nid=3261
All about space, includes resources and printable activity sheets at different levels (ages 7-16). Lesson plans and teachers' notes are useful and easy to follow.

Forces

http://puzzling.caret.cam.ac.uk/game.php?game=parachute
Parachute Man Simulation.

Light

http://starphysics.dit.ie/html/OPTICS/wavelight.htm
A good general reference.

http://micro.magnet.fsu.edu/primer/java/scienceopticsu/newton/
Using a prism to produce a spectrum.

http://mc2.cchem.berkeley.edu/Java/RGB/example1.html
Primary and secondary colours.

http://www.ltscotland.org.uk/5to14/interactive/science/light.asp
Good animations for this level, including colour mixing.

http://mc2.cchem.berkeley.edu/Java/absorption/Java%20Classes/absorption.html
Primary and secondary colours- the effect of filters.

http://www.mic-d.com/java/accommodation/
The eye: focussing and the rest of this site has a lot of information about light.

http://micro.magnet.fsu.edu/index.html
A very good website about microscopy and related subjects: light, eye, waves etc. Interesting simulators. For instance:
The eye and how it works.

http://micro.magnet.fsu.edu/primer/java/humanvision/accommodation/index.html
Human vision.

http://micro.magnet.fsu.edu/primer/lightandcolor/electromagintro.html
Light and waves.

Sound

http://www.westfieldnj.com/eis/team6/6science_ch17_3.htm
Excellent site for interactive resources about sound.

http://www.ltscotland.org.uk/5to14/interactive/science/sound.asp
An excellent source of animations: oscilloscope, bell jar experiment, speed of sound, sound waves in solids etc all for this level.

http://www.exploratorium.edu/music/index.htm
Fun music and sound games (and other Science activities).

http://www.rhythmweb.com/homemade/index.html

http://homeschooling.gomilpitas.com/explore/homemademusic.htm

http://www.musicinventions.org/base/page6.html
Ideas for making musical instruments.

http://library.thinkquest.org/19537/Inter.html
Making waves.

http://webphysics.ph.msstate.edu/jc/library/15-4b/simulation.html
Try this as a simple wave generator.

http://wow.osu.edu/Sound/stringtele.htm
Worksheet for making a string telephone.

http://www.nidcd.nih.gov/health/education/decibel/decibel.asp
Loudness and decibel animation.

http://www.kettering.edu/~drussell/Demos/waves/wavemotion.html
Animation of sound waves.

http://www.lsu.edu/deafness/HearingRange.html
Information about hearing range of other animals.

http://www.infj.ulst.ac.uk/~pnic/HumanEar/Andy's%20Stuff/MScProject/workingcode_Local/RunTest.html
An excellent ear animation.

http://www.hhmi.org/biointeractive/animations/cochlea/coc_frames.htm
A little animation of the cochlea.

http://www.visualprosthesis.com/javoice.htm
A wonderful interactive activity about frequencies.

Ecology

http://puzzling.caret.cam.ac.uk/game.php?game=foodchain
Food chain Simulation.

http://micro.magnet.fsu.edu/primer/anatomy/introduction.html
Microscope.

http://micro.magnet.fsu.edu/moviegallery/pondscum.html
Life in a pond.

Geology

www.jesei.org
Lots of activities and resources for teachers and pupils, experiences and how to do and evaluate them.

http://volcano.und.edu/vw.html
The best website about volcanoes with pictures movies and information.

www.earthscienceeducation.com
Interesting units about geological topics tectonic of plates, rock cycle, weathering and pictures and information about common rocks.

http://www.wwnorton.com/earth/earth/
Glossary of geological terms and animations on line.

Appendix 1

1. Assessment of Practical Investigations in Science

Sample practical assessment criteria for ESO 1

What is the effect of temperature on the growth of yeast?

	Investigation procedure	Assessment criteria
2 Investigation	A single celled fungus: yeast and wine What does yeast need to grow? **Put the yeast water mixture into a 100ml conical flask with a balloon over the end. Yeast will produce carbon dioxide, so the biggest balloons show the greatest activity.** **Which temperature is best?** Do they need sugar? Is glucose better? etc. Plan a fair test to investigate one of these questions. In this case the yeast is producing alcohol like in wine or beer. There is a lot of opportunity for extension work here.	To share ideas and information, carry out the task and then review ideas • to decide what to measure • how to control variables • about the number of measurements needed for data in which they have confidence • that yeast respires like other organisms

If the pupils have carried out their own investigations about temperature and been told to write a report which includes what they did, their results, a conclusion and an evaluation the marking criteria could be something like this:

Planning

Assessment band	Assessment criteria
Band 1	Needed help to get started. Did not suggest how to carry out the investigation needed to be told.
Band 2	Carried out a fair test but needed some help to make a good investigation. Understood the need to keep some variables, such as the amount of yeast, constant.
Band 3	Planned a good fair test making sure that only the temperature was changed, all other factors such as volume of water, amount of sugar etc remained constant.

Considering and evaluating results

Assessment band	Assessment criteria
Band 1	Notices that there is more gas at higher temperatures but does not really attempt an explanation. Does not make much attempt to suggest how to improve the investigation.
Band 2	Explains the observations in simple terms such as yeast produces less gas at lower temperatures. Make an attempt to explain the results (not necessarily correct). Suggests some simple improvements to the method.
Band 3	Related their observations to the fact that yeast is a living organism. Identified the gas in the balloons as carbon dioxide and compared it to respiration in other organisms (e.g. human). Criticised the method and made some suggestions for improving it. Used scientific language in the conclusions.

Sample practical assessment criteria for ESO 2

What factors determine the rate of descent of a parachute?

	Investigation procedure	Assessment criteria
Experiments 2h	**Lab experiments:** 1.- Parachutes with different materials 2.- Measuring cylinder with salted water and plasticine 3.- Measuring upthrust when an object is put into the water	Table of results. Graph of results Conclusions and evaluation.

If the pupils have carried out their own investigations and been told to write a report which includes what they did, their results, a conclusion and an evaluation the marking criteria could be something like this:

Planning

Assessment band	Assessment criteria
Band 1	Needed help to get started. Did not suggest how to carry out the investigation, needed to be told.
Band 2	Carried out a fair test but needed some help to make a good investigation. Understood the need to keep some variables, such as the weight on the parachute, constant. Able to design their own results table.
Band 3	Planned a good fair test making sure that only one variable, such as area of the parachute was changed, all other factors such as weight , number of strings, height dropped are kept constant. Design own results table and included calculated results such as speed of descent and allowed for repeated results at each area.

Considering and evaluating results

Assessment band	Assessment criteria
Band 1	Notices that big parachutes descend more slowly but does not really attempt an explanation. Does not make much attempt to suggest how to improve the investigation.
Band 2	Explains the observations in simple terms such as the bigger the area the slower the descent. Make an attempt to explain the results (not necessarily correct). Suggests some simple improvements to the method. Made a graph of the results: time of descent/area of parachute.
Band 3	Described the relationship between area of parachute and speed of descent. Criticised the method and made some suggestions for improving it. May have considered changing the weight and keeping the area constant. Used scientific language in the conclusions. Good graph of results with many different areas and repeated results for each area. Calculated speed of descent and average times.

Pupils cannot fail this kind of investigation, unless they have not done the work. The way they carry out the investigation depends on their scientific ability; some of them will not be ready for the skills expected in Band 3. Because of this, it is advised that the practical work is not given marks but simply banded. Pupils should have improved their practical skills since ESO1.

This is a little simulation which will help in planning a fair test.

http://puzzling.caret.cam.ac.uk/game.php?game=parachute

Parachute Man Simulation

Pupils cannot fail this kind of investigation, unless they have not done the work. The way they carry out the investigation depends on their scientific ability; some of them will not be ready for the skills expected in Band 3. Because of this, it is advised that the practical work is not given marks but simply banded. It is expected that most pupils will improve their practical skills over the year and most, or all of them should reach Band 2 by the time they enter ESO2.

GENERAL ASSESSMENT

Pupils should be assessed in a variety of ways. These should include:

Type of assessment	Examples of activities which can be assessed	Suggested proportion of the final grade
Continuous assessment of coursework and homework.	Work sheets, questions from the textbook, class activities, poster work, annotated diagrams, projects, etc	30%
Practical assessment	Planning, observations, tables, graphs, conclusions, evaluations	30%
Topic tests	Tests after each major topic, quizzes, oral questions	30%
Attitude	State of notebook, care over work, enthusiasm in class, group work collaboration, doing homework on time etc.	10%

The main function of the Topic Tests is to ascertain whether the pupils are progressing satisfactorily. The final mark for the year should be a reflection of this progress. It is important that the record of progress is continued from year to year.

2. Language for Learning

Close coordination between the Science and English departments within the school is essential in order to avoid slowing pupils' progress in science because of difficulties with reading and writing. Scientific language may be revised or reinforced as part of a literacy lesson where appropriate and teachers should introduce new items of vocabulary carefully, teaching the pupils to articulate them before writing.

Science has a strong visual element and this should be capitalised on through the use of illustrations, diagrams etc. Specifying the scientific vocabulary for a particular unit of work allows the pupils to refer back to this in books, charts, and other visual aids.

The main scientific language for the units in the curriculum for 1st cycle of ESO is presented here under the following topics:

- Space
- Physics and Chemistry
- Geology
- Biology

This is intended to serve as a guide for teachers as to the kind of extra input that may be necessary when teaching these topics.

Space

Through the activities pupils will be able to understand, use and spell correctly:

- Words relating to the solar system, *e.g. planets, asteroid, satellite, orbit, eclipse, phases of the Moon*
- Words with similar but distinct meanings, *e.g. orbit, rotate*
- Words and phrases relating to astronomical discoveries.

Physics and Chemistry

Through the activities in this unit pupils will be able to understand, use and spell correctly:

Materials

- words relating to physical processes, *e.g. mass, volume, density*
- words relating to materials and their properties, *e.g. particle, particle theory, element, compound, hydrogen, oxygen, compressible, diffusion, expansion, distillation, filtration, insoluble, saturated solution, separate, solute, solution, solvent, homogeneous, heterogeneous.*

Particles

- words with a precise meaning in scientific contexts, *e.g. evidence, theory, model*
- words and phrases relating to the particle model, e.g. particle, diffusion, gas pressure, vibration, thermal conduction
- words relating to scientific enquiry, *e.g. evidence, data, observation, conclusion.*

Solutions

- words and phrases relating to dissolving, *e.g. solution, solute, solvent, soluble, insoluble, saturated solution*
- words and phrases relating to the separation of mixtures, *e.g. filtration, distillation, chromatography, chromatogram*
- words and phrases relating to explanations using the particle model, *e.g. particle, attracted, mixing, mingling*
- words and phrases relating to scientific enquiry, *e.g. prediction, evaluate, interpret*
- words with similar spelling but different meanings, and use them in a consistently correct way, *e.g. affect, effect.*

Heat and temperature

- words and phrases related to heat and temperature, *e.g. degrees Celsius, Centigrade, energy*
- words and phrases related to energy transfer, *e.g. energy flow, heat transfer, conduction, good thermal conductors, poor conductors, convection, radiation, insulation, evaporation, thermal.*

Light and sound

- words and phrases related to light e.g. *opaque, translucent, transparent, transmission, light rays, light source, mirror, reflection, absorbtion, refraction, kaleidoscope, periscope, primary colours, secondary colours, spectrum, retina, optic nerve, lens, iris, cornea, focus*
- words and phrases related to sound *e.g. loud volume, quiet, high pitch, low pitch, frequency, amplitude, wavelength, vacuum, medium, decibel, noise pollution, Hertz, ear, eardrum, hammer, anvil, stirrup, cochlea, auditory nerve, deafness*
- with similar but distinct meanings in everyday use, *e.g. image, reflection quiet, soft, low, pitch, wave, loudness, volume.*

Acids and alkalis

- names of laboratory acids and alkalis, *e.g. hydrochloric acid*, *sodium hydroxide*
- names of classes of chemical, *e.g. acid, alkali*
- words with different meanings in scientific and everyday contexts, *e.g. indicator, solution, neutral, react, equation*
- words with similar but distinct meanings, *e.g. harmful, corrosive, caustic*
- words and phrases relating to scientific enquiry, e.g. *hazard, risk, pH range, evaluate, strength of evidence.*

Atoms and elements

Through the activities in this unit pupils will be able to understand, use and spell correctly:

- scientific words, *e.g. element, compound, atom, molecule, symbol, formula*
- names of elements and compounds, *e.g. oxygen, carbon dioxide, sodium*, *chlorine, sodium chloride*
- words and phrases with different meanings in scientific and everyday contexts, *e.g. element, equation, state*
- words relating to scientific enquiry, e.g. data search, predicting products of reactions
- words with precise scientific meaning, *e.g. element, compound, mixture, atom, composition, pure*
- names of compounds, e.g. *sodium carbonate, calcium chloride, hydrochloric acid*.

Geology

Through the activities in this unit pupils will be able to understand, use and spell correctly:

Rocks and weathering

- words and phrases for physical processes associated with rock formation, *e.g. chemical weathering, abrasion, sedimentation*
- words and phrases for timescales over which change occurs, *e.g. millions of years, millennia*
- names for specific rocks, *e.g. granite, limestone, sandstone*
- words and phrases relating to geological features, *e.g. sedimentary layers, porosity*
- words and phrases relating to scientific enquiry, *e.g. time-lapse photography, sequence of events.*

The rock cycle

- names of rock types, *e.g. igneous, metamorphic, sedimentary*
- names of rocks, *e.g. granite, pumice, shale*
- words and phrases describing properties of rocks, *e.g. relative density, iron rich, crystals, aligned, porous*
- names of materials and processes associated with volcanic processes, *e.g. magma, lava, volcanic ash, erupt*.

Restless earth

- words and phrases relating to plate tectonic *e.g. constructive, destructive and conservative plate margins. transform faults*
- names of characteristic features *e.g. continental shelf, continental slope, ocean basins (abyssal plain), mid-ocean ridges, deep-sea trenches*
- words and terms relating to earthquakes, *e.g. foci, epicentres, seismic waves, seismographs and seismograms*
- words relating to volcanic processes *e.g. intrusive and extrusive igneous rocks, crystal grain size.*

Biology

Through the activities on this topic pupils will be able to understand, use and spell correctly:

Characteristics of living things

- words related to the characteristics of living things, *e.g. respiration, movement, response, growth, nutrition, excretion, reproduction*
- words with similar but distinct meaning, *e.g. breathe, breath, respire*
- scientific words such as carbon *dioxide, limewater, oxygen*.

Cells

- words relating to the structure of organisms, *e.g. organ, tissue, cell*
- more specialised words relating to cells, *e.g. membrane, cytoplasm, nucleus, chloroplast, vacuole*
- words with similar but distinct meanings, *e.g. membrane and skin,* or terms that they regularly interchange, *e.g. cell wall and membrane*
- words with different meanings in scientific and everyday contexts, *e.g. cell, wall, tissue*
- words and phrases relating to scientific enquiry, *e.g. magnification.*

Variation and classification

- words relating to the structure of organisms, *e.g. segment, abdomen, shell, hypha, cone, flower*
- words with similar but distinct meanings, *e.g. limb* and *leg*
- words and phrases relating to classification, *e.g. key, vertebrate, invertebrate, mammal, amphibian, reptile, feature, characteristics, taxonomic group, kingdom, class, protoctista, fungi, mould, monera, bacteria, yeast, viruses, binomial*
- the words *variation, classification, identification, inherited, environmental*
- words relating to scientific enquiry, *e.g. classify, association, correlation, spreadsheet, database.*

Environment

- words and phrases relating to feeding, *e.g. predator, prey, food web, food chain*
- words and phrases relating to ecology, *e.g. habitat, community, population*
- words and phrases describing environmental conditions, *e.g. light intensity, availability of oxygen*
- words with different meanings in scientific and everyday contexts, *e.g. producer, consumer*
- words with similar but distinct meanings, *e.g. carnivore and predator*
- words relating to scientific enquiry, *e.g. temperature sensor, sample size, reliable data, quadrat.*

Ecological relationships

- words and phrases relating to the environment, *e.g. community, habitat, pyramid of numbers*
- words with similar but distinct meanings, *e.g. predator, carnivore, habitat, environment, ecosystem*
- words and phrases relating to the classification of plants, *e.g. taxonomic group, mosses, ferns, conifers*
- words and phrases relating to an investigation of a habitat, *e.g. environmental conditions, quadrat sampling, transect, population sizes, reliable data.*

Through all the activities pupils should, as appropriate:

- organise, sequence and link what they say so listeners can follow it
- find information from secondary sources using contents, index, glossary, key words or hotlinks
- join ideas within sentences using links of cause (so, because, since)
- use skimming, scanning, highlighting and note taking as appropriate to different texts
- describe and evaluate how work was undertaken and what led to the conclusion
- identify the main points in each paragraph, distinguishing key points from supporting material
- discuss and question what they are learning

- undertake independent research using knowledge of how texts and databases are organised and of appropriate reading strategies
- group sentences into paragraphs that are clearly focused and well developed
- organise facts/ideas/information in an appropriate sequence
- group sentences into paragraphs which have a clear focus
- link ideas and paragraphs into continuous text that is organised and coherent
- ask questions to gain clarification and further information, *e.g. why, how, what, when*
- find information, e.g. using contents, index, glossary, key words, and hotlinks.

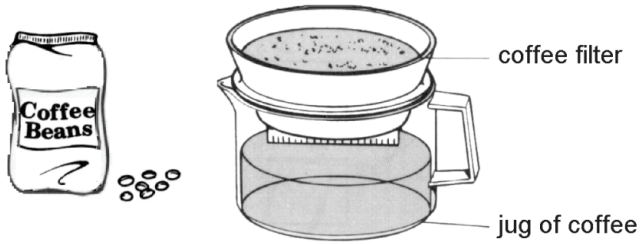
3. Key Questions for Raising Levels

Use questions like these to help students improve their science thinking skills. Ask questions outside their level to encourage thought. **Band 1: Knowledge and recall** **Who, What, When, Where, Why, Which** **How, How much** Describe or define Recall, select, list, find Tell me, show me, point out Name, label Remember, memorise **Band 2: Comprehension translating, interpreting, extrapolating** **Organisation and selection of facts** Retell, describe. in your own words What does this mean State in one word Give an example of What part doesn't fit Choose the statements you agree with Outline, summarise, match, translate, identify Indicate, locate, classify Explain what is happening Read the graph/table Compare and contrast Sequence the facts The main idea is …	**Lower range of Band 3 Application** **Using science in situations that are** **new or unfamiliar** How could you use Demonstrate how Show how Apply, construct, identify If ...how Demonstrate how What would happen if.... How much change would there be if… How would you organise Can we apply this knowledge How could we use what we have learnt today What questions would you ask in an interview **Upper range of Band 3 Analysis** **Breaking down into parts, relating to the whole** Distinguish, diagram, similar, like, chart, plan, dissect, contrast, arrange, conclude, separate, outline, differentiate Give reasons for What assumptions can you make What is fact, what is opinion What is the relationship between Justify your decision Categorise Formulate a hypothesis, predict What solutions would you suggest How could you test …	**Higher Level - Band 3 + Synthesis** **Creating something new** How could you improve Suggest an alternative What solutions would you suggest Think of an original way to… Using your knowledge predict Create, compose, design, develop, Solve the following Infer, State a rule about How else would you **Exceptional - Band 3 ++** **Judging according to a set of criteria and stating why** Appraise, judge Which is the best, verify, evaluate, Find the errors, criticise Are there any inconsistencies What may have caused experimental errors Which information is … More important, better, more reliable, valid, Appropriate, inappropriate Do you agree with... and why What do you think about... and why What would you advise Prioritise… and why What would you recommend and why How could you improve… explain why What is important, not important

4. Sample Exam Questions for Band 2 Level. ESO 1

These questions come from the British SAT tests and are printed from Testbase (see this website for further information on this excellent resource http://www.testbase.co.uk/sec/index.asp)

I. John ground some coffee beans into little pieces. He put them into a coffee filter and poured 800 cm³ of boiling water over them to make a jug of coffee.



(a) Complete the sentences below. For each sentence, choose **one** of the following words.

insoluble soluble solution solvent

(i) The liquid in the jug is brown because parts of the coffee beans are ..... in water. 1 mark

(ii) Some bits of coffee beans are left on the filter because they are ..... in water. 1 mark

(iii) The brown liquid which drips through the filter is a ..... of coffee. 1 mark

(b) How could John get dry, solid coffee from the brown liquid in the jug of coffee?
.....
.....… 1 mark

(c) John tried making coffee in the same way using cold water. He used 800 cm³ of cold water and the same amount of ground up coffee beans.

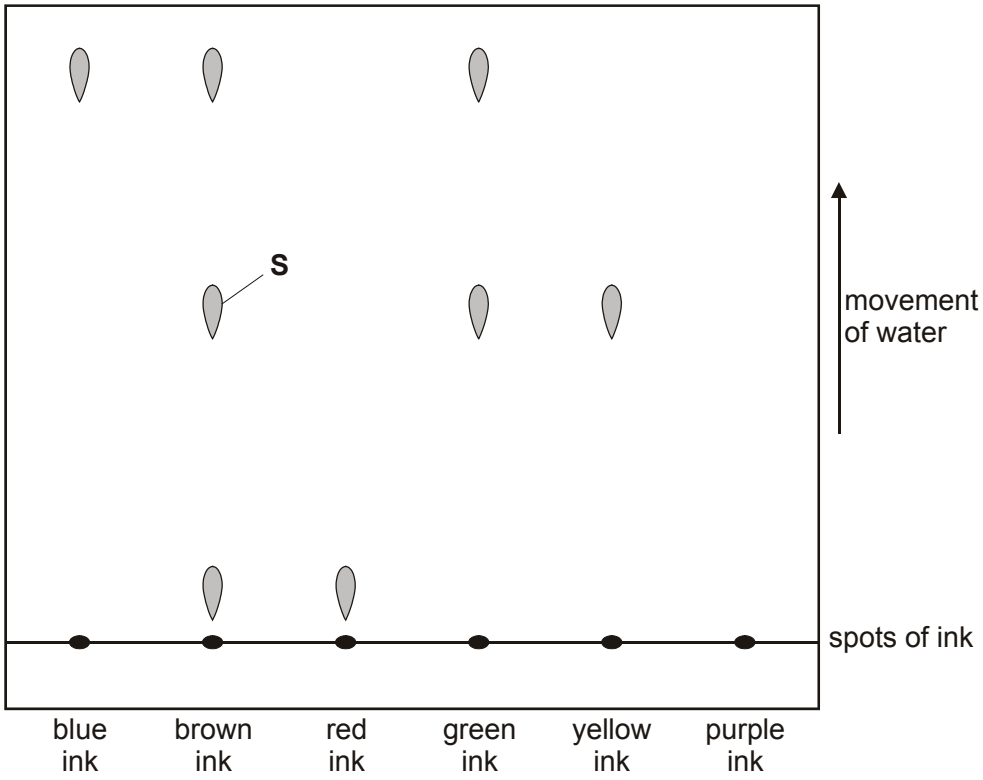
(i) The liquid in the jug was a lighter colour. Why was this?
.....
..... 1 mark

(ii) How much solid coffee could John get back from this liquid?
Tick the correct box.

more than before ☐
the same as before ☐
less than before ☐
none ☐ 1 mark

Maximum 6 marks

II. A pupil used chromatography to show which dyes are present in different coloured inks. The diagram shows some of her results. The results for purple ink are missing.



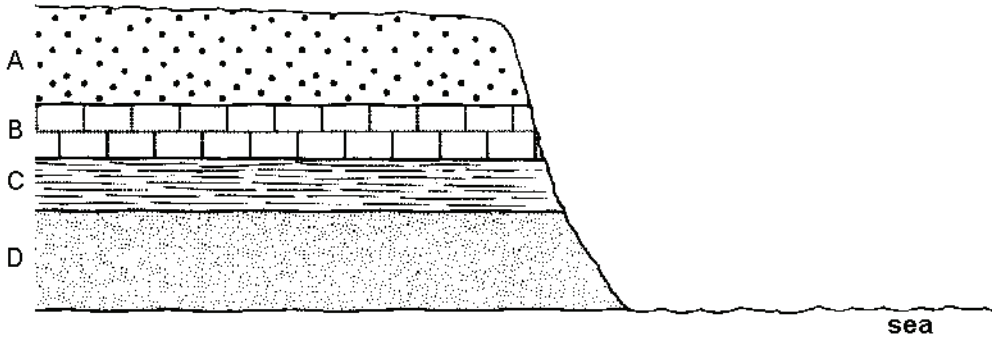
(a) (i) Give the colour of an ink which contains only **one** dye.
..... 1 mark

(ii) Give the colour of an ink which contains **three** dyes.
..... 1 mark

(iii) The purple ink is a mixture of the red and blue inks. On the diagram, draw the results you would expect from purple. 1 mark

(b) What would be the colour of the spot labelled S? ..... 1 mark

III. The diagram shows four different layers of sedimentary rock in a cliff



(a) Which layer of, A, B, C or D, is probably the oldest?
..... 1 mark

(b) Igneous rock is formed when magma cools.
Choose from the following words to complete the sentences below.

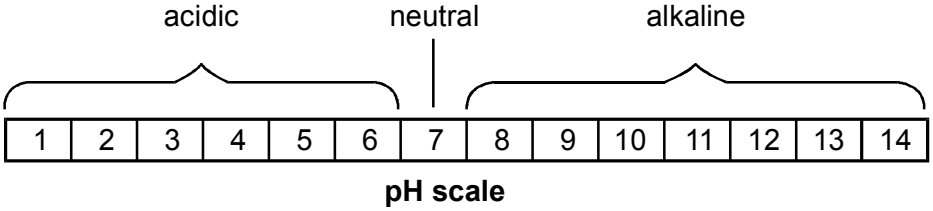
gas **liquid** **metal** **solid**

(i) Igneous rock is a ..... 1 mark
(ii) Magma is a ..... 1 mark

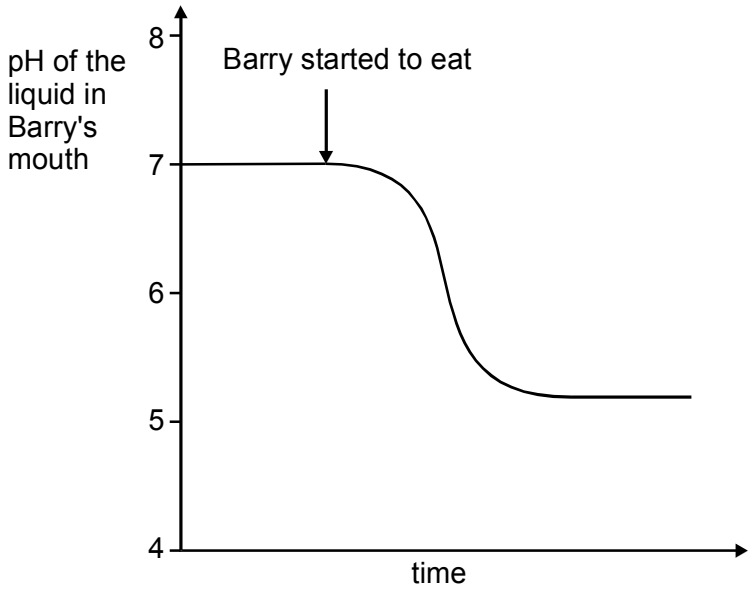
(c) Rocks are put into groups according to the way they are formed. The groups are **igneous, metamorphic and sedimentary.**
(i) To which group does sandstone belong?
..... 1 mark
(ii) In which group are fossils **never** found?
..... 1 mark

Maximum 5 marks

IV. The pH scale shown below is used to measure how acidic or alkaline a solution is.



The graph below shows how the pH of the liquid in Barry's mouth changed as he ate a meal.



(a) (i) Use the **graph** to give the pH of the liquid in Barry's mouth before he started to eat.
pH ..... 1 mark

(ii) What does this pH tell you about the liquid in Barry's mouth before he started to eat? Use the **pH scale** above to help you. Tick the correct box.

It was acidic.	It was alkaline.	It was colourless.	It was neutral.	
☐	☐	☐	☐	1 mark

(b) Look at the **graph** above. What happened to the pH of the liquid in Barry's mouth as he ate the meal?

..... 1 mark

(c) Barry chews special chewing gum after each meal. The chewing gum neutralises the liquid in his mouth.
What type of substance neutralises an acid? Tick the correct box.

an acid	☐	an alkali	☐	
an ndicator	☐	a solid	☐	1 mark

Maximum 4 marks

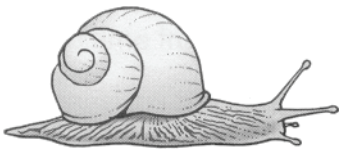
V. Each of the animals in the drawings below belongs to a different group.

(a) On the line beneath each drawing, write the name of the group the animal belongs to. Choose names from the list below.

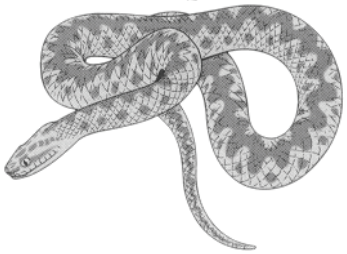
amphibians crustaceans insects mammals molluscs reptiles

.....
A

.....
B



.....
C

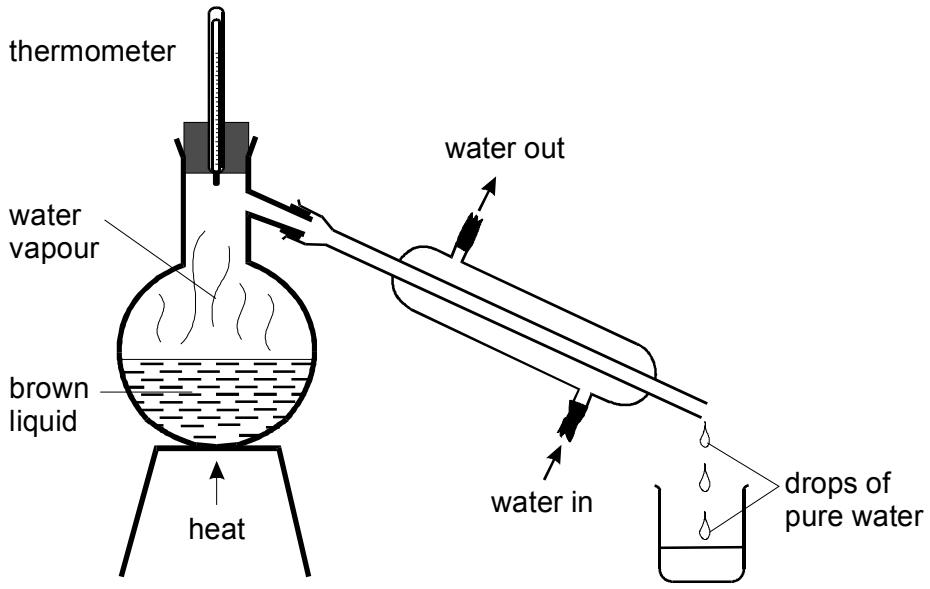


.....
D 4 marks

(b) Which of the animals drawn above are invertebrates? Give the correct letters.
..... and ..... 2 marks

Maximum 6 marks

VI. Dan wanted to get pure water from seawater. He set up the apparatus shown below.



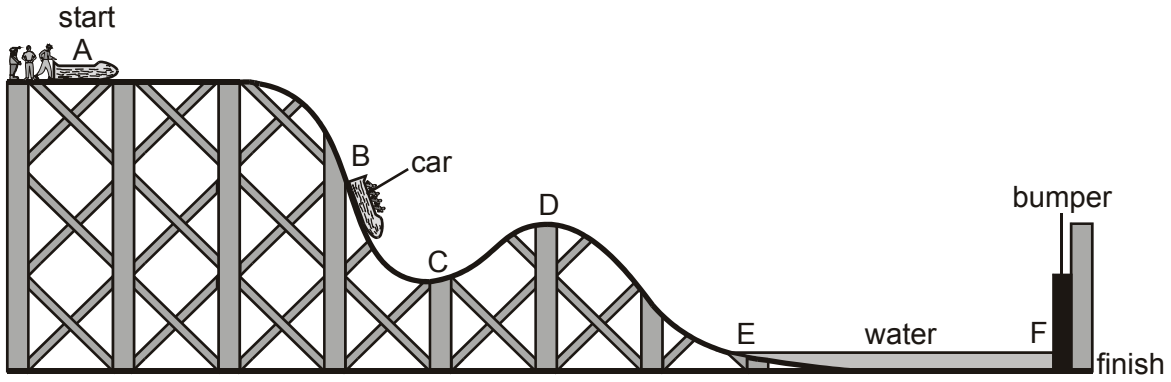
Water vapour from the brown liquid changed into drops of pure water which were collected in the beaker. What process caused the drops of water to form from the vapour? Tick the correct box.

boiling	☐	condensing	☐	
dissolving	☐	melting	☐	1 mark

Sample Exam Questions for Band 2 Level. ESO 2

I. The photograph shows some pupils in a log car on a theme-park ride.

The drawing below shows the ride. The letters A, B, C, D, E and F show different points along the track.



The car starts from A and travels to F, where it stops by hitting a bumper. At E the car enters a trench filled with water.

(a) (i) At which **two** points does the car have **no** kinetic energy? Give the **two** correct letters.
..... and ..... 1 mark

(ii) At which point does the car have the **most** gravitational potential energy? Give the correct letter.
..... 1 mark

(iii) At which point does the car have **some** kinetic energy and the **least** gravitational potential energy?
Give the correct letter.
..... 1 mark

(b) (i) The cars are **not** powered by a motor. What force causes the cars to move along the track from B to C?
..... 1 mark

(ii) When a car splashes through the water at E, it slows down. What force acts on the car to slow it down?

..... 1 mark

(c) Complete the sentence below by choosing from the following words.

chemical	gravitational potential	kinetic
light	sound	thermal

When the car hits the bumper at F, its ..... energy

is transferred into ..... energy and

..... energy. 3 marks

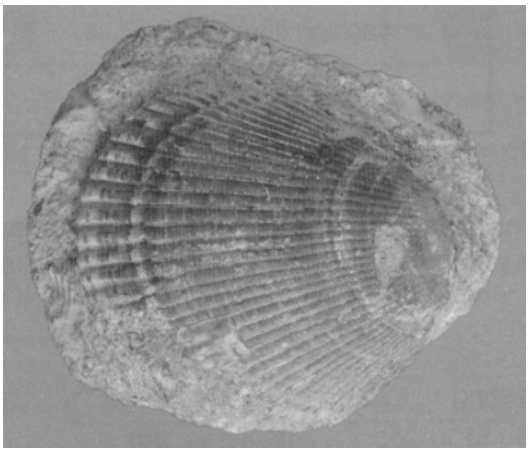
Maximum 8 marks

II. (a) Over many years, cliffs may be affected by weathering. Describe **one** effect of weathering on a cliff.

.....

..... 1 mark

(b) The photograph shows a piece of sandstone.



(i) The sandstone in the photograph contains a fossil. What is a fossil?

.....

..... 1 mark

(ii) What group of rocks does sandstone belong to?

..... 1 mark

(c) Granite and basalt are igneous rocks. They contain crystals but **no** fossils.

(i) How are igneous rocks formed?

.....

..... 1 mark

(ii) Explain why igneous rocks do **not** contain fossils.

.....

..... 1 mark

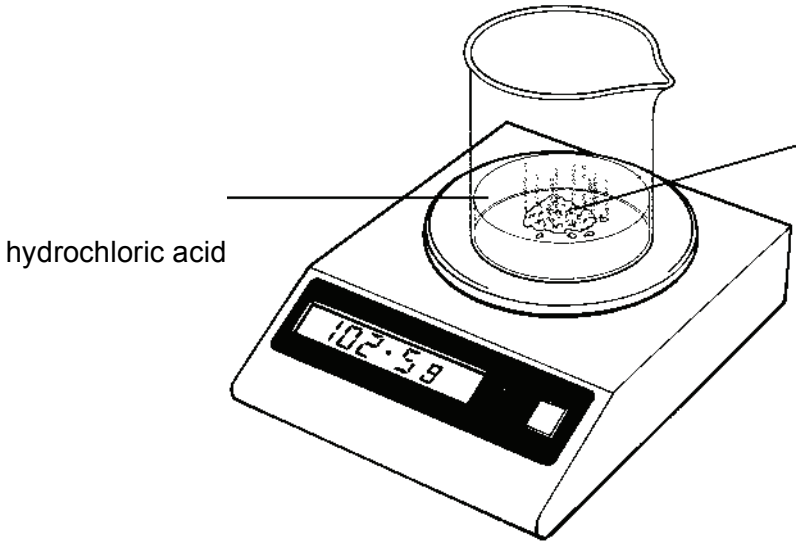
(iii) Granite takes much longer to form than basalt. How will the size of the crystals in granite be different from the size of the crystals in basalt?

.....

..... 1 mark

Maximum 6 marks

III. Ben put a beaker weighing 50g on a balance. He added 50g of dilute hydrochloric acid and 2.5g of calcium carbonate to the beaker. The total mass of the beaker and its contents was 102.5g.



(a) The hydrochloric acid reacted with the calcium carbonate. How could Ben tell that a chemical reaction was taking place in the beaker?

.....

..... 1 mark

(b) The word equation for the reaction which took place is:

hydrochloric acid + **calcium carbonate** → **calcium chloride** + **carbon dioxide** + **water**

When the reaction stopped, the total mass had decreased from 102.5g to 101.4g. Some water had evaporated from the beaker.
What else caused the drop in mass? Use the word equation to help you answer the question.

.....

..... 1 mark

(c) When the reaction stopped, Ben tested the contents of the beaker with universal indicator paper. The calcium carbonate had neutralised the acid. What is the colour of universal indicator paper in a neutral solution?

..... 1 mark

(d) Which **two** materials in the list below are mainly calcium carbonate? Tick the **two** correct **boxes.**

coal	☐
glass	☐
limestone	☐
marble	☐
sandstone	☐

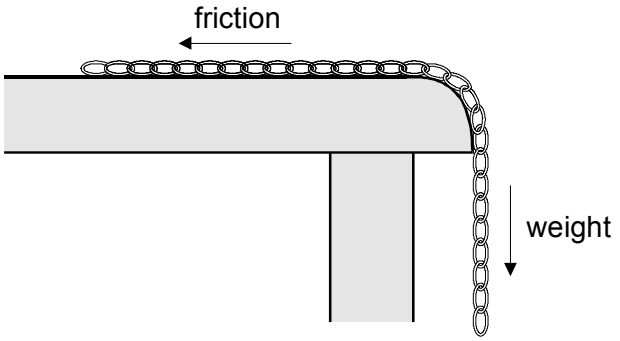
2 marks

(e) Metals react with acids. What gas is produced when a metal reacts with an acid?

..... 1 mark

Maximum 6 marks

IV. The diagram shows a chain hanging down over the edge of a table.



Two of the forces on the chain are:

- the weight of the part of the chain which is hanging over the edge;
- friction between the chain and the table.

(a) The chain is **not** moving. What does this tell you about these two forces acting on the chain?

1 mark

(b) The chain is moved slightly to the right. It begins to slide off the table.

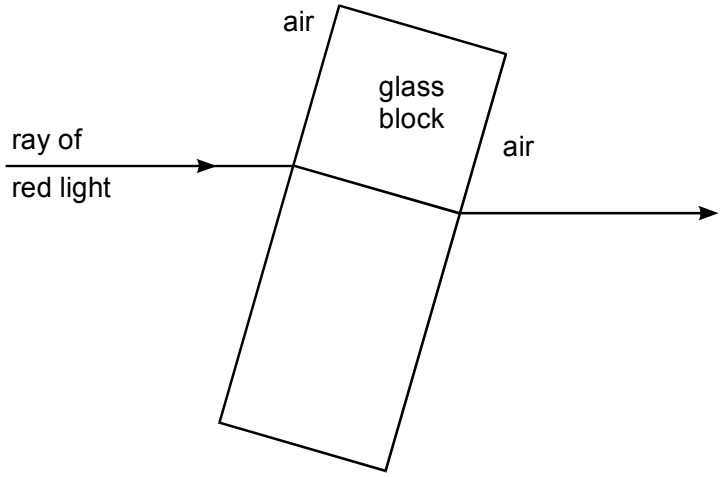
(i) What does this tell you about these two forces now?
……..……. 1 mark

(ii) Describe how the size of each force changes as the chain slides off the table.
- weight of the part of the chain hanging over the edge …….
  ……..……..……...
- friction between the chain and the table …….
  ……..……..……. 2 marks

(iii) How does the speed of the chain change as it slides off the table?
……..…….
……..……. 1 mark

Maximum 5 marks

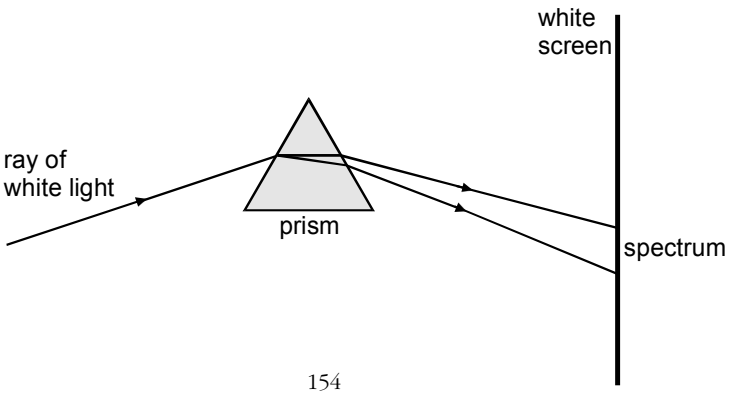
V. (a) The diagram below shows a ray of red light entering a glass block.



(i) Most of the light goes into the glass block, but some does not. What happens to the light which does **not** go into the glass block?
.....
..... 1 mark

(ii) As the light goes into the glass block, it changes direction. What is the name of this effect?
..... 1 mark

(b) The diagram below shows white light passing through a prism and forming a spectrum on a white screen.



The spectrum contains light of all colours. Red is at one end of the spectrum. Write **blue**, **green** and **violet** below in the order of the spectrum.

Red

_____

_____

_____

1 mark

(c) A pupil puts a green filter in the ray of white light. What happens to the spectrum on the screen?
Tick the correct box.

The whole spectrum turns green.	☐
The green part of the spectrum disappears, but the other colours stay the same.	☐
The green part of the spectrum stays the same, but the other colours disappear.	☐
The whole spectrum disappears.	☐

1 mark

Maximum 4 marks

VI. The information below was taken from the label of a can of baked beans in tomato sauce.

nutritional information		**list of ingredients**
100g provides:		
energy	406 kJ	haricot beans, tomato purée, water, sugar, modified starch, salt, paprika, onion powder, herb extracts, spices
protein	5.4 g	
total carbohydrate	17.6 g	
sugar	6.0 g	
fat	0.4 g	
fibre	3.7 g	

(a) A healthy diet contains a number of groups of substances. The nutritional information lists some of these.
Give **one** group of substances, needed for a healthy diet, which is missing from the nutritional information.
.....
1 mark

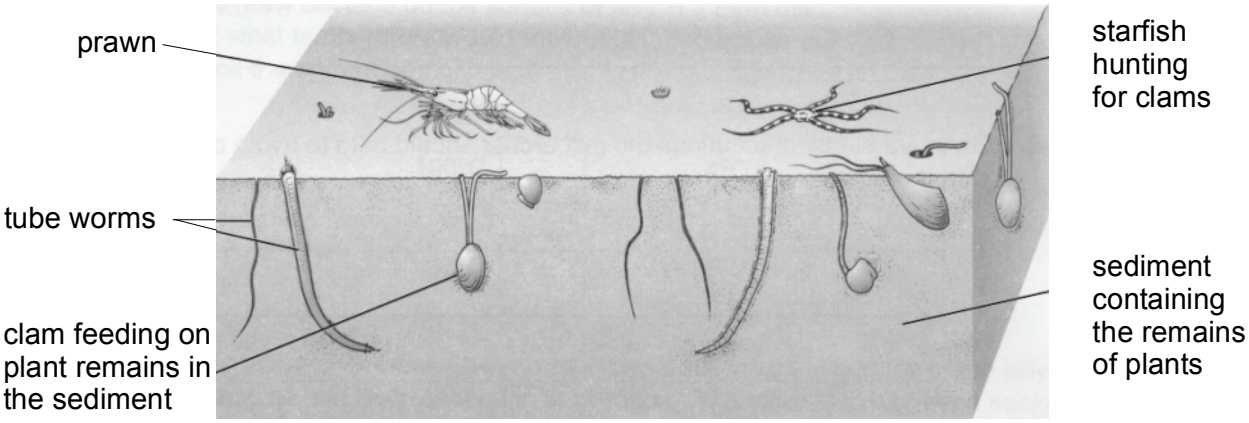
(b) (i) Which food, shown in the list of ingredients, provides the most protein in this can?
.....
1 mark
(ii) Give **one** reason why we need protein in our diet.
.....
1 mark

(c) (i) Name **one** food, shown in the list of ingredients, which provides fibre.
.....
1 mark

(ii) Why is fibre needed for a balanced diet?
.....
..... 1 mark

Maximum 5 marks

VII. The drawing shows some of the animals which live at the bottom of the North Sea.

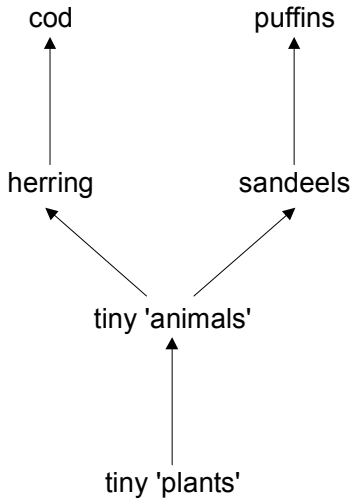


not to scale
WWF - UK Data Support for Education Service

(a) Suggest **two** advantages clams get from living in the sediment.

1. …….
……
2. …….
…….. 2 marks

(b) Part of a food web in the North Sea is shown below. Herring, sand eels and cod are types of fish. Puffins are sea birds.



- Herring lay eggs in the gravel on the seabed.
- Sand eels live where the seabed is covered with sand.

Millions of cubic metres of gravel and sand are removed from the bottom of the North Sea every year for roads and buildings.

(i) Give **one** reason why removing some of the sand and gravel might cause the numbers of herring and cod to decrease.

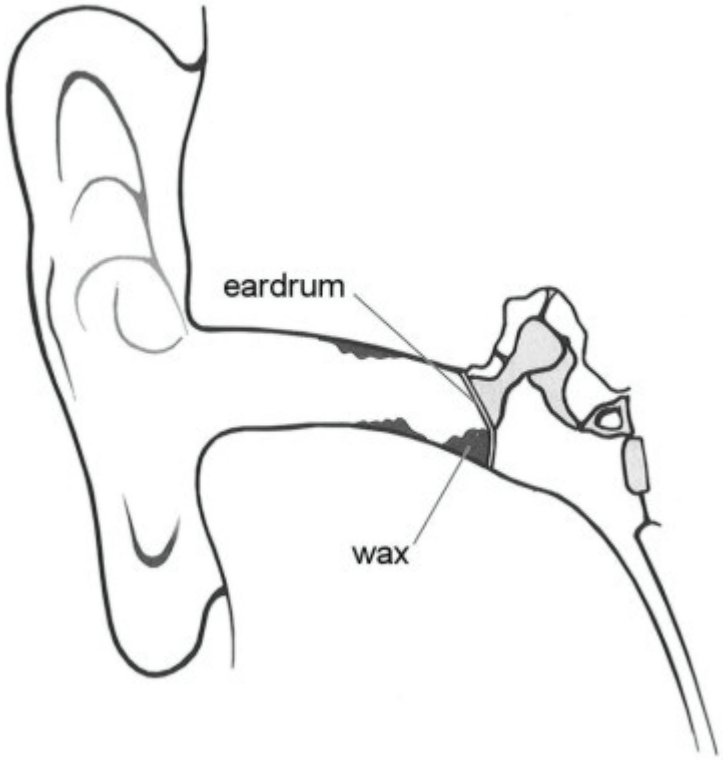
herring ……
……
…… 1 mark

cod ……
……
…… 1 mark

(ii) Explain why removing some of the sand has led to a decrease in the number of puffins.
……
……
……
…… 2 marks

Maximum 6 marks

VIII. The diagram below shows part of the human ear.



We can hear somebody speaking because sound waves enter our ears.

(a) (i) What do our eardrums do when sound waves reach them?
…… 1 mark

(ii) Sometimes a lot of wax is produced in the ear. The wax rests against the eardrum, as shown above. Give **one** reason why we **cannot** hear very well when our ears contain a lot of wax.

.....

..... 1 mark

(b) The table below shows the lowest and highest frequencies that five living things can hear.

living thing	**lowest frequency (Hz)**	**highest frequency (Hz)**
human	20	20 000
sparrow	300	20 000
dog	20	45 000
cat	20	64 000
rabbit	300	42 000

(i) Which **three** living things from the table **cannot** hear a frequency of 43 000 Hz?

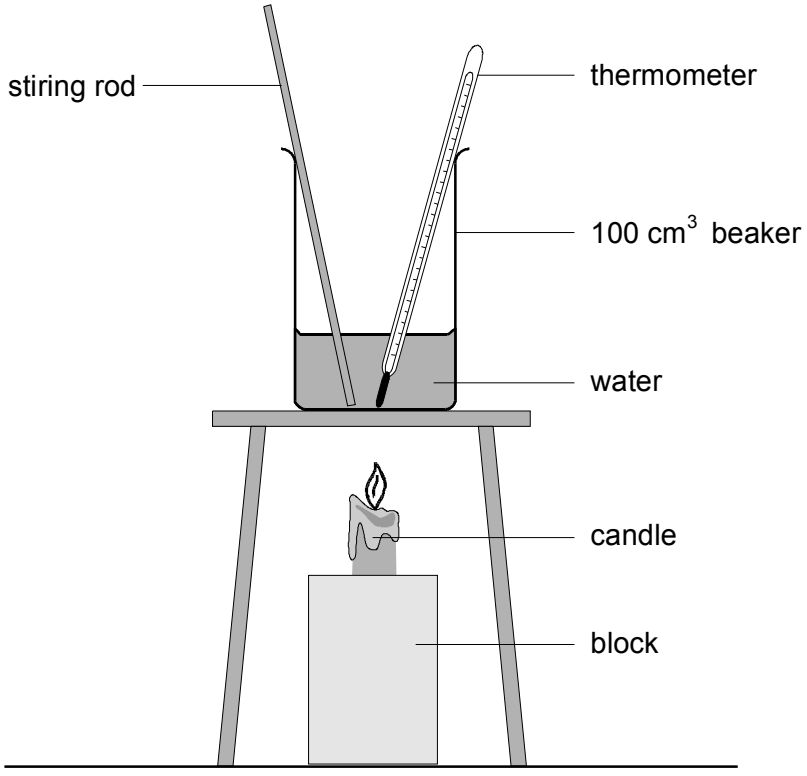
..... and ..... and ..... 1 mark

(ii) From the table, choose the living thing that can hear the biggest **range** of frequencies.

..... 1 mark

Maximum 4 marks

IX. Luke investigated the heating of water. He predicted that the rise in temperature would depend on the volume of water. The diagram shows the apparatus he used.



Luke recorded his results in a table as shown below.

beaker	volume of water, in cm^3	temperature at start, in °C	temperature after 2 minutes, in °C
A	**25**	**18**	**30**
B	**50**	**18**	**24**
C	**75**	**18**	**22**

(a) Why did Luke need to know the temperature of the water at the beginning and at the end of the experiment?

.....

..... 1 mark

(b) Did Luke's results support his prediction? Explain your answer.

.....

..... 1 mark

(c) Luke stirred the water during the experiment. How did this make his results more reliable?

.....

..... 1 mark

(d) Which of the following statements about the energy transferred to the beakers is correct? Tick the correct box.

Much more energy went into beaker 'A' because its temperature increased the most.	☐
The same amount of energy went into all three beakers.	☐
Beaker 'C' received the most energy because there was more water to heat.	☐

(e) After a time, all three beakers cooled down to room temperature. What happened to the thermal energy in the beakers as they cooled down?

.....

..... 1 mark

Maximum 5 marks

5. Investigation Planner

Name _____ **Class** _____

Title of investigation

Planning

This is what I am trying to find out …

_____

_____

I plan to do the investigation this way (a labelled diagram could help)

_____

_____

_____

To make it a **fair test**, I am going to keep these things (variables) the same …

_____

_____

I am going to change these things (variables) …

_____

_____

I am going to measure/observe …

_____

_____

_____

These are my **predictions** (what I think will happen) …

_____

_____

_____

My scientific reasons for thinking this are …

_____

_____

_____

This is what I will do to make sure I am safe …

_____

_____

_____

Recording your results

These are my results (a table may be necessary).

_____

_____

_____

_____

_____

_____

_____

_____

I have/have not also drawn a graph/chart.

Considering your results/conclusions

I see the following patterns in my results… AND/OR… this is what I learn from my results…

_____

_____

_____

_____

This is how my results compare with my prediction …

_____

_____

_____

This is the way I can explain my results …

_____

_____

_____

_____

Evaluation

This is my judgement of how well the investigation worked (including an overall comment, and perhaps comment on experimental technique, equipment and errors)

_____

_____

_____

If I could do this investigation again, I would change it in the following ways …
or perhaps you could suggest other experiments that could be done.

_____

_____

_____

I would change these things because …

_____

_____

Teacher comment:

Evaluation area	Grade
Planning	
Observing and Recording	
Considering the evidence (conclusions)	
Evaluating	

Appendix 2:
Equipment and Materials

1. Equipment for ESO 1 and ESO 2

This is a list of the basic equipment and materials needed for the whole cycle of the integrated curriculum. Most school laboratories will already have a lot of the general equipment and probably a lot of the rest as well. This list is not meant to be definitive, just a guide.

ESO1	This column shows the area of the curriculum when the equipment will be needed.
Item	A description of the materials, all found in Philip Harris 2003 catalogue (http://www.philipharris.co.uk/)) who have a Spanish representative.
Class set?	This is to give an idea about whether a class set of materials might be needed; obviously it will depend on the teacher as to whether it will be a class experiment or not.
Number	A rough guide as to how many sets of equipment might be needed; this is based on a class of about 25 pupils working in groups of 2 or 3.
Importance	1 = highly recommended, 2 = very useful 3= desirable.

There are many Spanish suppliers such as:

Ventus: ventus@ventusciencia.com

Didaciencia: correo@didaciencia.com
www.didaciencia.com

TSD Enosa: tsd@tsd.es
www.tsd.es

ID	ESO1 Topic	Item	Class set?	Number	Importance
1	Acids	Bicarbonate 500g		1	1
2	Acids	Indicator papers books		20	1
3	Acids	Indicator Universal 1 to 14		1	1
4	Acids	Indigestion tablets		4	1
5	Acids	pH meters simple type	Yes	3	1
6	Acids	Sensor: pH		2	3
7	Acids	Variety of acids about 5l		5	1
8	Acids	Variety of alkalis about 5l		5	1
9	Atoms	Molecular model building system set		1	3
10	Atoms	Periodic table charts		1	1
11	Atoms	Plasticine	Yes	5	1
12	Bacteria	Disinfectants and antiseptics and antibiotics		1	2
13	Bacteria	Nutrient agar pk100 tablets		1	1
14	Bacteria	Petrie dishes plastic pack 20	Yes	5	1
15	Bacteria	Presept disinfectant tablets		1	1
16	Bacteria	Pressure cooker		1	1
17	Cells	Body organs model		1	2
18	Cells	Graticules pack 10	Yes	1	3
19	Cells	Microscope cover slips box		5	1
20	Cells	Microscope simple	Yes	10	1
21	Cells	Microscope slides box 100		1	1
22	Cells	Prepared slides of cells		20	1
23	Classification	Animal specimens			2
24	Classification	Dissecting set	Yes	5	2
25	Classification	Living animals e.g. Tenebrio			3
26	Classification	Plant specimens			3
27	Classification	Field guides and keys			2
28	Density	Materials blocks kit			1
29	Ecology	Grid quadrats	Yes	5	1
30	Ecology	Sensor Light		2	3
31	Ecology	Sensor water temperature		2	3
32	Fungi	Balloons pack		10	3
33	Fungi	Yeast		2	1
34	Gases	Limewater CaOH2 1kg		1	1
35	General	Aluminium foil		1	1
36	General	Balance digital 0,1g		1	1
37	General	Balance digital 1g		1	1
38	General	Beakers 100 ml pack12	Yes	3	1
39	General	Beakers 250 ml pack 12	Yes	3	1
40	General	Beakers 500cm3 polypropylene	Yes	30	1
41	General	Beakers 5litre		2	2
42	General	Beakers Tri pour polypropylene 1000ml pack 10	Yes	1	2
43	General	Beakers Tri pour polypropylene 250ml pack 10	Yes	3	2

ID	ESO1 Topic	Item	Class set?	Number	Importance
44	General	Beakers Tri pour polypropylene 100ml pack 10	Yes	3	2
45	General	Bench lamp	Yes	2	3
46	General	Bottle rack	Yes	5	2
47	General	Bottles 2,5l polythene		5	1
48	General	Bottles dropping 50ml	Yes	30	1
49	General	Bottles reagent 250ml	Yes	30	1
50	General	Bungs test tube 13 - 16mm 1-hole pack10	Yes	10	1
51	General	Bungs test tube 21- 24,5mm solid pack10	Yes	10	1
52	General	Bunsen burners	Yes	8	1
53	General	Candles nightlight pack 10		5	2
54	General	Clamp stands with clamp and boss	Yes	10	1
55	General	Conical flasks 100ml	Yes	20	2
56	General	Conical flasks 250 ml	Yes	20	1
57	General	Crucibles nickel	Yes	10	2
58	General	Droppers pack 500	Yes	1	1
59	General	Evaporating basins	Yes	10	1
60	Safety	Eye wash bottles	Yes	5	1
61	Safety	Fire blanket		1	1
62	General	Funnels plastic 64mm pack 10	Yes	1	2
63	General	Funnels plastic140mm pack 5	Yes	2	1
64	General	Gas jar lids pack 10	Yes	10	1
65	General	Gas jars	Yes	8	1
66	General	Gauzes pack 10	Yes	2	1
67	General	Gloves polythene disposable pack 100	Yes	5	2
68	General	Gratnell trays - deep pack6		1	3
69	General	Gratnell trays - shallow pk6		4	2
70	General	Magnifiers pk10		1	1
71	General	Masses 100g (10g set)	Yes	10	1
72	General	Masses (100g set) 1000g	Yes	10	1
73	General	Measuring , cylinders 50 ml	Yes	8	1
74	General	Measuring cylinders 1000ml	Yes	2	1
75	General	Measuring cylinders 10ml	Yes	8	1
76	General	Meter rules	Yes	8	1
77	General	Mounted needles	Yes	10	2
78	General	Plastic bags pack 100		1	1
79	General	Plastic cups pack 100		1	2
80	General	Pneumatic troughs		2	2
81	General	Rubber bands pack		10	2
82	Safety	Safety goggles	Yes	30	1
83	General	Scalpels pack 10		1	2
84	General	Scissors	Yes	8	1
85	General	Spatulas	Yes	15	1
86	General	Splints wooden bundle		1	1

ID	ESO1 Topic	Item	Class set?	Number	Importance
87	General	stirring rods pack	Yes	1	1
88	General	Stop-clocks	Yes	10	1
89	General	Syringes 1ml pk100	Yes	1	2
90	General	Syringes 60ml	Yes	20	2
91	General	Test tube brushes pack10		2	2
92	General	Test tube holders	Yes	10	1
93	General	Test tube racks	Yes	10	1
94	General	Test tubes (boiling tubes) pack 100	Yes	1	1
95	General	Test tubes pack 100	Yes	2	1
96	General	Thermometers -10 110 spirit	Yes	20	1
97	General	Tongs	Yes	8	1
98	General	Tripods	Yes	8	1
99	General	Trolley with trays		1	3
100	General	Tubing plastic m		10	2
101	General	Watch-glasses	Yes	10	1
102	Geology	Carbonate rocks			3
103	Geology	Fossil samples		1	3
104	Geology	Marble chips 3kg		1	2
105	Geology	Rock collections igneous		1	1
106	Geology	Rock collections metamorphic		1	1
107	Geology	Rock collections sedimentary		1	1
108	Geology	Salol pack		1	2
109	Mixtures	Chromatography paper	Yes	1	1
110	Mixtures	Coloured dyes or pens	Yes	4	1
111	Mixtures	Distillation flask 250ml		1	1
112	Mixtures	Ethanol 5l		1	1
113	Mixtures	Filter paper 90cm box 100		5	1
114	Mixtures	Liebig's condenser			1
115	Mixtures	Rock salt 1kg		5	1
116	Particles	Particle simulation model		1	3
117	Particles	Potassium permanganate 500g		1	2
118	Solutions	Copper sulphate1kg		1	1
119	Space	Foot pump		1	3
120	Space	Globe		1	1
121	Space	Measuring tape 50m			2
122	Space	Space software, videos			3
123	Space	Water rocket kit		1	3

2. Additional materials required for ESO 2

ID	ESO 2 Topic	Item	Class set?	Number	Importance
124	Material &Energy	Lego brick model		1	3
125	Material &Energy	Fossil fuel samples: coal, mineral oil		1	2
126	Geology and Energy	Aluminium foil roll		1	1
127	Geology and Energy	Black and white paint		1of each	1
128	Geology and Energy	Coloured dye or Potassium permanganate 250g		1	1
129	Geology and Energy	Salol crystals 250g		1	2
130	Chemical changes	Magnets	yes	10	1
131	Chemical changes	Non-metals: e.g. lumps of sulphur, carbon, Metals: e.g. iron, copper, nickel, aluminium		selection	1
132	Chemical changes	Iron filings or iron powder 500g	yes	1	1
133	Chemical changes	Powdered sulphur 500g	yes	1	1
134	Chemical changes	DCPIP powder 5g (makes 0.1% solution)	yes	1pack	2
135	Chemical changes	Metals: iron, magnesium	yes		1
136	Chemical changes	Compounds: copper sulphate, calcium carbonate other carbonates, sodium bicarbonate	yes	1jar of each	1
137	Forces and Effects	Force meters: 10N, 20N, 50N	yes	10 of each	1
138	Forces and Effects	Rubber bands	yes	20	1
139	Forces and Effects	Stop watches	yes	5	1
140	Forces and Effects	Measuring tape 50m		1	2
141	Forces and Effects	Polystyrene beads (for low friction surface) 100g		1	3
142	Forces and Effects	Bathroom scales (in Newtons)		2	1
143	Light	Laser pointer or torch		1	1
144	Light	Ray boxes	yes	10	1
145	Light	Rectangular plane mirrors (e.g. 10x5cm)	yes	30	1
146	Light	Protractors	yes	10	1
147	Light	Small square mirrors (e.g. 5x5cm)	yes	30	3
148	Light	Convex and concave mirrors	yes	10 of each	3
149	Light	Solid glass or Perspex blocks (e.g. 10x5x2cm)	yes	10	1
150	Light	Glass or Perspex prisms (45°,45°,90°)	yes	20	1
151	Light	Coloured filters to fit light source	could be	1set	1
152	Light	Slide projector (three if possible)		3	3
153	Light	Model eye to show focussing		1	3
154	Sound	Musical instrument e.g. guitar		1	1
155	Sound	Oscilloscope		1	3
156	Sound	Signal generator		1	3

ID	ESO 2 Topic	Item	Class set?	Number	Importance
157	Sound	Bell jar, electric bell, vacuum pump		1set	3
158	Sound	Decibel meter		3	2
159	Sound	Model ear		1	3
160	Sound	Microphone		1	3
161	Heat and temperature	Different types of thermometers		selection	
162	Heat and temperature	Electric plate heater		1	2
163	Heat and temperature	Rods about 2mm diameter e.g. copper, iron, brass, glass, wood, plastic	yes	10 of each	2
164	Heat and temperature	Insulating materials e.g. cotton wool, polystyrene cups			
165	Heat and temperature	Ball and ring apparatus	yes	10	3
166	Heat and temperature	Hot air balloon kit		1	3
167	Heat and temperature	Large thin plastic bags e.g. from dry cleaners		3	3
168	Heat and temperature	Magnifying glasses		10	3
169	Energy and living things	Animal skeletons			
170	Energy and living things	Amylase 10g, starch 1kg, glucose test strips 50	yes	1	2
171	Energy and living things	Visking tubing 10m		1	3
172	Energy and living things	Limewater 2 litres (or Calcium hydroxide 250g)		1	2
173	Energy and living things	Icing sugar 250g		1	3
174	Energy and living things	Iodine solution 1 litre, alcohol 2 litres		1	1
175	Energy and living things	Seeds e.g. cress (berro), radish Fertilizer 100g	yes		1
176	Ecosystems	Sensors: e.g. light, temperature		5 each?	3

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