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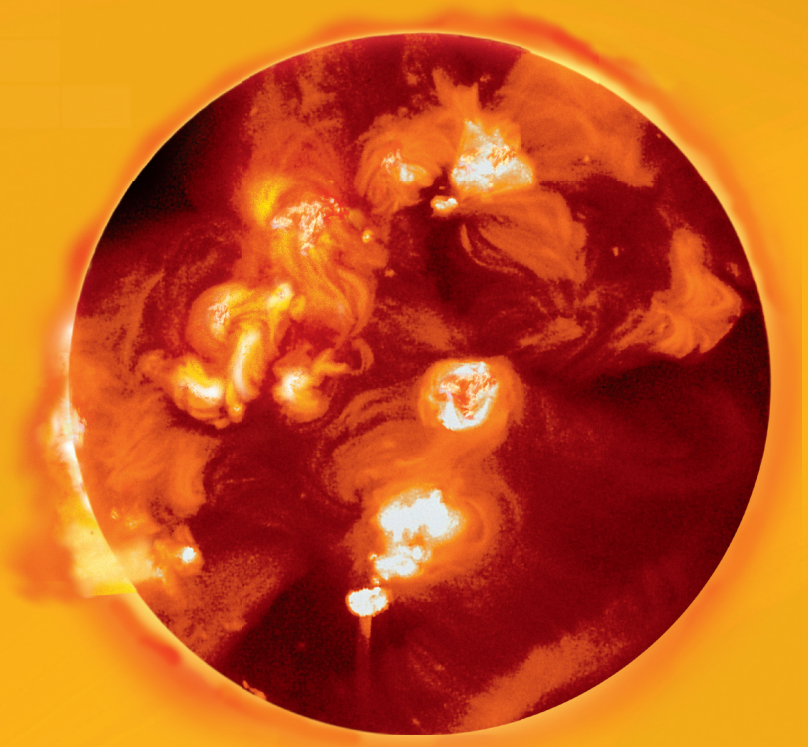

Entry Level Certificate in Science

Specification

Edexcel Entry 1, Entry 2 and Entry 3 Certificate in Science (8939)

First examination June 2014

ALWAYS LEARNING

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Introduction

The Edexcel Entry Level Certificates in Science are designed for use in schools. The qualification recognises achievement at National Curriculum Levels 1, 2 and 3. The qualification is part of a suite offered by Edexcel.

Key subject aims

The Edexcel Entry Level Certificate in Science qualification enables students to:

- acquire a body of basic scientific knowledge and an understanding of some important scientific ideas
- develop basic experimental and investigative abilities
- recognise the difference between scientific and non-scientific ideas and explanations
- develop a basic understanding of some of the important technological and environmental applications of science and the economic, ethical and social implications
- develop literacy, numeracy and ICT skills as appropriate to them and the centre resources that are available
- develop an interest in science leading to further study at a higher level, for example, the Edexcel GCSE in Science.

Key features and benefits of the qualification

Key features and benefits are:

- provides entitlement to the Programme of Study for Key Stage 4 Science
- recognises achievement at National Curriculum Levels 1, 2 and 3
- meets the needs of students with special educational needs
- meets the requirements of students with learning and behavioural difficulties
- motivates students by recognising small steps of achievement
- no terminal examination
- flexible teaching and assessment approaches
- clear links to the Edexcel GCSE in Science.

Contents

Rationale for Entry Level Science

These qualifications are designed for Key Stage 4 students who are not yet ready to follow a Level 1 programme through either an academic or vocational pathway. There are nine topics that focus on the following important areas of the Key Stage 4 Programme of Study.

1 Classification and variation
2 Changes in humans and plants
3 Drugs and bacteria
4 The Earth, its atmosphere and chemical reactions
5 Acids and metals
6 Fuels
7 Waves and radiation
8 Earth and space
9 Electricity and energy

The topics have been chosen to ensure that students develop a grasp of some important concepts and that they are presented in a way that maximises engagement.

To ensure students have the opportunity to fulfill their potential, the topics are aligned to content in the Edexcel 2011 GCSE in Science. This ensures that students can either:

- start to gain GCSE foundation tier knowledge but then drop back to Entry level if the GCSE is too demanding

or

- complete the Entry Level qualification and then build on their knowledge by attempting to learn the GCSE foundation tier knowledge.

Alignment of the content to the Edexcel 2011 GCSE in Science also means that some resources you use to deliver the GCSE, for example practical equipment and books, can be of use when teaching at Entry level, as long as you take appropriate steps to ensure students can access any learning materials at the appropriate level.

Qualification content

National Qualifications Framework (NQF) criteria

This qualification complies with the requirements of the common criteria and Criteria for Entry Level Qualifications which are prescribed by the regulatory authorities.

Knowledge and understanding

This Edexcel Entry Level Certificate in Science requires students to demonstrate a knowledge and understanding of:

- basic scientific concepts
- scientific terms, conventions, symbols and technical vocabulary
- applications of science in everyday life.

Skills

The Edexcel Entry Level Certificate in Science requires students to apply:

- experimental skills to perform simple experiments in which they carry out fair testing, follow procedures, take basic measurements, record observations and organise and present their results
- analytical skills to interpret experimental data and draw conclusions
- communication skills to communicate observations and ideas using basic scientific and technical vocabulary
- simple mathematics to solve scientific problems.

Topic index

Topic 1: Classification and variation

Biology

In this topic, students will explore:

- the structure of a simple animal cell and a simple plant cell
- the classification of living things
- variations in humans
- inheritance of characteristics
- genetic disorders
- evolution.

Students are expected to undertake practical work and to collect data to test simple ideas. They should draw conclusions using appropriate scientific, technical and mathematical language, conventions and symbols. Students should be encouraged to use ICT, for example to write up experiments, make bar charts, calculate percentages, produce posters and reports.

Structure of a simple animal cell and a simple plant cell	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 1.1 describe plants and animals as being made up of tiny units called cells 1.2 recall that all cells: a. have an outer surface membrane and that some have a wall as well b. contain a watery liquid called cytoplasm c. contain chromosomes which are sometimes in a nucleus 1.3 recall that chromosomes contain genes 1.4 identify the nucleus in a cell 1.5 identify the chloroplast and vacuole in a plant cell.	*Use a microscope to view and draw a cell (e.g. onion cell).* *View pre-prepared slides of other cells, including some animal cells.* *Research the internet for diagrams of different cells.* *Make a simple model of a cell.* *Draw the nucleus in an outline cell.* *Draw a chloroplast and vacuole in an outline plant cell.*

Classifying living things	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 1.6 classify objects into living and non-living things 1.7 classify living things into the five kingdoms: a. *bacteria*: one celled and no nucleus b. *algae* (including plankton): one celled or many celled with nuclei c. *fungi*: many celled with cell walls and nuclei d. *plants*: many celled with cell walls, cell membranes, chlorophyll and nuclei e. *animals*: many celled with cell membranes and nuclei 1.8 recall that animals with a backbone are called vertebrates and animals without a backbone are called invertebrates 1.9 identify vertebrates and invertebrates from diagrams or photographs	*Sort or match clear diagrams of representative organisms into kingdoms.* *Collect and observe some organisms, e.g. from leaf litter hedgerow, pond, wall, lawn.* *Record observations using photographs and posters, etc.* *Research common features of each class.* *Sort or match clear diagrams of representative animals into vertebrates and invertebrates.*

Classifying living things (*continued*)	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 1.10 classify vertebrates into five classes: a. *mammals*: take in oxygen through lungs, fur, internal fertilisation, young born alive, constant (internal) body temperature b. *reptiles*: take in oxygen through lungs, dry scaly skin, internal fertilisation, young laid as eggs, variable (internal) body temperature c. *birds*: take in oxygen through lungs, feathers, internal fertilisation, young laid as eggs, constant (internal) body temperature d. *amphibians*: take in oxygen through lungs and skin, moist skin, external fertilisation, young laid as eggs, variable (internal) body temperature e. *fish*: take in oxygen through gills, scales, external fertilisation, young laid as eggs, variable (internal) body temperature	*Use a key to sort clear diagrams of representative animals into classes.*
1.11 investigate how some plants and animals have characteristics that enable them to survive in different environments, e.g. deserts, polar regions.	*Match the characteristics of (unusual) plants and animals to their environment.*

Variations in humans	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 1.12 use keys to show how species can be distinguished 1.13 construct a simple key 1.14 recall that there is variation within each species 1.15 describe variation as continuous or discontinuous 1.16 investigate variation in human characteristics to illustrate continuous and discontinuous variation.	*Sort coloured shapes into groups and construct a simple key.* *Sort wild bird seed mixture into groups and construct a simple key to identify each seed.* *There is some good material at:* *http://learn.genetics.utah.edu/content/begin/tour/index.html on heredity and characteristics and worksheets at http://teach.genetics.utah.edu/content/* *Investigate common physical characteristics in people that are continuous, e.g. circumference of wrist, hand span, height, length of foot/middle finger.* *Investigate common characteristics in people that are discontinuous, e.g. hair colour, left or right handedness, tasting, hairline shape, colour-blindness, freckles, curly hair, dimples, cleft chin, eye colour, blood type.*

Inheritance of characteristics	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to:	
1.17 recall that some characteristics can be inherited only while others can be inherited or changed by the environment	*Sort common physical and behavioural characteristics into genetic only and genetic and/or environmental.*
1.18 recall that organisms inherit characteristics from both parents through genes.	*Make a family tree of characteristics, e.g. curly hair, dimples.* *http://teach.genetics.utah.edu/content/begin/traits/handyfamilytree.pdf*

Genetic disorders	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 1.19 demonstrate an understanding that some disorders can be inherited, e.g. sickle cell disease and cystic fibrosis 1.20 discuss the issues facing a person who has a genetic disorder.	*Research the internet for information on different disorders.* *Produce a poster to show the effects of these disorders.*

Evolution	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 1.21 recall that Darwin's theory of natural selection gives rise to a change in characteristics of the population of organisms 1.22 recall that evolution is change over time.	*Research the internet for information on Darwin and his theory of evolution.* *www.bbc.co.uk/schools/gcsebitesize/science/aqa_pre_2011/evolution/evolutionrev1.shtml*

Entry Level 1	Entry Level 3
Students at this level are likely to be able to: • label the nucleus in a generalised animal cell • distinguish between plant and animal cells • use a simple branching key to sort living things into kingdoms • give examples of some characteristics of animals which live in water and on land, using drawings or images • use a simple branching key to sort vertebrates into classes • describe some differences between individuals and give one reason for these differences • identify one continuously varying trait in humans from a given list • identify one discretely varying trait in humans from a given list • identify inherited characteristics from a given list • name one disease that can be inherited • recognise appropriate scientific vocabulary.	Students at this level are likely to be able to: • label the nucleus in a cell and recognise it as containing chromosomes which control the cell • label the cell wall and chloroplasts in a generalised plant cell • use data to complete a simple branching key to sort living things into kingdoms • give examples of some characteristics of animals which live in a variety of habitats and describe how these characteristics help the animal to survive • use data to complete a simple branching key to sort vertebrates into classes • describe some differences between individuals and give the reasons for these differences • give examples of continuously varying characteristics in humans • give examples of discretely varying characteristics in humans • give examples of characteristics that are inherited and those that are changed by the environment • name at least two diseases that can be inherited and some of their related symptoms • use appropriate scientific vocabulary.

Topic 2: Changes in humans and plants

Biology

In this topic, students will explore:

- keeping body conditions constant
- hormones
- the nervous system
- changes in plant growth.

Students are expected to undertake some practical work to make observations and draw simple conclusions using appropriate scientific, technical and mathematical language, conventions and symbols. The use of ICT to present experimental work should be encouraged. Spreadsheets may be used to tabulate data and produce graphs where appropriate.

Keeping body conditions constant	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 2.1 state that it is important to keep temperature, blood sugar and water balance in the body steady	*Look at data on people's body temperature and water gains and losses, if possible during various activities (e.g. running, sleeping) over a period of time.* *Discuss temperature as a defence mechanism when ill (e.g. fever).* *Use a strip clinical thermometer to measure temperature (e.g. neck, hand, forehead).* *Measure the temperature of water in a beaker using a thermometer.*
2.2 explain the function of the skin in controlling body temperature: a. sweating can cool the body; shivering can warm it b. body hairs become erect when the body is cold to create a layer of insulating air; they lay flat when hot to allow heat to escape.	*Illustrate how sweating (water evaporation) cools the body by showing the temperature drop of a thermometer bulb wrapped in a damp cloth.*

Hormones	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 2.3 state that hormones: a. are chemical messengers b. travel around the body in the blood to a target organ c. set off an action in the target organ	
2.4 state that insulin is made in the pancreas and helps control the amount of sugar in our blood	*Test for the presence of sugar in simulated urine using Clinistix (available from pharmacists). Follow the instructions on the pack very carefully.*
2.5 state that excess sugar is stored so that the body can use it when needed	
2.6 explain that: a. some people with diabetes cannot produce enough insulin and, as a result, their blood sugar levels cannot be controlled b. some people with diabetes can inject insulin into themselves to reduce the levels of sugar in their blood c. some people with diabetes control the levels of sugar in their blood by diet and exercise d. there may be a link between obesity and one type of diabetes.	

The nervous system	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to:	
2.7 recall that messages pass from sense organs to the brain and from the brain to muscles, and that these messages are passed on by a series of nerve cells	*Carry out tasting sessions (blindfold tests) of various foods – sweet, sour, salty, bitter.*
2.8 recall that the messages are impulses that are electrical and that these cross nerve cell junctions by a chemical	*A student volunteer places one hand in ice-cold water and at the same time places one hand in warm water. They describe what they feel/sense. After two or three minutes they quickly place both hands into a bowl of cold water. The cold hand now feels hot and the warm hand feels cold.*
2.9 explain that some muscle actions take place without conscious control and that these are called reflex actions	*Investigate reflex reactions (take care!), e.g. pupil of eye in ordinary light and in shade, knee jerk.*
2.10 recall the structure of a reflex arc, including stimulus, sensory neurone, relay neurone, motor neurone and effector.	

Changes in plant growth	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 2.11 state that plant growth can be affected by light and gravity 2.12 explain that plant growth substances bring about changes in plant growth in response to light and gravity.	*Grow plants from seeds in the light and in the dark.* *Germinate broadbean seeds – put seeds at different angles, trapped by rolled wet newspaper, in jam jars and observe how the shoots and roots change direction.* *Grow cress punnets from a supermarket in normal light, light from one side (keep cress in a shoebox with a window cut in one end), and in the dark (keep cress in a shoebox with no openings).*

Entry Level 1	Entry Level 3
Students at this level are likely to be able to: • recall that sweating lowers body temperature • recall that hormones are chemical messengers • state that insulin controls the amount of sugar in the body • recall that messages to and from the brain are carried by nerve cells • state that plants grow towards light.	Students at this level are likely to be able to: • state that sweating lowers body temperature and shivering raises it • state that hormones are chemical messengers that travel around the body in the blood • state that insulin is made in the pancreas, controls blood sugar levels and cannot be produced by some people with diabetes • recall that there are two types of diabetes • recall that some muscle actions take place without conscious control • recall that plant growth can be affected by both light and gravity.

Topic 3: Drugs and bacteria

Biology

In this topic, students will explore:

- the general effects of the four major drug types on the human body
- how reaction times are affected by drugs
- the implications of drug misuse
- the spread of infectious diseases by pathogens
- measures to reduce the spread of infectious diseases
- use of antibiotics to control infection.

Students are expected to undertake some practical work to make observations and draw simple conclusions using appropriate scientific, technical and mathematical language, conventions and symbols. The use of ICT to present experimental work should be encouraged. Spreadsheets may be used to tabulate data, produce graphs where appropriate, produce reports, surveys etc. Information can be obtained from websites.

The general effects of the four major drug types on the human body	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 3.1 describe the general effects of: a. painkillers that block nerve impulses, including morphine b. hallucinogens that distort sense perception, including LSD c. stimulants that increase the speed of reactions, including caffeine d. depressants that slow down the activity of the brain, including alcohol 3.2 recall some chemicals in cigarette smoke and their effects, including: a. nicotine which is addictive b. tar which can cause cancer c. carbon monoxide gas which reduces the amount of oxygen in the blood 3.3 recall some harmful effects of alcohol consumption: a. in the short term – blurred vision, lowering of inhibitions, slower reactions b. in the long term – liver cirrhosis, brain damage 3.4 describe some positive and negative effects that medical drugs can have on an individual's health.	*Match drug types to their effects.* *This website has a lot of up-to-date information: www.talktofrank.com/* *Sort common drugs into their types by using their effects.* *Produce a poster warning people of some of the consequences of drinking alcohol/smoking tobacco/taking (named) drugs.* *Tutor demonstration to show the tar and acidic gases produced by burning a cigarette.*

How reaction times are affected by drugs	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 3.5 investigate reaction times 3.6 recall that alcohol slows down reaction times and caffeine speeds up reaction times.	*Measure reaction times using either an online timer or the ruler drop method.* *Suitable websites, in no particular order, include:* *http://getyourwebsitehere.com/jswb/rttest01.html* *www.humanbenchmark.com/tests/reactiontime/* *www.topendsports.com/testing/reactiontest.htm* *www.bbc.co.uk/science/humanbody/sleep/sheep/reaction_version5.swf*

The implications of drug misuse	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to:	
3.7 recall some of the social issues of drinking alcohol, taking drugs and smoking	*Discuss social pressures and the effects of the use of excess alcohol and drugs.*
3.8 discuss data showing the relationship between smoking and negative health effects	*Gather information to complete a worksheet showing effects of drug use (medicinal) and abuse.*
3.9 discuss some of the ways people try to give up smoking.	*Collect leaflets and other information on ways of helping a person to give up smoking.* *Useful websites include:* www.quit.org.uk *and* www.talktofrank.com/

The spread of infectious diseases by pathogens	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 3.10 recall that pathogens (microbes) cause infectious disease 3.11 describe how pathogens are transmitted (spread) and typical infections: a. in water by bacteria, e.g. cholera/typhoid b. by food by bacteria, e.g. salmonella c. airborne (such as sneezing), e.g. influenza virus d. by contact, e.g. athlete's foot fungus e. by body fluids, e.g. HIV f. by animals, e.g. housefly can carry dysentery; mosquito can transmit malaria.	*Explain that bacteria, viruses and fungi are responsible for many infectious illnesses.* *Match an illness to its cause, e.g. diarrhoea can be caused by dirty water.* *Produce a report on the problems of poor sanitation.* *This website has material on drugs and pathogens: www.abpischools.org.uk/page/index.cfm*

Measures to reduce the spread of infectious diseases	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 3.12 recall how the human body defends itself from pathogens, through: a. physical barriers – skin, mucus b. chemical defence – hydrochloric acid in the stomach, lysozymes in tears 3.13 describe simple measures (including antiseptics) that can be used to prevent the spread of infection.	*Produce a poster to show how the spread of infectious diseases can be prevented.*

Use of antibiotics to control infection	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to:	
3.14 recall that antibiotics can be used to control infection, including: a. antibacterials to treat bacterial infections b. antifungals to treat fungal infections	*Select the most appropriate treatment for a bacterial or fungal infection from a given list.*
3.15 investigate the effects of antiseptics or antibiotics on microbial cultures.	*Investigate the effect of antibiotics on a microbial culture either as a class experiment or as a simulation.* *Culture details can be found at:* *www.biotopics.co.uk/edexcel/pracw.html* *Simulations can be found at:* *www.abpischools.org.uk/page/modules/infectiousdiseases_medicines/medicines2.cfm?coSiteNavigation_allTopic=1* *Focus investigations at:* www.focuseducational.com/product/science-investigations-2/41

Entry Level 1	Entry Level 3
Students at this level are likely to be able to: • recognise that non-medical drugs are often harmful • list several drugs (both medical and recreational) • state one chemical in tobacco and how it affects the human body • state one harmful effect of alcohol • describe a benefit of a common medical drug, e.g. aspirin, cough mixture • measure the reaction time of an individual using a simple method or computer simulation • use given data to identify the effect of alcohol on reaction times • identify a simple pattern from a graph, e.g. how the number of cigarettes smoked by an individual relates to an increased risk of the individual dying from lung cancer • state that infectious illness are caused by microbes • describe some of the methods by which pathogens spread • describe a simple method used to limit the spread of pathogens/control infection • identify a simple pattern from a graph, e.g. how the concentration of an antibiotic affects microbial cultures.	Students at this level are likely to be able to: • describe the effects of specific drugs • classify drugs into different types • describe the effect of tar and nicotine on the lungs • describe the short- and long-term effects of alcohol • describe some benefits and side effects of common medical drugs • measure the reaction time of an individual using a simple method or computer simulation a number of times, and record measurements in a suitable chart so that graphs or averages can be produced • find out the effect of alcohol on reaction times by selecting information from more than one source provided for them • identify a simple pattern from a graph and suggest reasons for the pattern, e.g. how the number of cigarettes an individual smokes relates to an increased risk of the individual dying from lung cancer and give reasons for trends shown • give examples of infectious diseases caused by bacteria, viruses and fungi and their method of spread • explain methods used to limit the spread of pathogens/control infection • identify a simple pattern from a graph and suggest reasons for the pattern, e.g. how the concentration of an antibiotic affects microbial cultures.

Topic 4: The Earth, its atmosphere and chemical reactions

Chemistry

In this topic, students will explore:

- the atmosphere – how it has changed over time
- igneous, sedimentary and metamorphic rocks
- atoms and chemical reactions.

Students are expected to undertake practical work to achieve many of the outcomes for this topic. They should make observations and draw conclusions using appropriate scientific, technical and mathematical language, conventions and symbols. The use of ICT to present experimental work should be encouraged.

The atmosphere — how it has changed over time	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to:	
4.1 recall that the gases produced by volcanic activity formed the Earth's early atmosphere	*Thoughtshower gases that are in the air and discuss which gases came from volcanoes.* *Produce a poster of volcanoes and the gases they produce.*
4.2 recall that the early atmosphere contained: a. little or no oxygen b. a large amount of carbon dioxide c. water vapour and small amounts of other gases	*Use different methods of presenting data to show the percentage composition of the Earth's earliest atmosphere, e.g. pie chart, bar chart, leaving space to add the current composition later.*
4.3 recall the current composition of the Earth's atmosphere.	*Investigate the proportion of oxygen in the atmosphere, either by tutor demonstration using hot copper and the syringe experiment to measure the percentage of oxygen in the air or as a class practical www.rsc.org/learn-chemistry/content/filerepository/CMP/00/000/523/cce-69.pdf.* *Add data to show the current composition of the atmosphere on previous bar/pie chart.*
4.4 describe how to test for oxygen	
4.5 describe how condensation of water vapour from the early atmosphere formed oceans	*Compare data on bar/pie charts for the Earth's early and current atmospheres and identify differences.*

The atmosphere — how it has changed over time (*continued*)	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 4.6 recall that the amount of carbon dioxide in the atmosphere has reduced since the Earth's earliest atmospheres 4.7 explain that photosynthesis by plants increased the amount of oxygen in the atmosphere since the Earth's earliest atmospheres 4.8 explain that photosynthesis by plants decreased the amount of carbon dioxide in the atmosphere since the Earth's earliest atmospheres	*Discuss how the change in percentage of gases has happened, e.g. photosynthesis, condensation of water vapour.* *Produce a poster of the current composition of the Earth's atmosphere, use string or art straws to link the gases on this poster to the same gas on the earliest atmosphere poster, e.g. carbon dioxide. Make labels to hang on the strings stating the process (photosynthesis) that has changed the percentage of gas and how it has changed (decreased).*

The atmosphere	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 4.9 explain that small changes in the atmosphere are constantly occurring through: a. volcanic activity b. human activity, including the burning of fossil fuels, farming and deforestation.	*Thoughtshower anything that students can think of that gives off or takes in gases, refer back to photosynthesis and refer to deforestation. Refer back to volcanoes producing the first gases and ask if this is still happening.* *Demonstrate a lit candle under an inverted jar. Discuss why the candle goes out.* *Discuss which gases are used up and which are produced as the candle is burning. Relate the candle to other fuels such as petrol, diesel, etc.* *Produce a poster showing gases used up and gases produced when a candle/other fuel is burning.*

Igneous, sedimentary and metamorphic rocks	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 4.10 describe that igneous rocks, such as granite, are: a. formed by the solidification of magma or lava b. made of crystals whose size depends on the rate of cooling 4.11 describe how sedimentary rocks are formed by the compaction of layers of sediment over a very long time period 4.12 explain that sedimentary rocks: a. may contain fossils b. are susceptible to erosion 4.13 describe chalk and limestone as examples of sedimentary rocks 4.14 describe the formation of metamorphic rocks by the action of heat and/or pressure, including the formation of marble from chalk or limestone 4.15 describe marble as an example of a metamorphic rock 4.16 recall that limestone, chalk and marble are forms of calcium carbonate	*Practical – to model the formation of crystals in igneous rock. Cool the liquids at different rates by placing them on cool and warm microscope slides. The crystals are observed, whilst forming, using a light microscope.* *www.practicalphysics.org/go/Experiment_153.html* *Make a model of a sedimentary rock with different-coloured layers of sand/rocks.* *See experiment G, on www.knockan-crag.co.uk/downloads/Sedimentary%20rock%20demos%20-%20teachers%20notes.pdf* *Carry out experiments on different rock types to show different forms of erosion.* *www.knockan-crag.co.uk/downloads/Sedimentary%20rock%20demos %20-%20teachers%20notes.pdf* *Set up a circus of rock types (sedimentary, metamorphic, igneous).* *Supply students with hand lenses. Students observe key properties (density, hardness etc) and appearance for different rock types and then look for trends in properties for different rock types.*

Igneous, sedimentary and metamorphic rocks (*continued*)	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 4.17 describe some uses of limestone 4.18 discuss the advantages and disadvantages of quarrying limestone 4.19 describe the thermal decomposition of calcium carbonate 4.20 describe the effect of water on calcium oxide 4.21 describe how calcium hydroxide dissolves in water to form a solution, known as limewater 4.22 describe how limewater is used to test for carbon dioxide.	*Class discussion: debate the advantages and disadvantages of quarrying limestone, to include ideas on social, environmental and financial impacts. Students could present the advantages and disadvantages of each and vote on the outcome. (This is an opportunity for students to produce posters, use the internet for research, use oral communication skills and teamwork to gather their evidence and arguments.)* *Carry out the practical at:* *www.practicalchemistry.org/experiments/thermal-decomposition-of-calcium-carbonate,282,EX.html*

Atoms and chemical reactions	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 4.23 explain that an element consists of very small particles called atoms	*Use models to rearrange atoms in simple reactions.*
4.24 explain that during chemical reactions, atoms are neither created nor destroyed	
4.25 explain that during chemical reactions, atoms are rearranged to make new products (compounds) with different properties from the reactants, e.g. when iron and sulfur react to form iron sulfide	*Use: appearance; a magnet; whether products and reactants float or sink in water; dilute acid to investigate the properties of iron and sulfur; a mixture of iron and sulfur; or iron oxide to show that the products of the reaction have different properties to the reactants.*
4.26 recall that the total mass before and after a reaction in a sealed container is unchanged.	*Demonstrate the reaction between lead nitrate and potassium iodide solutions on a balance. Discuss that the precipitate is a new product and that the starting reactants had the same mass as this product.* *Demonstrate (or students could carry out) the reaction between calcium carbonate and hydrochloric acid, using a balloon over the mouth of a test tube to collect the carbon dioxide produced. The reaction between magnesium and hydrochloric acid could also be investigated, collecting the hydrogen produced and lighting with a splint, to further reinforce the point that products have different properties to reactants.*

Entry Level 1	Entry Level 3
Students at this level are likely to be able to: • recall some of the main gases that made up the Earth's earliest atmosphere and make up the atmosphere of the Earth today • give one example of a process or action which would result in a change in the composition of the Earth's atmosphere today, e.g. driving a car • identify different types of rock using an identification chart • name some rocks • describe advantages and disadvantages of quarrying limestone, communicating their ideas in a simple way • describe atoms and reactions in a simple way, e.g. using drawings • recall that limestone breaks down when heated to produce new substances and that these new substances can be reacted further.	Students at this level are likely to be able to: • describe the gases in the Earth's earliest atmosphere and the atmosphere today and use scientific terms to explain how the percentage of the gases has changed • describe different processes which change the percentages of gases in the atmosphere using scientific terms, e.g. photosynthesis, deforestation • describe the properties of different rocks and identify rocks as igneous, sedimentary or metamorphic without the need for an identification chart • name at least one rock that belongs to each rock type • describe advantages and disadvantages of quarrying limestone, communicating ideas in simple sentences • describe atoms using simple sentences • describe reactions using simple sentences and word equations • describe the products formed during the thermal decomposition of calcium carbonate and recall the products of the further reaction of these products.

Topic 5: Acids and metals

Chemistry

In this topic, students will explore:

- some properties of metals and non-metals
- metals in the Earth
- neutralisation reactions
- how to test for some gases.

Students are expected to undertake practical work to achieve many of the outcomes for this topic. They should make observations and draw conclusions using appropriate scientific, technical and mathematical language, conventions and symbols. Students should be encouraged to use ICT to present experimental work.

Some properties of metals and non-metals	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 5.1 group elements as metals or non-metals 5.2 locate blocks of metals and non-metals on an outline of the Periodic Table 5.3 describe properties exhibited by most metals (solid, shiny, hard, conduct heat and electricity) 5.4 describe some varied properties of non-metals, e.g. most do not conduct heat or electricity; many are gases	*Use the internet to research some uses of common metals and non-metals.* *Look at a pictorial Periodic Table. Look at actual elements themselves that are safe.* *Assemble a simple jigsaw of the two 'blocks' into an outline Periodic Table.* *A useful resource is:* *CD ROM Multimedia Science School – The Periodic Table (New Media).* *Acting as a metal or non-metal, write a letter to a prospective employer asking for a job, e.g. copper wanting to be part of an electrical circuit. Explain what properties you have that would make you a suitable metal or non-metal for the job.* *Produce a poster or leaflet to display some uses of these common properties.*
5.5 describe the uses of metals in relation to their properties, including: a. aluminium b. copper c. gold d. steel	*Use the internet to research the properties and uses of metals including aluminium, copper, gold and steel. Students could produce a poster to show their research.*
5.6 investigate how metals and non-metals conduct heat at different rates.	*Carry out an experiment heating metal and non-metal rods, with pins stuck on with wax, to show how some materials conduct heat better than others.* *Discuss how conductivity is applied at home, e.g. using a wooden spoon to stir your baked beans rather than a metal one.*

Metals in the Earth	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to:	
5.7 recall that some metals are found as elements (e.g. gold) and some are found in compounds (ores) (e.g. iron oxide)	*Look at samples (or pictures) of pure metals and ores to see the difference between them. Match the ores to the metal that can be extracted from it.*
5.8 investigate where metals are found (in the UK/world)	*Students could colour in a map to show where different metals are found.*
5.9 explain why gold/silver/platinum are more expensive (they are rarer) than other metals	
5.10 describe the reaction between metals and acids and explain how this provides evidence for the different reactivities of metals	*Investigate the reaction between metals (not above magnesium in the reactivity series) and acids (not dilute nitric acid).*
5.11 explain that metals found as compounds (ores) are harder to extract than to recycle, e.g. aluminium.	

Neutralisation reactions	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to:	
5.12 investigate the production of metal salts from the neutralisation of acids by insoluble metal oxides and carbonates	*Make some use of scientific terms (e.g. neutralisation reaction) in discussions and written work.*
5.13 recall that: a. hydrochloric acid produces chloride salts b. nitric acid produces nitrate salts c. sulfuric acid produces sulfate salts	
5.14 state the different coloured flames obtained when specified metals are placed in a Bunsen burner flame	*Identify metals using a simple flame test.*
5.15 explore some useful products that are derived from neutralisation reactions, e.g. fireworks and fertilisers	
5.16 describe how to test pH using indicator paper and universal indicator	
5.17 recall that hydrochloric acid is produced in the stomach to help digestion and kill bacteria	*Produce a poster on useful products derived from neutralisation reactions.*
5.18 investigate how indigestion remedies neutralise stomach acid.	*Collect indigestion tablet packets and compare ingredients.* *Reaction of indigestion tablets with dilute acid to produce gas bubbles, showing that a gas is produced. Test pH of solutions before and after experiment.*

How to test for some gases	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 5.19 recall that hydrochloric acid can be broken down using electricity to produce hydrogen and chlorine 5.20 describe how to test for hydrogen, chlorine and carbon dioxide gases 5.21 describe chlorine as a toxic gas 5.22 describe the use of chlorine to manufacture bleach.	*Tutor demonstrates electrolysis of hydrochloric acid and tests each gas produced.* *Identify hydrogen, chlorine and carbon dioxide gases using appropriate tests.*

Entry Level 1	Entry Level 3
Students at this level are likely to be able to: • make limited use of scientific terms (e.g. reaction) in discussions • describe properties of groups of materials, e.g. metals and non-metals • describe how to test for hydrogen and carbon dioxide gases • state the different-coloured flames obtained when specified metals are placed in a Bunsen burner flame • use simple texts, with help, to obtain information, e.g. about recycling materials • describe reactions between acids and metals and metal compounds • give uses for metal salts • know that chlorine gas can be made from hydrochloric acid and can be used in making bleach.	Students at this level are likely to be able to: • make some use of scientific terms (e.g. neutralisation, reaction) in discussions and written work • use the properties of materials to sort them into groups, e.g. metals and non-metals • identify hydrogen and carbon dioxide gases using appropriate tests • identify metals using a simple flame test • describe reactions between acids and metals and metal compounds, and know what type of salt is formed • describe uses of metal salts • know that electricity is used to break down hydrochloric acid to form hydrogen and chlorine.

Topic 6: Fuels

Chemistry

In this topic, students will explore:

- fuels
- useful substances produced from crude oil
- pollution and the environment, including the greenhouse effect
- sustainability.

Students are expected to undertake practical work to achieve many of the outcomes for this topic. They should make observations and draw conclusions using appropriate scientific, technical and mathematical language, conventions and symbols. The use of ICT to present experimental work should be encouraged.

Fuels	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to:	
6.1 investigate the use of fossil fuels (coal, crude oil and natural gas) and some other common fuels (e.g. wood, petrol, charcoal)	*Collect information on various fuels (e.g. for a poster display).* *Discuss the best type of fuel for different situations, considering cost, storage, transport, etc.*
6.2 recall that in order to burn, a fuel needs heat energy and oxygen	*Build a 'fire-triangle'.*
6.3 explain that fire fighting involves removing one or more of fuel, heat energy or oxygen	*Visit the local fire station.*
6.4 discuss some methods of putting out fires (e.g. different types of fire extinguisher, fire blankets, sand) and which of the following they remove: fuel, heat energy or oxygen	*Use pictures of various types of fire and link to the methods of putting them out.* *Carry out a survey of fire extinguishers and fire blankets in the centre.*
6.5 describe what happens when a fuel burns, i.e. it reacts with oxygen in the air and gives out heat and light energy; this reaction is called combustion	
6.6 describe how carbon and carbon monoxide will form if there is not enough oxygen for complete combustion	*Watch relevant videos on carbon monoxide poisoning, e.g. www.hse.gov.uk/gas/domestic/videos.htm*
6.7 recall that carbon monoxide is a toxic gas	
6.8 describe the problems caused by incomplete combustion in appliances that use carbon compounds as fuels (i.e. the production of carbon monoxide and soot)	*Tutor uses a yellow flame of a Bunsen burner to show soot formation.*
6.9 describe the test for carbon dioxide and water	*Tutor demonstration of burning a fuel to produce products which:* *a. turn limewater 'milky' (carbon dioxide)* *b. turn dry white copper sulfate blue (water).*

Fuels (*continued*)	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 6.10 investigate the products produced when a fuel burns by testing for carbon dioxide gas and water using limewater and anhydrous copper sulfate 6.11 explain how this test shows that fuels contain carbon and hydrogen 6.12 investigate the factors that make a good fuel, including how easily it burns, the amount of ash or smoke it produces, the amount of heat it produces, ease of transport and storage 6.13 recall the equation: fuel + oxygen → carbon dioxide + water	*Compare various fuels (e.g. paper, wood, fire-lighter, cream cracker and powdered coal).*

Useful substances produced from crude oil	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to:	
6.14 identify locations where oil is found (under land and sea)	*Watch relevant videos (e.g. Oil and Gas Formation from BP Amoco) or use wall charts or CD ROM resources.*
6.15 recall that crude oil is formed over millions of years and explain why it is not a renewable resource.	*Complete a cut and paste picture puzzle on the stages of the formation and production of oil.* *Useful websites: www.shell.co.uk; www.esso.co.uk; www.bpes.com*

Useful substances produced from crude oil (*continued*)	
Knowledge, understanding and process skills	**Suggested activities**
6.16 investigate how crude oil can be separated by distillation (a process called refining) into many useful substances: a. fuels (gas, petrol, diesel fuel) b. substances which can be used to produce plastics, paints, drugs and dyes c. building materials (e.g. bitumen for roads).	*Basic demonstration of the distillation of two liquids.* *Make a model fractionating tower from a large plastic drinks bottle. Put on sticky labels to show the various temperatures and products at each level.* *Use the internet to collect information on the materials that can be made from crude oil. Produce a leaflet on these materials using a word processing and graphics package.* *Demonstrate distillation of substitute 'crude oil'; use 'made-up' crude oil, in a fume cupboard, using a recipe from CLEAPSS Hazcards or from Teaching Secondary Chemistry, John Murray Publications (ISBN 0719576385). Do not use crude oil, which is carcinogenic.* *Class discussion.* *Debate the use of fossil fuels and nuclear fuels. Students should present the advantages and disadvantages of each and vote on the outcome.* *(This is an opportunity to produce posters, use the internet for research, use oral communication skills and teamwork to gather evidence and arguments.)*

Pollution and the environment	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to:	
6.17 explain that pollutants are substances or forms of energy (heat, noise, radiation) that may harm living things and the environment	*Design a board game on energy or pollution.*
6.18 investigate the damaging effects that harmful waste products (e.g. carbon dioxide, acidic gases and smoke) have on the environment when fossil fuels are burned	
6.19 explain that too much carbon dioxide in the Earth's atmosphere can cause global warming	
6.20 explore how global warming can damage the Earth (e.g. the melting of polar ice caps causes sea levels to rise, droughts).	*Investigate the possible effects of global warming. Use the internet for research and films (e.g.* The Day After Tomorrow*) for public ideas about global warming.*

Sustainability	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 6.21 explain why biofuels (e.g. ethanol) are sometimes used as alternatives to fossil fuels	*Investigate the uses of biofuels using the internet (e.g. in Brazil the use of alcohol in cars rather than petrol).*
6.22 investigate how recycling certain materials (glass, metal and paper) uses less energy and produces less pollution than making more of these materials.	*Investigate what substances are recycled by your local council and your centre (use internet sites for local councils). Possibly visit a local land disposal site/recycling plant.* *Design a poster to encourage people to recycle more glass, metal and paper.*

Entry Level 1	Entry Level 3
Students at this level are likely to be able to: • describe global warming in a simple way, e.g. using drawings or a poster • make limited use of simple scientific terms (e.g. fuel) in discussions • know how fuels burn and how fires are extinguished • describe how to test for water and carbon dioxide gas • know the uses of products made from crude oil • use simple texts, with help, to obtain information, e.g. about recycling materials • discuss the pollution produced by burning fossil fuels and the harm caused to the environment, in a general context.	Students at this level are likely to be able to: • describe global warming using simple sentences (perhaps within a leaflet) and outline its impact on the environment • make some use of scientific terms (e.g. fossil fuels, biofuels) in discussions and written work • use a simple word equation for burning and understand the hazards of incomplete combustion • identify the products formed when a fuel is burned, using appropriate tests • describe useful products derived from crude oil • select information from given sources that are provided to obtain information, e.g. recycling materials • discuss the impact on the environment of the different pollutants produced by burning fossil fuels.

Topic 7: Waves and radiation

Physics

In this topic, students will explore:

- uses of converging lenses
- how to describe waves
- the visible spectrum
- the electromagnetic spectrum
- ionising and other radiation.

It is expected that most of the outcomes for this topic will be achieved via practical work. Students should be encouraged to draw conclusions from their data and use appropriate scientific, technical and mathematical language, conventions and symbols. As ICT contributes to how science works, students should be encouraged to use ICT facilities. For example, they can use a word-processing package to write up experiments and produce booklets. Spreadsheets may be used to tabulate data and produce graphs where appropriate.

Uses of converging lenses	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to:	
7.1 discuss the benefits of using an instrument (camera or telescope) to help our sight	*Match benefits to the instrument.*
7.2 recall that a camera has one convex lens and that a telescope has two lenses or mirrors	*Research different cameras and telescopes.*
7.3 describe how to measure the focal length of a converging lens using a distant object	*Measure the focal length of different shapes of convex lenses as a class practical or by using a simulation.*
7.4 investigate the relationship between the shape of a convex lens and its focal length	*This website has a suitable simulation:* *http://phet.colorado.edu/en/simulation/geometric-optics*
7.5 recall that in a simple telescope, the objective lens forms an image that the eyepiece magnifies.	*Make a simple telescope with two lenses and a ruler. Caution: do not look at bright lights (e.g. the Sun) using a telescope.* *This website shows the method clearly: www.youtube.com/watch?v=0eZ2o4WNtJU&list=UUEE5jdhxraA_bliIGs1ymIw&index=24&feature=plcp*

Describing waves	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to:	
7.6 recall that waves transfer energy and information from one place to another	*Demonstrate with a Mexican wave.*
7.7 investigate what happens to a floating object when a wave passes	*Class demonstrations with slinky/ripple tank or use a suitable simulation.*
7.8 describe how particles move in water waves and sound waves	*www.youtube.com/watch?v=Kbd8QUkRbjw&feature=related*
7.9 recall that waves do not transfer particles from place to place	*http://phet.colorado.edu/en/simulation/wave-on-a-string*
7.10 use the terms crest, trough, frequency, wavelength, amplitude and speed to describe waves.	*Label a (sine) wave, identify largest frequency, wavelength and amplitude on wave diagrams.* *Use an oscilloscope and sound generator to observe the relationships between:* *a. amplitude and loudness* *b. pitch and frequency* *c. wavelength and pitch/frequency.*

The visible spectrum	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to:	
7.11 investigate how to produce a visible spectrum using a prism or CD spectrometer	*Class experiment with a prism and light source or CD spectrometer.* *For example:* *a.* www.youtube.com/watch?v=iOR9ZMMCNNs *b.* www.cs.cmu.edu/~zhuxj/astro/html/spectrometer.html *Describe which colour is affected most, e.g. 'Blue Bends Best'*
7.12 recall the colours of the visible spectrum	*Make a mnemonic for the colours, e.g. '**R**ichard **o**f **Y**ork **G**oes **B**attling **i**n **V**ain'.*
7.13 investigate UV beads	*Class practical with UV beads indoors and outside/under UV lamp.*
7.14 recall that there are other radiations or waves like light that are invisible but that we can detect.	

The electromagnetic spectrum	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to:	
7.15 discuss that these waves are a 'family' because they can travel through space (a vacuum) and have the same speed	
7.16 list the electromagnetic spectrum in order: a. radio waves b. microwaves c. infrared d. visible light e. ultraviolet f. X-rays g. gamma rays	*Use a mnemonic to remember the order* ***G**randma **X**'s **U**mbrella **V**anishes **I**n **M**ild **R**ain* *or make up own mnemonic or rap like these* *www.youtube.com/watch?NR=1&feature=endscreen&v=Ay2VFGDsxac* *www.youtube.com/watch?v=A0un-_jBPPU&feature=related* *Use the internet to research the speed of each wave.*
7.17 recall that radio waves have a long wavelength, low frequency and carry little energy	*Produce a poster to show where the high energy etc is in the electromagnetic spectrum.*
7.18 recall that gamma rays have a very small wavelength, high frequency and carry high energy	
7.19 list one harmful effect of: a. microwaves b. infrared c. ultraviolet d. X-rays and gamma rays	*Match the harmful effect to the region.* *UV sources are available from:* *www.epa.gov/sunwise/educator_resources.html* *Other content is available at:* *www.hpa.org.uk/Topics/Radiation/UnderstandingRadiation/UnderstandingRadiationTopics/*
7.20 discuss that the potential danger of an electromagnetic wave increases with frequency	

The electromagnetic spectrum (*continued*)	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 7.21 list uses of: a. radio waves b. microwaves c. infrared d. visible light e. ultraviolet f. X-rays g. gamma rays.	*Match the use to the region.* *Discuss the benefits and disadvantages of using the high energy end of the spectrum.*

Ionising and other radiation	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 7.22 recall that another 'family' of (invisible) radiation carries harmful energy that can damage cells 7.23 recall that this 'family' includes alpha, beta and gamma radiations 7.24 recall that they are called ionising radiations 7.25 state that these radiations are produced by radioactive sources.	*Demonstrate that this 'family' of radiation exists or use a simulation, e.g. http://visualsimulations.co.uk/* *Discuss safety for this demonstration.* *Discuss where the names 'alpha, beta, gamma' come from.*

Entry Level 1	Entry Level 3
Students at this level are likely to be able to: • identify the lens in a diagram of a camera • measure the focal length of a convex lens • complete a diagram to show how light from a distant source is bent inwards by a lens • identify that a fat lens is stronger than a thin lens • recall that there are two lenses in a simple telescope • match particle movement to the type of wave (limited to sound and water waves) • label a diagram of a wave with crest and trough • identify the largest amplitude/wavelength on a diagram of different waves • recall that you can use a prism to split up light • state some of the colours in the visible spectrum (not necessarily in order) • recall that we can detect invisible radiation in sunlight with special beads • complete a chart of the electromagnetic spectrum from a given word box • recall that electromagnetic waves carry energy • state one harmful effect of an electromagnetic wave • state some uses of electromagnetic waves • recall that radioactive sources emit radiation which cannot be seen.	Students at this level are likely to be able to: • explain the benefits of using a telescope • describe how to find the focal length of a convex lens • measure the focal length of several lenses to find a pattern between the thickness and focal length • label the focal point/length on a completed diagram to show how light from a distant source is bent inwards by a lens • label the eyepiece and objective lens in a diagram of a simple telescope • state that the eyepiece is a stronger lens than the objective lens • describe the movement of particles for a sound or water wave • draw and label a wave with wavelength and amplitude • identify the largest frequency on a diagram of different waves • describe amplitude as 'loudness' and frequency as 'pitch' • describe how to find the colours of the visible spectrum using a prism • list the colours in the visible spectrum in order • describe how to use UV beads • complete a chart of the electromagnetic spectrum without a word box • recall that the gamma/high frequency end of the electromagnetic spectrum carries more energy than radio waves • relate the harmful effects of electromagnetic radiation to the energy carried • state a use for each region of the electromagnetic spectrum • list the names of the radiation emitted by radioactive sources.

Topic 8: Earth and space

Physics

In this topic, students will explore:

- the structure of the Earth
- the nature, location and harmful effects of earthquakes
- different ways of finding out information about our Universe, including the use of optical telescopes and their limitations
- the use of secondary data on the Solar System and earthquakes.

As ICT contributes to how science works, students should be encouraged to use word processing software and internet searches to produce booklets/information leaflets on earthquakes and their effects, and also on how and why we explore Space. This topic also provides opportunities to look at how ideas on the Solar System, and our understanding of it, have changed with time. Students should use scientific, technical and mathematical language, conventions and symbols where appropriate.

The Earth	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to:	
8.1 recall that the Earth is composed of a crust, a mantle and a liquid core	*Investigate the thicknesses and textures of the layers in a soft- and a hard-boiled egg.*
8.2 compare the relative thicknesses of crust, mantle and core to the layers in an egg or an apple	
8.3 recall that the Earth's outermost layer is composed of tectonic plates which are in relative motion	
8.4 compare the plates to the movement of polystyrene lumps on the surface of a tray of unevenly heated water/syrup	*Observe the movement of polystyrene lumps on the surface of a tray of unevenly heated water/syrup and compare with water heated in a beaker.*
8.5 explain that the plates move due to convection currents in the mantle	
8.6 demonstrate an understanding of how, at plate boundaries, plates may slide past each other, sometimes causing earthquakes and tsunamis	*Investigate how earthquakes occur through the use of sliding blocks and weights.*
8.7 demonstrate an understanding of why it is difficult to predict earthquakes	*Use given distances to pinpoint the position of an earthquake (possibly on a map).*
8.8 explain how distances measured by seismometers at different stations can be used to identify the location of an earthquake	
8.9 discuss why it is important to be able to locate where an earthquake happens.	*Use secondary data to compile a fact sheet comparing the effects of two recent earthquakes.*

Space	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 8.10 recall that the Solar System comprises the Sun, planets, moons, comets and asteroids 8.11 recall that a galaxy is a collection of stars and that the Solar System is part of the Milky Way galaxy and that the Universe includes all of the galaxies 8.12 compare the relative sizes of and distances between the Earth, the Moon, the planets, the Sun, galaxies and the Universe	*Write their own address up to the Solar System and then address an envelope to send a letter to someone on a planet in a different galaxy.* *Use secondary data to produce a mobile of the Solar System.*

Space (*continued*)	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to:	
8.13 use secondary data to compare conditions in Space between and on different planets and the equipment/resources needed to survive. Conditions include: a. lack of atmosphere b. temperature c. weightlessness	*Use the website http://spaceflight.nasa.gov/living/index.html, or similar, to draw up a list of equipment etc. that astronauts would need to take with them to travel and live on another planet.*
8.14 describe the methods used to gather evidence for life beyond Earth, including telescopes, space probes and soil experiments by landers, e.g. Curiosity lander on Mars	*Use word-processing software and the internet to produce a leaflet illustrating the different methods used to explore the Universe, including their advantages and disadvantages.*
8.15 discuss some of the benefits of Space exploration	
8.16 describe the evolution of stars like our Sun through the following stages: a. nebula b. star (main sequence) c. red giant d. white dwarf	*Use secondary data to draw a timeline for the formation of a white dwarf from a nebula, in the form of an annotated diagram.*
8.17 describe the role of gravity in the formation of stars from a nebula.	

Entry Level 1	Entry Level 3
Students at this level are likely to be able to: • use simple texts and the internet, with help, to obtain information about, e.g., the effects of earthquakes • use secondary data sources, with help, to produce a fact sheet on the Solar System • show a basic understanding of how earthquakes occur, communicating their ideas in a simple way, e.g. using drawings • describe how our understanding of the Solar System has changed over time • discuss the social and economic benefits of locating earthquakes, in a general context • make limited use of scientific terms (e.g. core, planet, moon) in discussions.	Students at this level are likely to be able to: • select, with little, if any, help, information from given sources about, e.g., the cause and effect of earthquakes • use secondary data sources with little or no help to produce a fact sheet, e.g. on the Solar System • show an understanding of the causes of earthquakes, communicating their ideas using simple sentences • describe how our understanding of the Solar System and the Universe has developed over time, outlining scientific evidence for developments in our understanding • discuss the social and economic benefits of locating earthquakes, in a specific context • make some use of scientific terms (e.g. mantle, tsunami, Solar System) in discussions and written work.

Topic 9: Electricity and energy

Physics

In this topic, students will explore:

- the generation of electricity using a variety of energy sources
- avoiding wastage and the efficient and safe use of electricity.

As ICT contributes to how science works, students should be encouraged to use word-processing software and internet searches to produce booklets/information leaflets on renewable and non-renewable energy sources. They should use scientific, technical and mathematical language, conventions and symbols where appropriate.

Electricity	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to:	
9.1 use the following terms and units: a. voltage – volts b. current – amps c. power – watts d. energy – joules and kilowatt-hours	
9.2 recall the factors that affect the size of an induced current	*Investigate factors affecting the generation of electric current by induction, using magnets and coils.*
9.3 recall the factors that affect the direction of an induced current	
9.4 explain how to produce an electric current by the relative movement of a magnet and a coil of wire on a small scale, as in a dynamo	*Investigate how the speed of rotation affects the induced, alternating current.*
9.5 explain the difference between direct and alternating current	
9.6 recall that a transformer can change the size of an alternating voltage	*Investigate which everyday devices use (external) transformers.*
9.7 recall where step-up and step-down transformers are used	
9.8 describe the hazards associated with electricity transmission	*Research the safety precautions to be taken when using electricity.*
9.9 explain that the amount of electricity used by an electrical appliance in a given time depends on its power rating (in watts)	*Investigate the power consumption of electrical items, including those using a low voltage.*
9.10 recognise some energy-saving devices	
9.11 discuss the economic and environmental advantages of using energy-saving devices	

Electricity (*continued*)	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to: 9.12 use data to compare and contrast the advantages and disadvantages of different energy-saving devices 9.13 recall that energy from the mains supply is measured in units called kilowatt-hours 9.14 calculate the cost of using different electrical appliances in the home from given formula and data.	*Investigate the cost of using different electrical appliances in the home from given formula and data.*

Energy	
Knowledge, understanding and process skills	**Suggested activities**
Students should be able to:	
9.15 recall different forms of energy in the home or in everyday life	
9.16 describe energy transfers which occur in everyday life	*Investigate places where energy is transferred, in everyday life.*
9.17 demonstrate an understanding of situations where energy is needed to make something happen	
9.18 recall that dull, dark surfaces radiate and absorb thermal (heat) radiation better than shiny, light-coloured surfaces	*Investigate how the nature of a surface affects the amount of thermal energy radiated or absorbed using a Leslie's cube or other suitable alternative.*
9.19 explain that reducing energy losses is important to keep costs down and save energy resources	*Investigate methods of reducing heat wastage in the home.*
9.20 demonstrate an understanding that energy is conserved	
9.21 compare renewable and non-renewable sources of energy, used to produce electricity, to include: a. sources that will run out (coal, oil, gas and nuclear) b. sources that will not run out (solar, wind, tidal, wave, biomass, geothermal, hydro).	*Use secondary data to produce a booklet describing renewable and non-renewable sources.*
9.22 discuss changes of energy resources which are likely to occur this century.	

Entry Level 1	Entry Level 3
Students at this level are likely to be able to: • use simple texts and the internet, with help, to obtain information about, e.g., safety precautions when near electricity cables and pylons and when using electricity in the home • use secondary data sources with help to, e.g., produce a fact sheet on renewable sources of energy, including wind, solar, wave, hydro • show a basic understanding of the production of electricity using magnets and coils, communicating their ideas in a simple way, e.g. using drawings • describe how our use of energy sources has changed over time, e.g. why electricity has meant that heating/cooking/lighting/communicating is easier and quicker than previous methods • discuss the social and economic benefits of energy-saving devices such as lamps and various domestic insulations, in a general context • make limited use of scientific terms (e.g. electric current, volts, watts, transformer) in discussions.	Students at this level are likely to be able to: • use given information sources with little, if any, help, to obtain information about, e.g., safety precautions when near electricity cables and pylons, and when using electricity in the home • use secondary data sources with little, if any, help to, e.g., produce a fact sheet on renewable sources of energy, including wind, solar, wave, hydro • show an understanding of, e.g., the production of electricity using magnets and coils, communicating their ideas using simple sentences • describe how our use of energy sources has changed over time, outlining the development of the scientific ideas involved, e.g. why electricity has meant that heating/cooking/lighting/communicating is easier and quicker than previous methods • discuss the social and economic benefits of energy-saving devices such as lamps and various domestic insulations in a specific context • make some use of scientific terms (e.g. induced current amps, kilowatt-hour) in discussions and written work.

Assessment

The Entry Level Certificate in Science is awarded at one of three levels: Entry 1, Entry 2 and Entry 3, with Entry 1 being the lowest level of achievement and Entry 3 the highest.

For each level, assessment is based on two components:

- topic tests 60 percent internally marked, externally set and moderated
- assignments 40 percent internally marked, externally set and moderated.

Although each topic has an associated topic test and assignment, only six topic test results and three assignments need to be submitted from different units to determine the level of achievement.

All components require students to use scientific, technical and mathematical language, conventions and symbols where appropriate. Each assessment component is described below.

Topic tests

Each topic has an associated topic test. These will remain valid for the lifetime of the qualification. Topic tests will be used to assess students knowledge and understanding of scientific concepts. Questions will require students to recognise, recall and use scientific knowledge. Edexcel will provide topic tests and mark schemes. Specimen topic tests and mark schemes are provided in a separate publication.

The topic tests:

- are provided as photocopiable master copies
- are confidential and must be kept under secure conditions with the tutor's mark scheme at all times
- each have a maximum of 15 marks
- are not time limited
- should be taken at an appropriate time for each student or group of students
- can be set in normal classroom conditions, but other examination procedures regarding invigilation and safeguards against communication between students must be observed
- may be read to students by the tutor; individual oral responses may be recorded (by written or audio means) where judged necessary
- must not be taken out of the tutor's direct supervision
- are to be collected and marked by the tutor according to the published mark scheme
- are moderated by Edexcel.

Marks can be given to students who have taken the test, but students cannot be shown any marked material.

Types of questions used in the topic test

Different types of question are used in the topic tests, including some of the following.

Types of question
• Single word response. • Multiple-choice questions. • Word boxes in various forms, such as three to six words in a box, words to be used once only and all words used. • Simple perspective drawings and diagrams. • Simple arithmetic. • Word boxes in various forms, four to six words in a box, words to be used once, more than once or not at all. • Simple free response.

Assignments

Each topic has an associated assignment. These will remain valid for the lifetime of the qualification. Edexcel will provide the assignments and mark schemes. Specimen assignments and mark schemes are provided in a separate publication.

The assignments:

- are provided as photocopiable master copies
- are confidential and must be kept under secure conditions with the tutor's mark scheme at all times
- each have a maximum of 20 marks
- are not time limited
- should be taken at an appropriate time for each student or group of students
- can be set in normal classroom conditions, but other examination procedures regarding invigilation and safeguards against communication between students must be observed
- may be read to students by the tutor; individual oral responses may be recorded (by written or audio means) where judged necessary
- must not be taken out of the tutor's direct supervision
- are to be collected and marked by the tutor according to the published mark scheme
- are moderated by Edexcel.

Marks can be given to students who have taken the assignment, but students cannot be shown any marked material.

Assignments may include some of the following tasks.

Assignment tasks
• Plan (but not carry out) an experiment.
• Identify equipment needed for a specific purpose.
• State what would be observed in given practical situations, e.g. describe what happens when carbon dioxide passes through limewater.
• Describe how to carry out simple scientific tests, e.g. test for carbon dioxide.
• Draw graphs, pie or bar charts using data provided by Edexcel.
• Interpret simple pie and bar charts, tables and histograms, and extract data from simple data tables.
• Recognise trends/patterns in simple data tables and line graphs.
• Draw conclusions from experimental results provided by Edexcel.
• Suggest how an experiment may be improved.

Retaking of assessment

If work submitted by students on any of the topic tests or topic assignments is inadequate or incomplete, students may be allowed (at the discretion of the centre) to retake it. However, no feedback or guidance on their original answers should be provided.

There must be a gap of at least two weeks between the original assessment and the retake.

Alternatively, centres can disregard the original assessment and students could be examined on a different topic.

Student record sheets

A sheet for recording the marks for each student is provided in *Appendix 3: Record sheet for topic tests and assignments*.

Calculating the overall mark

Evidence for the two components (topic tests and assignments) must be available for moderation. However, there is no minimum requirement for any individual component.

The marks awarded for up to the best **six** topic test marks and up to the best **three** assignment marks from **different** units will be used to determine the level of achievement. Marks for topic tests and assignments must be submitted from **different** units; the submission of marks for both a topic test **and** an assignment from the **same** topic is **not** permitted.

Marks for the topic tests and assignments need to be combined as shown below to give a total mark out of 150.

Component	% weighting	Total marks (maximum)
Topic tests	60	90
Assignments	40	60

This will give each student a maximum total mark of 150. The total mark out of 150 then establishes the level a student has achieved as shown in the table below.

Level	Minimum total marks required
Entry Level 1	30/150
Entry Level 2	65/150
Entry Level 3	100/150

The marks awarded for the topic tests and assignments must be submitted to Edexcel on the form in *Appendix 3*: *Record sheet for topic tests and assignments*.

Assessment Objectives and weightings

	% in Entry Level Certificate
AO1: Recall, select and communicate their knowledge and understanding of science	52–56%
AO2: Apply skills, knowledge and understanding of science in practical and other contexts	28–38%
AO3: Analyse, draw conclusions and evaluate evidence	10–16%
TOTAL	**100%**

Relationship of Assessment Objectives to Tasks for the Entry Level 1 Certificate

	Assessment Objective			
Task	**AO1**	**AO2**	**AO3**	**Total for AO1, AO2 and AO3**
Topic tests	44–48%	12–16%	0%	56–64%
Assignments	8%	16–22%	10–16%	34–46%
Total for Entry Level 1 Certificate	52–56%	28–38%	10–16%	100%

Entering your students for assessment

Student entry

Details of how to enter students for this qualification can be found in Edexcel's *UK Information Manual*, copies of which (in CD format) are sent to all active Edexcel centres. The information can also be found on the Edexcel website: www.edexcel.com

Classification code

Centres should be aware that students who enter for more than one qualification with the same classification code will have only one grade (the highest) counted for the purpose of the School and College Performance Tables.

Access arrangements and special requirements

Edexcel's policy on access arrangements and special considerations for GCE, GCSE, International GCSE, and Entry Level qualifications aims to enhance access to the qualifications for students with disabilities and other difficulties without compromising the assessment of skills, knowledge, understanding or competence.

The centre assessor and/or centre examinations officer may exercise their own discretion in providing reasonable support to Entry Level Certificate students with particular access requirements. Useful information is contained in the regulations and guidance published annually by the Joint Council for Qualifications; permission from Edexcel is not required for access arrangements deemed to be necessary for individual students.

Please see the Joint Council for Qualifications website (www.jcq.org.uk) for:

- the JCQ policy Access Arrangements, Reasonable Adjustments and Special Considerations.

Please see the Edexcel website (www.edexcel.com) for:

- any forms to submit requests for access arrangements and special considerations
- dates for submission of relevant forms.

Requests for access arrangements and special considerations must be addressed to:

Special Requirements
Edexcel
One90 High Holborn
London WC1V 7BH

Equality Act 2010

Please see the Edexcel website (www.edexcel.com) for information on the Equality Act 2010.

Internal standardisation

The tasks will be marked by the tutor against the set assessment criteria found in this specification.

If more than one tutor in a centre is marking student work, there must be a process of internal standardisation to ensure that there is consistent application of the assessment criteria.

Awarding and reporting

The grading, awarding and certification of this qualification will comply with the requirements of the current GCSE/GCE Code of Practice, which is published by the Office of Qualifications and Examinations Regulation (Ofqual).

The Edexcel Entry Level Certificate qualification will be graded as pass or fail and is awarded at three levels:

- Entry 1
- Entry 2
- Entry 3.

The first certification opportunity for the Edexcel Entry Level Certificate in Science will be 2014.

Retaking of qualifications

Students may retake an Edexcel Entry Level Certificate qualification at any point within the life of the specification. There are no limits on the number of retakes. Students are able to claim certification once per year in the June series.

Language of assessment

Assessment of this qualification will be available in English only. Assessment materials will be published in English only and all work submitted for examination or moderation must be produced in English.

Malpractice and plagiarism

For up-to-date advice on malpractice and plagiarism, please refer to the Joint Council for Qualifications (JCQ) *Suspected Malpractice in Examinations and Assessments: Policies and Procedures* document on the JCQ website (www.jcq.org.uk).

Student recruitment

Edexcel's access policy concerning recruitment to our qualifications is that:

- they must be available to anyone who is capable of reaching the required standard
- they must be free from barriers that restrict access and progression
- equal opportunities exist for all students.

Prior learning

This qualification builds on the content, knowledge and skills developed in the Key Stage 3 Programme of Study for Science as defined by the National Curriculum Orders for England.

Progression

This qualification supports progression to Level 1 or Level 2 qualifications such as the Edexcel GCSE Level 1/Level 2 in Science or a BTEC First Certificate in Science or a vocationally related qualification.

Support and training

Edexcel support services

Edexcel has a wide range of support services to help you implement this qualification successfully.

Ask the Expert – to make it easier for you to raise a query with us online, we have merged our **Ask Edexcel** and **Ask the Expert** services.

There is now one easy-to-use web query form that will allow you to ask any question about the delivery or teaching of Edexcel qualifications. You'll get a personal response, from one of our administrative or teaching experts, sent to the email address you provide.

We'll also be doing lots of work to improve the quantity and quality of information in our FAQ database, so you'll be able find answers to any questions you might have by searching before you submit the question to us.

Training

A programme of professional development and training courses, covering various aspects of the specification and examination, will be arranged by Edexcel. Full details are on our website: www.edexcel.com

Appendices

Appendix 1: Wider curriculum

Signposting and development suggestions

Issue	Opportunities for development
Spiritual	The benefits derived from the application of science to improve human conditions, e.g. finding treatment for genetic disorders, use of insulin to treat diabetes, improving technology for food production.
Moral	The use of animals in experiments.
Ethical	The use of animals in experiments.
Social	The impact of science and technology on society. The harm caused by smoking.
Legislative	Legislation concerning laboratory practices.
Economic	Reducing the cost of energy for industrial and domestic purposes.
Sustainable	The need to use sustainable energy resources.
Health and safety	Health and safety is a vital consideration when carrying out experiments.
European initiatives	European legislation, e.g. health and safety and environmental.

Appendix 2: Codes

Type of code	Use of code	Code
National classification codes	Every qualification is assigned to a national classification code indicating the subject area to which it belongs. Centres should be aware that students who enter for more than one qualification with the same classification code will have only one grade (the highest) counted for the purpose of the School and College Performance Tables.	1310
National Qualifications Framework (NQF) codes	Each qualification title is allocated a National Qualifications Framework (NQF) code. The National Qualifications Framework (NQF) code is known as a Qualification Number (QN). This is the code that features in the DfE Funding Schedule, Section 96, and is to be used for all qualification funding purposes. The QN is the number that will appear on the student's final certification documentation.	The QN for this qualification is: 600/7881/9
Entry code	The entry code is used to: • enter a student for assessment • claim certification of a student's grade for the qualification.	The entry code for this qualification is 8939. Please refer to the Edexcel *UK Information Manual*, available on the Edexcel website for the entry codes of other qualifications**.**

Appendix 3: Record sheet for topic tests and assignments

A candidate record sheet is provided on the next page. Please ensure you use this record sheet as a top cover sheet when submitting candidate work for moderation.

Please note that if any candidates complete more than six topic tests, only the best six topic test marks should be submitted. Similarly, if any candidates complete more than three assignments, only the best three assignment marks should be submitted. Topic test marks and assignment marks must be submitted from different units.

Record sheet for topic tests and assignments

Specification number _____

Candidate name _____

Candidate number _____

Centre name _____

Centre number _____

Assessment marks

Please enter up to the **six** best topic test marks and up to the **three** best assignment marks for **different** units in the following table.

Topic number	Assessment marks	
	Topic test (maximum 15 marks)	**Assignment (maximum 20 marks)**
1		
2		
3		
4		
5		
6		
7		
8		
9		
Total marks	**Total for up to the six best topic tests (maximum 90 marks)**	**Total for up to the best three assignments (maximum 60 marks)**

Marks awarded for the topic tests	[redacted]	[redacted]	=
Marks awarded for the assignments	[redacted]	[redacted]	=
Total mark (maximum 150)			

Please complete the Declaration of Authentication (on next page)

Declaration of Authentication

I declare that the work submitted for assessment has been carried out without assistance other than that which is acceptable under the scheme of assessment.

Signed (candidate): _____

Date: _____

Signed (tutor): _____

Name of tutor: _____

Date: _____

Please ensure this form is completed and placed as the top sheet when submitting work for moderation.

ma260213G:\WORDPROC\LT\PD\ENTRY LEVEL\W031185_ENTRY_LVL_L123_SCIENCE\W031185_ENTRY_LVL_L123_SCIENCE.DOC.1–92/1

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