OCR
RECOGNISING ACHIEVEMENT

ENTRY LEVEL CERTIFICATE IN SCIENCE

ACCREDITED SPECIFICATION

R591

VERSION 1

MAY 2011

WELCOME TO ENTRY LEVEL SCIENCE

THOUSANDS OF TEACHERS ALREADY UNLEASH THE JOY OF SCIENCE WITH OCR.

A FEW GOOD REASONS TO WORK WITH OCR

- You can enjoy the **freedom and excitement** of teaching science qualifications which have been developed to help you inspire students of all abilities.
- We've built specifications **with you in mind**, using a clear and easy-to-understand format, making them straightforward for you to deliver.
- Our **clear and sensible assessment** approach means that exam papers and requirements are clearly presented and sensibly structured for you and your students.
- **Pathways for choice** – we have the broadest range of science qualifications and our Entry Level provides an ideal foundation for students to progress to more advanced studies and science-related careers.
- **Working in partnership to support you** – together with teachers we've developed a range of practical help and support to save you time. We provide everything you need to teach our specifications with confidence and ensure your students get as much as possible from our qualifications.
- **A personal service** – as well as providing you with lots of support resources, we're also here to help you with specialist advice, guidance and support for those times when you simply need a more individual service.

HERE'S HOW TO CONTACT US FOR SPECIALIST ADVICE:

Phone: 01223 553998

Email: science@ocr.org.uk

Online: http://answers.ocr.org.uk

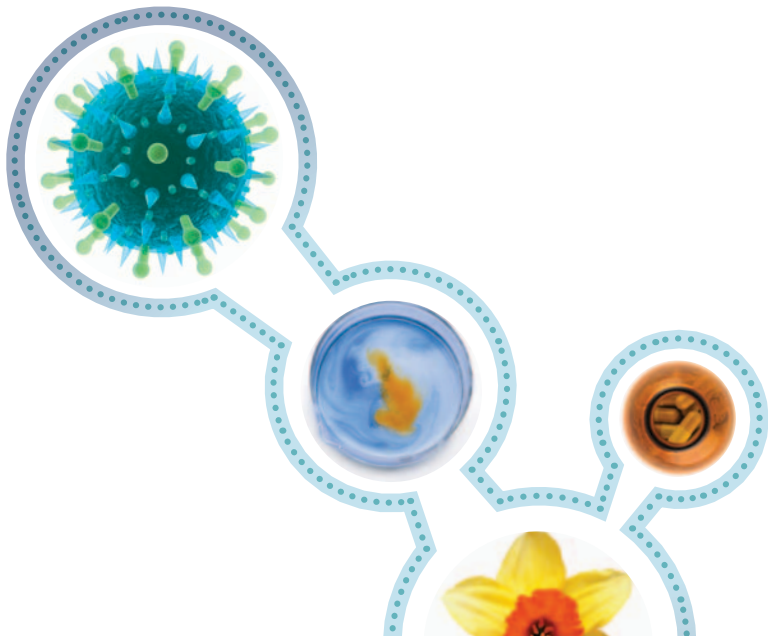
Fax: 01223 552627

Post: Customer Contact Centre, OCR, Progress House, Westwood Business Park, Coventry CV4 8JQ

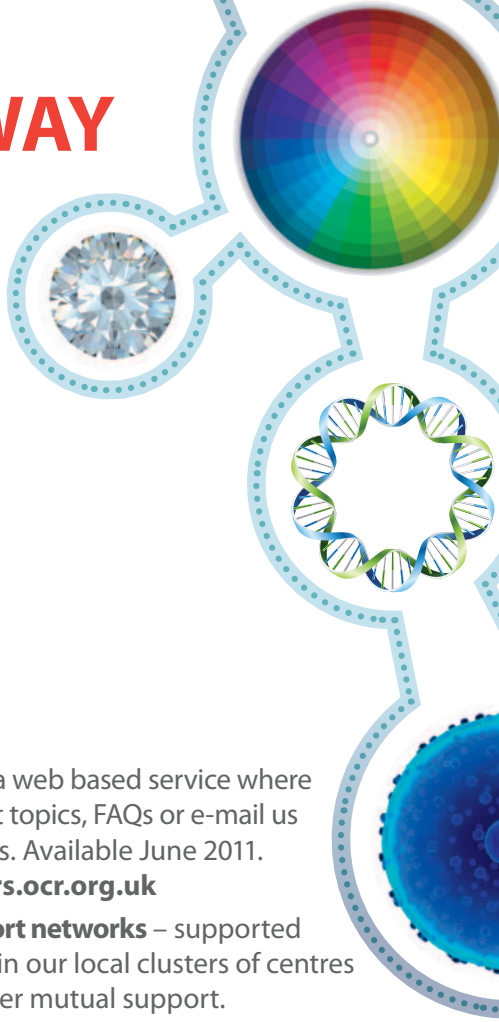
DON'T FORGET

– you can download a copy of this specification and all our support materials at

www.ocr.org.uk/science



SUPPORTING YOU ALL THE WAY



Our aim is to help you at every stage and we work in close consultation with teachers and other experts to provide a practical package of high quality resources and support.

Our support materials are designed to save you time while you prepare for and teach our new specifications. In response to what you have told us we are offering detailed guidance on key topics and curriculum planning.

Our essential FREE support includes:

Materials

- Support booklet
- Specimen assessment materials and mark schemes
- Lesson plans
- Curriculum planning sheets
- Past papers.

You can access all of our support at:
www.ocr.org.uk/science

Training

Our FREE GCSE Science Get Started events:

- include useful information about our specifications direct from the experts
- are designed to assist you in preparing to teach
- provide you with an opportunity to speak face-to-face with our team.

Go to **www.ocr.org.uk/training** for full details and to book your place.

Science Community

Join our social network at **www.social.ocr.org.uk** where you can start discussions, ask questions and upload resources.

Services

- **Answers @ OCR –** a web based service where you can browse hot topics, FAQs or e-mail us with your questions. Available June 2011. Visit **http://answers.ocr.org.uk**
- **Local cluster support networks** – supported by OCR, you can join our local clusters of centres who offer each other mutual support.

Endorsed publisher partner materials

We're working closely with our publisher partners Collins Education and Oxford University Press to ensure effective delivery of endorsed materials when you need them. Find out more at:
www.collinseducation.com
www.oxfordsecondary.co.uk

WHAT TO DO NEXT

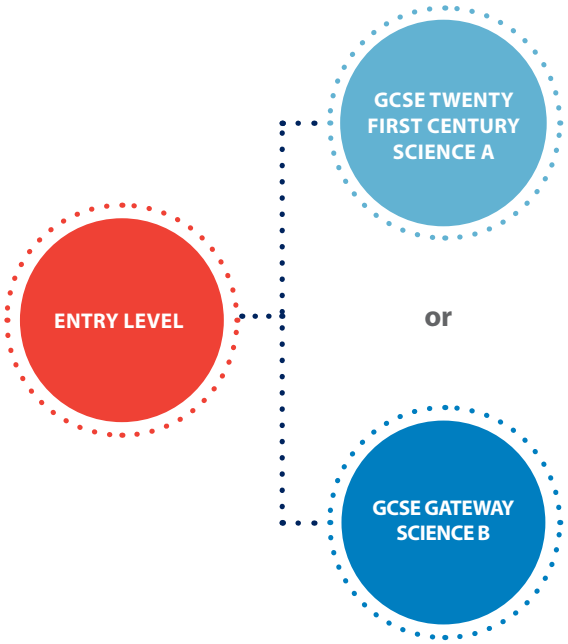
1) Sign up to teach – let us know you will be teaching this specification to ensure you receive all the support and examination materials you need. Simply complete the online form at **www.ocr.org.uk/science/signup**

2) Become an approved OCR centre – if your centre is completely new to OCR and has not previously used us for any examinations, visit **www.ocr.org.uk/centreapproval** to become an approved OCR centre.

ENTRY LEVEL CERTIFICATE IN SCIENCE

An exam-free KS4 science qualification for those students where a GCSE may not be a realistic or appropriate goal. Taught and assessed in small units Entry Level Certificate in Science gives students realistic targets and achievements and enables the more able students to progress to GCSE.

POSSIBLE GCSE COMBINATIONS



ENTRY LEVEL CERTIFICATE IN SCIENCE

- Is a course designed to provide students with realistic targets, encouraging them to develop science skills. This enables the more able students to progress to GCSE Science.
- Provides the flexibility to link between the practical task and the controlled assessment for OCR's Twenty First Century Science GCSE and Gateway Science GCSE, allowing the possibility for some students being entered, as late Year 11, for the Foundation Tier of an OCR GCSE Science qualification.
- Is assessed with a combination of short end-of-item tests, can-do tasks and practical tasks by teachers, internally standardised and then externally moderated by OCR.

COURSE OVERVIEW

Biology Items

B1 Dead or Alive
B2 Babies
B3 Extinction
B4 Casualty
B5 Healthy Eating
B6 Control Systems
B7 Gasping for Breath
B8 Creepy Crawlies
B9 Fooling your Senses
B10 Food Factory
B11 Drugs in Society
B12 My Genes
B13 Body Wars

Chemistry Items

C1 Acids and Alkalis
C2 Cooking and Cleaning
C3 Colours and Smells
C4 Heavy Metal?
C5 Fibres and Fabrics
C6 Clean Air?
C7 Strong Stuff
C8 Restless Earth
C9 How Fast? How Slow?
C10 Sorting Out
C11 CSI Plus
C12 Fuels
C13 What's Added to Our Food?

Physics Items

P1 Getting the Message
P2 Our Electricity Supply
P3 Attractive Forces
P4 Pushes and Pulls
P5 Let there be Light!
P6 Final Frontier
P7 Alternative Energy
P8 Deep Impacts
P9 Driving Along
P10 Hot Stuff!
P11 Nuclear Power
P12 Full Spectrum
P13 Medical Rays

ASSESSMENT OVERVIEW

One unit made up of three elements listed below.
There is one assessment series each year in June.

Element 1:
End-of-Item Tests
70% of the total
70 points

Students may submit the results of a maximum of 35 out of 39 tests.

This number should consist of a minimum of nine items from each of Biology, Chemistry and Physics to provide an appropriate overall balance.

The marks for each test are converted into points. Each test is worth a maximum of two points.

Element 2:
Can-Do Tasks
10% of the total
10 points

Each task is marked out of 1 mark, 2 marks or 3 marks. A maximum of 10 tasks are assessed giving a maximum of 30 marks. This mark is divided by 3 to give a maximum of 10 points.

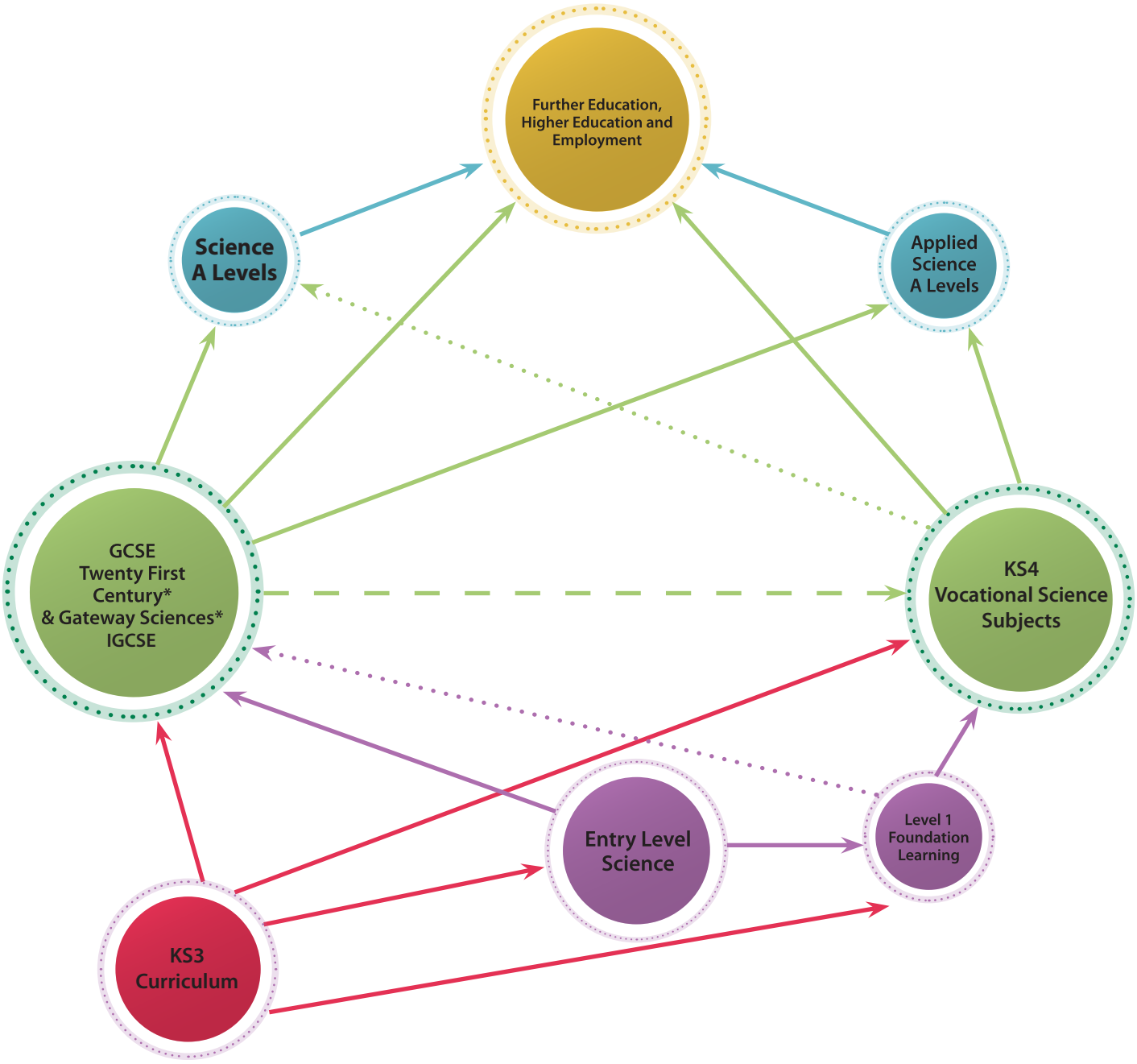
Element 3:
Practical Tasks
20% of the total
20 points

Centres are able to devise their own practical tasks or may use ones suggested in the Teachers' handbook.

Students can attempt more than one of these tasks but the points submitted must be based on each student's response to the whole of one task.

The total mark, out of a maximum of 20, is directly converted into points.

PROGRESSION PATHWAYS IN SCIENCE



This could be a progression route along a particular curriculum pathway. (Stage, not age pathways)

This could be a progression route however students would require additional support.

Alternative qualification options

* Offered as
Science, Additional Science, Biology, Chemistry and Physics.

OCR Entry Level Certificate in Science R591

Contents

Contents

1 Introduction to Entry Level Certificate in Science

1.1 Overview of OCR Entry Level

Entry Level Certificate in Science (R591)

Element 1 *End-of-Item Tests* 70% of Entry Level Certificate in Science	OCR provided, 15 mark tests, each approximately 10 minutes in duration, to be taken after teaching a topic (item). The results of a maximum of 35 tests to be submitted out of a possible 39. Available for downloading from *Interchange*. Marked by teachers using mark schemes provided by OCR.

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Element 2 *Can-Do Tasks* 10% of Entry Level Certificate in Science	List of possible tasks given in the specification and on the candidate record card. Recorded as achieved/not achieved. Assessed in practical situations. Tasks differentiated at 1, 2 and 3 marks: the results of a maximum of 10 tasks to be submitted.

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Element 3 *Practical Task* 20% of Entry Level Certificate in Science	Candidates are assessed on a practical procedure (experiment) designed to provide an answer to a relevant scientific issue relating to the content of the course. Tasks are set by the teacher – OCR will provide exemplars in supporting materials. The task involves planning the experiment and the processing and analysing of the data. Suggested time: 4 Hours.

This qualification consists of one unit composed of three elements.

1.2 About the Entry Level Certificate in Science specification

This booklet contains OCR's Entry Level Certificate in Science specification for teaching from September 2011 and for first certification in June 2013.

This specification has been specifically designed to meet the need of those candidates in Key Stage 4 for whom courses leading to a GCSE examination do not represent a realistic or appropriate goal.

Since it does not lead to a GCSE qualification, there is no requirement for this specification to conform either to the general GCSE criteria or to the science-specific criteria for GCSE. It does, however, meet the requirements of the Ofqual common criteria and criteria for Entry Level qualifications and covers those aspects of the Science National Curriculum Programme of Study for Key Stage 4 appropriate for students working at this level. The course will lead to final certification by OCR at Entry Level 1, 2 or 3. It is possible for interim certification to be achieved by candidates at stages during the course. These interim certificates can be awarded by the centre at Bronze, Silver and Gold levels.

The specification can be used as the basis of an independent course for those candidates identified as unlikely to be entered for GCSE, and as a source of material to support the teaching of lower-attaining candidates in teaching groups where the majority will be entered for the Foundation Tier of a GCSE examination.

The specification consists of 39 items, equally divided between biology, chemistry and physics. Candidates do not need to have been assessed for all items in order to enter for certification. There is no minimum number of items required but an approximate balance between Biology, Chemistry and Physics is expected.

The absence of the requirement to conform to GCSE criteria enables a significantly more flexible approach to be used and this is reflected in an increased emphasis on positive achievement through the realisation of short-term goals, using 100% teacher assessment.

There is no terminal examination, and assessment is by means of a combination of short end-of-item tests, can-do tasks and a practical task. All assessments are centre-based, are supervised by the candidate's own teacher, and are carried out at times determined by the centre. All assessments will be subject to normal moderation procedures by OCR.

Part of the inherent flexibility of the Entry Level Science specification is the linking of the mark descriptors for the practical task to those for the controlled assessment tasks for OCR Twenty First Century GCSE Science and OCR Gateway GCSE Science. This allows the possibility of progression from Entry Level Science to GCSE Science. Candidates making this progression can be entered, as late as February of Year 11, for the Foundation Tier of an OCR GCSE Science qualification.

The specification is approved by Ofqual as a national Entry Level award and is also approved by DCELLS for use in maintained schools in Wales and, by CCEA, in Northern Ireland.

1.3 Guided learning hours

There are no specified guided learning hours for this course but typically the course could take between 60 and 120 guided learning hours depending on the ability of the candidates and the delivery approach adopted.

2 Content of Entry Level Certificate in Science

2.1 Summary of content

The course consists of 39 items, 13 for each of Biology, Chemistry and Physics. The items are related to those aspects of science which feature in the life of candidates in the Twenty-First Century.

The subject content of each item can be delivered in approximately four hours, including the time required for practical work and assessment.

Biology Items	Title
B.1	Dead or Alive
B.2	Babies
B.3	Extinction
B.4	Casualty
B.5	Healthy Eating
B.6	Control Systems
B.7	Gasping for Breath
B.8	Creepy Crawlies
B.9	Fooling your Senses
B.10	Food Factory
B.11	Drugs in Society
B.12	My Genes
B.13	Body Wars

Chemistry Items	Title
C.1	Acids and Alkalis
C.2	Cooking and Cleaning
C.3	Colours and Smells
C.4	Heavy Metal?
C.5	Fibres and Fabrics
C.6	Clean Air?
C.7	Strong Stuff
C.8	Restless Earth
C.9	How Fast? How Slow?
C.10	Sorting Out
C.11	CSI Plus
C.12	Fuels
C.13	What's Added to our Food?

Physics Items	Title
P.1	Getting the Message
P.2	Our Electricity Supply
P.3	Attractive Forces
P.4	Pushes and Pulls
P.5	Let there be Light!
P.6	Final Frontier
P.7	Alternative Energy
P.8	Deep Impacts
P.9	Driving Along
P.10	Hot Stuff!
P.11	Nuclear Power
P.12	Full Spectrum
P.13	Medical Rays

2.2 Layout of Item content

The specification content is displayed as 39 items. For each item the cells in the left-hand column list suggested activities which teachers could use in developing the content.

Each of the cells in the right-hand column lists the content statements which are open to assessment in the end-of-item tests. **In the end-of-item tests, candidates will be expected to be able to apply their knowledge and understanding in straightforward contexts.**

The use of ICT is integral to the study of science and every opportunity should be taken to use ICT as part of the learning process, e.g. using digital photography to record variation in animals and plants in item B3 Extinction.

How Science Works

In addition to the scientific knowledge, understanding and skills that are detailed in the items which follow, candidates require an understanding of the fundamental scientific processes that underpin these explanations. Studying these processes will provide candidates with some understanding of:

- how scientific explanations have been developed
- their limitations, and
- how they may impact on individuals and society.

Examples of links to Items	Learning outcomes which can be assessed
Particle collisions and reaction rates – C9 Forces and movement – P4 Uses of machines – P9	Describe a simple scientific idea using a simple model.
Causes of global warming – P2 Formation of the Moon – P8	Identify two different scientific views or explanations of scientific data.
Understand that one case is not enough evidence to show a pattern between one change and another – B4 Most features are determined by genes – B12 Wegener's theory of continental drift – C8 Interpret data from a crime scene and decide whether or not it confirms a suspect's presence – C9	Recall that scientific explanations (hypotheses) are: • used to explain observations • tested by collecting data / evidence.
Changing species and evolution – B3 Energy absorption by different coloured surfaces – P7	Describe examples of how scientists use a scientific idea to explain experimental observations or results.
Understand that one case is not enough evidence to show a pattern between one change and another – B4 Wegener's work on plate tectonics – C8 Formation of the Moon – P8	Recognise that science explanations are provisional but more convincing when there is more evidence to support them.
Genetic testing of embryos – B12 Vaccination of children – B13 Testing of perfumes – C3	Identify different views that might be held regarding a given scientific or technological development.

Organ transplantation – B1 Recycling and the environment – C4 Catalytic converters and air pollution – C6 Uses of radiation in medicine – P13	Identify how a scientific or technological development could affect different groups of people or the environment.
Sensitivity to enzymes in washing powder – C2 Effects of food additives – C13 Use of mobile phones – P1 & P12 Nuclear power – P11	Describe risks from new scientific or technological advances.
Organically grown food – B10 Effectiveness of biological washing powders – C2 Interpret data for different energy saving strategies – P2	Distinguish between claims/opinions and scientific evidence in sources.
Identify trends in the growth of babies – B2 Interpret data on nutrients in foods – B4 Interpret information from charts and graphs about rates of reaction – C9 The link between star temperature and colour – P5	Present data as tables, pie charts or line graphs and identify trends in the data and process data using simple statistical methods such as calculating a mean.
Risk factors for heart disease – B4 Air pollution and asthma – B7 Choices about which fuels to use – C12	Explain how a conclusion is based on the scientific evidence which has been collected.

B1 DEAD OR ALIVE

Suggested Activities and Experiences	Content Statements
• Discuss the processes of life and how we know that someone is still alive. • Make up a mnemonic (e.g. MrsGren) to remember this.	• Know the life processes: growth, nutrition, reproduction, movement, sensitivity, excretion, and respiration. • Be able to name the body systems involved with these life processes: circulatory, respiratory and digestive.
• Build up systems to show organisation using diagrams of cells, tissues, organs, and systems. • Build simple 3D models to show and label an animal cell. • http://www.ibiblio.org/virtualcell/index.htm (The cell.)	• Be able to label the nucleus, cytoplasm and cell membrane of an animal cell. • Know that the nucleus controls the cell; the membrane allows some chemicals to pass in and out, and the cytoplasm is where useful chemical reactions take place. • Know that new body cells are made when cells divide. • Know that new body cells are needed for growth and repair.
• Carry out a simple exercise to show muscle fatigue (finger stretching an elastic band, or fist clenches with arm raises). • Different ways of measuring pulse rate. • Find out how exercise affects breathing rate and pulse rate. • Discuss the link between recovery time and fitness. • Measuring the effect of exercise on pulse rate.	• Recall that cells use oxygen to release energy from glucose (sugar), and this is called respiration. • Recall that energy is needed for muscle contraction. • Understand that during exercise muscles need to be supplied with more oxygen and be able to relate this to an increase in heart rate. • Interpret simple data on breathing and pulse rates during exercise [no recall expected]. • Understand that general fitness can be indicated by recovery times in pulse and breathing rates. • Know that warming up and down can help reduce muscle damage during exercise.
• Look at the position of organs within the body. Stick cut-out organs into position on a body outline. • http://www.lessontutor.com/jm_digestive.html (Outline of body.) • Design a Donor card/organ carrying box. • Discuss why an individual cannot accept organs from everyone.	• Be able to name and locate: lungs, heart, kidneys, liver, brain, stomach. • Know that some healthy organs can be removed from dead people and transplanted into hosts. • Know that transplants can be rejected. • Know that people can opt to donate their organs and can carry donor cards. • Understand why transplant organs have to be kept cold during transport.

Related Can-Do Tasks (1) I can measure a person's breathing rate or pulse.

Possible Practical Activity Effect of exercise on pulse rate.

B2 BABIES

Suggested Activities and Experiences	Content Statements
• Label simple diagrams of male/female reproductive systems. • Discuss the role of male and female in sexual intercourse. • Add arrows to a diagram of the female reproductive system to show direction of sperm movement towards the egg. • Discuss what fertilisation involves, and how the egg can separate to form twins.	• Know the names of the main organs of the female reproductive system: ovary, oviduct, womb, vagina. • Know the names of the main organs of the male reproductive system: penis, testis, sperm duct. • Know the functions of testes (make sperm), ovary (make eggs). • Know that fertilisation occurs by fusion of sperm and egg cells. • Know that the fertilised egg develops into a foetus. • Know that identical twins develop from the same fertilised egg. • Know that non-identical twins develop from two different fertilised eggs.
• Discuss the changes that take place in the female body after fertilisation. • Visit to clinic/midwife. • Test fake urine for protein. • http://www.med.unc.edu/embryo_images/ (Development of the embryo.)	• Know some of the changes that occur in the female body after fertilisation: stopping periods and weight gain. • Know that tests are carried out to monitor progress of mother and foetus during pregnancy: blood pressure, height, weight.
• Cut and stick work sheets to show positions of placenta, cord, foetus, bag of water. • Complete a table to show the basic role of these structures. • Demo to show need for bag of water – shake jar containing egg with/without water.	• Be able to name and locate the placenta, cord, foetus and bag of water and know the basic role of these structures.
• Sequence statements of events of labour leading up to birth. • Make a checklist of what the mother needs to take to hospital. • Discuss how the hospital can aid the birth process (painkillers, epidural, breathing exercises). • Discuss how the parents' lifestyle will change after the birth of the baby and list the jobs the father could do to help. • Discuss post-natal care (visit by community nurse).	• Know the early stages of labour: water breaking, labour pain. • Know the placenta is lost as the afterbirth. • Interpret data from babies' growth. • Know that periods start again after childbirth.
• Discuss the affects of the increasing human population.	• Recall that the human population is increasing. • Interpret data on human population size. • Understand that increased population will put greater demand on resources: homes, food, clean water, fuel, more household waste and sewage.

Related Can-Do Tasks (13) I can read data from a graph.

Possible Practical Activity Compare the absorbency of different nappies.

B3 EXTINCTION

Suggested Activities and Experiences	Content Statements
• Look at display/pictures of fossils. • Discuss how fossils were formed. • Compare a dustbin and compost heap – oldest material at the bottom. • Make plaster casts of 'fossils'.	• Recall that fossils provide evidence of living organisms from long ago. • Know that some rocks are formed in layers. • Know that the soft part of bodies rot but teeth and bones may be preserved in some conditions. • Be able to sequence the main stages of fossil formation. • Recall that animals and plants can also be preserved in ice, amber and tar pits.
• Put in sequence a timeline for the evolution of major animal groups. • http://wsrv.clas.virginia.edu/~rjh9u/hdevsum.html (The Jurassic Period.) • http://www.enchantedlearning.com/subjects/dinosaurs/index.html (Dinosaurs)	• Know that life on Earth began about 3500 million years ago and that these were very simple living things. • Know that living things have been changing ever since through evolution. • Know that some species have changed very little over thousands of years e.g. crocodiles.
• Spot variation in animals and plants of the same species (photographs/living things). • Grow seeds with different numbers of seeds per small pot (egg boxes).	• Be able to identify variations in animals or plants of the same species [no recall expected]. • Understand that living things compete for shelter, food and mates, in order to survive. • Know that the survivors can breed and pass on their features to the next generation.
• Use the internet to find names of some animals/plants that are endangered species. • Match species to the reasons for them becoming endangered/extinct. • Produce a poster on how to protect a chosen species. • Make a plasticine dinosaur body with straw legs and cardboard feet to support the dinosaur on a swamp (wall paper paste).	• Understand the terms *habitat* and *species*. • Understand that a species may become extinct if their habitat changes or another species is better adapted to survive there. • Understand how human beings have caused some species to become endangered or extinct: habitat destruction, hunting, pollution. • Interpret data on population sizes of endangered species. • Recall examples of endangered species: panda, gorilla, primroses. • Recall examples of extinct species: dinosaurs, sabre-toothed tiger, dodo.

Related Can-Do Tasks
(2) Given information I can match an animal to where it lives or when it lived.
(14) I can collect (scientific) information about an endangered or extinct species.

Possible Practical Activity Effect of competition on plant growth.

B4 CASUALTY

Suggested Activities and Experiences	Content Statements
• Learn basic first aid for an emergency – video/St John Ambulance etc. • Practise simple First Aid techniques. • Discuss how and when to call for help: making a 999 call.	• Understand the importance of maintaining the supply of oxygen to the body. • Know the steps to take in an emergency situation. • Know how and when to call for help: 999, 112. • Know the ABC code: airway, breathing, circulation. • Know the RICE procedure for soft tissue damage.
• Look at the structure of the heart (dissection or model). • http://www.smm.org/heart/heart/top.html (The structure of the heart.) • Use a stethoscope to listen to the heart beat.	• Know that the heart is made of muscle. • Know that the heart pumps to force blood out to the lungs or around the body. • Know that the heart acts as a double pump. • Know why the heart muscles need a good blood supply.
• Discuss differences between arteries and veins and capillaries. • Look at microscope slides to show the structures of arteries veins and capillaries • http://wsrv.clas.virginia.edu/~rjh9u/hdevsum.html (Blood circulation.) • Observe/identify differences from video/slides, or Visking tubing and Bunsen tubing.	• Know that arteries carry blood away from the heart, and veins to the heart. • Be able to recognise the difference between an artery and a vein. • Understand that a cut to a major blood vessel is more serious than a cut to a capillary. • Know that the body can cope with a 10% blood loss. • Know that 30% blood loss is serious and that the casualty may need a blood transfusion.
• Look at health education leaflets and identify factors that increase the risk of heart disease. • Explore heart disease risk factors for different individuals. • Consider patterns in evidence that smoking increases the risk of heart disease. • Look at video material reporting studies of risk factors for heart disease.	• Know that heart disease often happens when arteries supplying the heart with blood become blocked. • Recall that the risk of heart disease is increased by some factors including high-fat diet and smoking and understand that these factors increase the risk of heart disease, but will not cause it in everyone. • Understand that one case is not enough evidence to show a pattern between one change and another. • Recall that regular exercise reduces the risk of heart disease.

Related Can-Do Tasks (1) I can measure a person's breathing rate or pulse.

Possible Practical Activity Effect of different types of exercise on pulse rate.

B5 HEALTHY EATING

Suggested Activities and Experiences	Content Statements
• Discuss how different people with different lifestyles need different diets. • Look at the main food groups and which foods contain them. • Look at our own diets. • http://www.lessontutor.com/jm_digestive.html (The digestive system.)	• Know that a balanced diet must contain: water, carbohydrates, protein, fats, vitamins, minerals. • Know examples of foods that are rich in each of the main food groups i.e. carbohydrates, protein, fats, vitamins, minerals. • Interpret data on nutrient content of different foods. • Know that a poor diet could lead to someone being overweight or underweight. • Know that being overweight or underweight is linked to increased health risks. • Understand that exercise is important for a healthy lifestyle.
• Discuss how the diet should be balanced. • Discuss dietary excesses, deficiencies and allergies. • Research diets of people in other countries.	• Know that different people have different lifestyles and therefore dietary requirements. • Know that the diet in many parts of the world is deficient in protein. • Know that a high protein diet is needed by teenagers for growth.
• Look at food labels. • Visit shops/kitchen cupboards.	• Know that carbohydrates and fats provide energy, and protein is needed for growth and repair. • Know that food labels give nutritional information.
• Testing foods for starch, glucose, protein and fat. • Plan to test different sweets for glucose.	• Interpret simple data on food tests [no recall expected].
• Produce a full size model body with labelled cut-outs of the organs. • Discuss / watch a video about how we digest food. • Discuss the role of enzymes in digestion. • Show that large molecules (e.g. starch) cannot pass through Visking tubing, while smaller molecules (e.g. simple sugars) can. • Show that only particular types of enzyme can digest certain foods, e.g. protease cannot digest starch.	• Know the names and positions of the main organs of the human digestive system: mouth, stomach, small intestine, large intestine. • Understand, in simple terms, the processes of digestion and absorption and where these events occur. • Know that enzymes speed up reactions in humans. • Understand that enzymes speed up digestion to produce smaller soluble chemicals (which can pass into the blood). • Know that there are different enzymes in the mouth, stomach and intestines, each of which digests a different type of food.

Related Can-Do Tasks (4) I can safely carry out a food test for starch. (15) I can safely carry out a food test for sugar.
(25) I can record my daily protein intake.

Possible Practical Activity Find the energy content of different types of food and link this to the fat content.

B6 CONTROL SYSTEMS

Suggested Activities and Experiences	Content Statements
• Introduce the idea that our internal environment needs controlling. • Discuss changes in our surrounding environment which can affect our body's internal environment.	• Understand that changes in our surroundings can affect our body's internal environment. • Understand that the body's internal environment can change and that the body tries to control this change.
• Discuss what factors can affect our body temperature. • Place cards under headings: 'Keeping our body warm' and 'Keeping our body cool'. • Use thermometers / 'fever scans' to take external body temperature. • Find out about hypothermia and frostbite. • Investigate insulation / huddling.	• Know that the body's temperature is about 37 °C. • Know that the body loses heat in cold air. • Know that working muscles generate heat. • Know that shivering and moving produce heat. • Know that raised hair, stored fat and clothing reduce heat loss. • Understand that temperature extremes are dangerous to your body.
• Discuss what happens to our bodies when we get too hot. • Research secondary sources including ICT to find out about cooling mechanisms. • Investigate the temperature drop of warm water with wet, dry or with no covering.	• Know that sweating and more blood flow near the skin helps to keep the body cool. • Be able to interpret the results of simple cooling experiments.
• Label a simple diagram of a kidney and a bladder. • Survey the amount of liquid drunk in summer and winter. • Discuss the use of isotonic liquids by athletes.	• Know the ways the body gains or loses water. • Be able to name and locate the kidneys and the bladder. • Know that kidneys remove excess water.
• Read a story about a diabetic. • Discuss how being a diabetic affects your life. • Design a leaflet to explain what being a diabetic means	• Know that blood sugar levels need to be controlled. • Know that the body controls blood sugar levels with insulin. • Be able to name and locate the pancreas. • Know that insulin is produced by the pancreas. • Know that diabetes can be managed by controlling sugar levels in the diet and use of insulin.

Related Can-Do Tasks (16) I can produce a poster to warn old people about the risks of hypothermia.
(26) I can use a thermometer to accurately measure temperature.

Possible Practical Activity Experiment to show rate of cooling.

B7 GASPING FOR BREATH

Suggested Activities and Experiences	Content Statements
• Measure chest movement during breathing. • Make a model thorax.	• Understand how the movement of the ribs brings about breathing. • Be able to name and locate the windpipe, lungs and ribs on a diagram of the thorax.
• Design a health education poster about asthma. • Talk to asthma sufferers about the symptoms. • Measure lung volumes. • Use a peak flow meter.	• Recall that air pollution may cause asthma and that asthma causes the airways to narrow. • Understand that it is difficult to prove that air pollution causes asthma. • Interpret data about asthma [no recall expected]. • Know that an inhaler can relieve and prevent the symptoms of asthma. • Understand that lung volumes vary and may be affected by smoking and asthma. • Understand that the speed of exhalation varies and may be affected by smoking and asthma.
• Demonstrate a model smoking machine. • Debate smoking in public places. • Use websites / books to find out about smoking.	• Know that smoking can cause heart disease and cancer. • Know that tobacco smoke contains carbon monoxide, nicotine, tars and solid particles. • Know that carbon monoxide is odourless, colourless and poisonous. • Know that nicotine is addictive and that nicotine patches can be used to help someone give up smoking. • Interpret data relating to health studies on smoking. • Know that other people may be affected by passive smoking.
• Look at microscope slides or diagrams of muscle cells. • Watch a video/simulation (e.g. www.bbc.co.uk/bitesize) to show respiration in cells. • Test exhaled air to show it contains carbon dioxide and water vapour. • Link exercise to respiration rate.	• Recall that in all cells, glucose from food and oxygen breathed in combine to release energy and that this process is called respiration. • Recall that carbon dioxide and water are the waste products of respiration. • Know how to test breath for carbon dioxide using limewater, and for water vapour with a mirror or cobalt chloride paper. • Recall that carbon dioxide is removed from our bodies via the lungs. • Know that during exercise, more oxygen and glucose is needed by muscles, and water and carbon dioxide are removed more quickly.

Related Can-Do Tasks
(1) I can measure a person's breathing rate or pulse.
(17) I can carry out a test to show the presence of carbon dioxide.

Possible Practical Activity Compare lung volumes to chest size of different people.

B8 CREEPY CRAWLIES

Suggested Activities and Experiences	Content Statements
• Grow plants in different conditions of light and water. • Test a leaf for starch	• Know that plants make their own food from carbon dioxide in the air and water. • Know that this process is called photosynthesis. • Know that plants also need light to make their own food. • Know that oxygen is a waste product of photosynthesis.
• Identify adaptations of prey and predators.	• Know that animals get their food from eating plants or other animals. • Know that some animals are adapted to survive being caught as prey. • Understand how some animals are adapted as successful predators.
• Construct a food chain using well-known examples. • Use simple food webs to predict affects of changes on different members of the food web.	• Understand the terms *herbivore* and *carnivore*. • Be able to construct a simple food chain with a plant, a herbivore and a carnivore. • Be able to interpret a simple food web (limited to 3 organisms at any level). • Understand how a change affecting one species in a food web can affect another species in the same food web.
• Collect data using a variety of sampling techniques. • Collect pond or leaf-litter organisms. • Use a key to identify collected organisms. • Match plants and animals to their habitats.	• Be able to describe and carry out simple sampling methods: limited to pooters, nets, pitfall traps and quadrat surveys. • Be able to use simple keys to name plants and animals. • Recall the meaning of the term *habitat*. • Understand that organisms are adapted to live in their habitat.
• Estimate the number of weeds in a field.	• Recall that a variety of plants live in a 1 m quadrat area. • Be able to estimate the number of plants in an area using results of a quadrat survey.

Related Can-Do Tasks (2) Given information I can match an animal to where it lives or when it lived. (27) I can carry out a simple survey of a habitat. (28) I can measure length / distance accurately.

Possible Practical Activity Investigate population sizes in different conditions using a quadrat survey, e.g. *Pleurococci* on trees, distribution of weeds.

B9 FOOLING YOUR SENSES

Suggested Activities and Experiences	Content Statements
• Look at a model / video / website of the structure of the eye. • Build a cut and stick model of the eye. • Demonstrate binocular vision by bringing two pencil points together at arms length using one eye and two eyes. • Look at pictures of predators (binocular) and prey (monocular).	• Be able to label a diagram of the eye (limited to cornea, iris, pupil, lens, retina, optic nerve). • Recall the job of the pupil, lens, retina, optic nerve and iris. • Recall that humans have good binocular vision, but a limited field of view. • Know the differences between monocular and binocular vision. • Be able to use the position of eyes to state if an animal is a predator or prey. • Know that 3D vision enables distances to be judged.
• Taste food when the sense of smell is impaired, e.g. apple and onion. • Investigate of the four taste areas on the tongue. • Identify substances by smell, e.g. different types of crisps.	• Know that the nose is lined with nerves sensitive to chemicals in the air. • Know that taste buds are located on the tongue and are sensitive to four tastes: salt, sweet, sour, bitter. • Know that different areas of the tongue are more sensitive to different tastes. • Understand that the flavour of food diminishes when we have a cold and cannot smell.
• Watch a video / website simulation of how nerve impulses work. • Investigate reflex reactions, e.g. knee jerk, pupil dilation and blinking. • Measure reaction times by catching a dropped ruler. • http://www.neurophys.wisc.edu/animations/ (The structure of the ear.)	• Recall that sensor (receptor) cells detect stimuli, and effector cells (muscles) produce a response. • Understand the need for simple reflex actions, i.e. for protection. • Recall examples of simple reflex actions limited to knee jerk, iris, touching a hot surface. • Interpret simple data on reaction times.
• Use 'feelie' boxes to test skin sensitivity. • Test water temperature with the hands. • Test different areas of skin for sensitivity.	• Know that the skin contains sensory nerves for touch, temperature, pain and pressure. • Know that pressure sensors are deeper than pain sensors. • Know that some areas of skin contain more nerve endings than others.

Related Can-Do Tasks (3) I can measure the effect of caffeine on heart rate. (6) I can add results to a bar chart.
(13) I can read data from a graph.

Possible Practical Activity Compare reaction times / find out if reaction times improve with practice.

B10 FOOD FACTORY

Suggested Activities and Experiences	Content Statements
• Test a leaf for starch • Grow plants from seeds and tubers • Investigate conditions needed for germination. • Cut open a soaked seed and look for root, shoot, food store and test it for starch. • Grow plants from cuttings, and/or compare cuttings grown with or without rooting powder. • Discuss the advantages and disadvantages to garden centres of cloning plants.	• Know that plants make sugars and some is stored as starch. • Know how plants can be propagated limited to: – seeds – cuttings – runners – tubers. • Know that cuttings, runners and tubers are examples of cloning. • Know that cloning produces identical offspring. • Know the conditions necessary for germination: warmth, air and water.
• Measure the pH of different soil samples • Measure the water content of different types of soil • Measure the humus content of different types of soil	• Understand that there are different types of soil and that this can affect the type of plants that grow there. • Know that some soils dry out easily and others get waterlogged. • Know how to test the pH of soil. • Interpret data to determine pH preferences of different plant species.
• Compare grass grown with and without fertiliser • Research different methods of organic farming • Sort arguments for and against different methods of farming and matching them to organic and intensive farming methods	• Know that fertilisers supply the chemicals that plants need for growth. • Know that fertilisers include nitrogen for improved growth, phosphorus for good root growth and potassium for flowers and fruit growth. • Know that organic farmers use manure and crop rotation to improve soil fertility. • Be able to distinguish between facts and opinions about organically grown food.
• Compare the taste of different types of milk. • Test samples of milk to see how fresh it is. • Make cheese or yoghurt • Carry out a consumer preference test on varieties of cheese and yoghurt.	• Know that most of the milk we buy comes from cows (or sheep or goats) and is processed before being supplied to customers. • Know that cows can be selectively bred to produce higher milk yields. • Know the stages in providing milk to people's homes. • Know how milk is pasteurised and sterilised. • Understand why it is important to test samples of milk before it is sold.

Related Can-Do Tasks
(4) I can safely carry out a food test for starch.
(18) I can use Universal Indicator solution to find pH.

Possible Practical Activity Effect of different conditions on seed germination.

B11 DRUGS IN SOCIETY

Suggested Activities and Experiences	Content Statements
• Arrange a visit from the relevant police departments or rehabilitation centres • Test different tablets for their solubility	• Recall that drugs can be beneficial or harmful. • Understand that some drugs are only available on prescription because they can be harmful if not used properly. • Know how to test for solubility of soluble tablets e.g. aspirin. • Know that a drug is a chemical that has an effect on the mind or the body.
• Research ideas about making cannabis legal	• Recall the names of legal drugs limited to: – caffeine (found in coffee, tea and some soft drinks) – aspirin / paracetamol – alcohol – nicotine (found in cigarettes and tobacco). • Know that some people want to make some other drugs legal e.g. cannabis.
• Research drug testing in sport • Measure the affect of caffeine on heart rate e.g. in *Daphnia*	• Know that some drugs are addictive. • Know the effects of different categories of drugs and be able to name one example in each category limited to: – depressant: slows down the brain e.g. alcohol, solvents – pain killer: blocks nerve impulses e.g. aspirin, paracetamol – stimulant: increases brain activity e.g. nicotine, caffeine, ecstasy – hallucinogen: distorts what is seen and heard e.g. LSD – performance enhancer: muscle development e.g. anabolic steroids. • Know how the effect of caffeine on heart rate can be measured.
• Produce a poster on the dangers of drink driving • Research drink driving laws in different countries	• Recall that alcohol abuse accounts for more deaths and crime than any other drug. • Know the short term effects of alcohol (limited to blurred vision, slurred speech, poor balance and slower reactions). • Know the dangers of drink driving. • Know the long term effects of alcohol (limited to liver damage).
• Research the classification of drugs	• Recall that illegal drugs are classified as Class A (most dangerous), Class B and Class C. • Understand why the penalty for using or supplying Class A drugs is much more severe than for using or supplying Class C. • Understand why the penalty for supplying drugs is greater than the penalty for possession for personal use. • Know the dangers of driving after taking some drugs.

Related Can-Do Tasks (3) I can measure the effect of caffeine on heart rate.

Possible Practical Activity Solubility of different types of aspirin / affect of caffeine on heart rate.

B12 MY GENES

Suggested Activities and Experiences	Content Statements
• Make models, use books, use the internet or multi-media to show that the nucleus contains chromosomes. • Use pipe cleaners or coloured sweets to make models of genes and chromosomes.	• Know that human cells contain a nucleus. • Know that the nucleus contains chromosomes. • Know that chromosomes are made of DNA. • Know that lengths of DNA in chromosomes are genes. • Recall that our DNA carries our unique genetic code.
• Record and present data on variation in human features. • Identify human features which are inherited, environmental or both. • Look at photographs of families and identify similar features.	• Know that most human features are determined by a person's genes. • Understand that environment also affects many features. • Understand that most features are affected by several genes, e.g. height. • Be able to classify a range of human features as genetic: e.g. tongue rolling, ear lobes, environmental e.g. scars, accent, and both e.g. hair colour, good at sport. • Interpret data on human variation.
• Use a gene pairing game to show males have an odd set of chromosomes (XY) while females have (XX). • Vary the game to pair genes and decide the outcome of a baby. • Use simple punnett squares to show possible genotypes and the ratio of each. • http://www.accessexcellence.org/RC/VL/GG/recessive.html (Dominance.)	• Know that normal body cells have 46 chromosomes: – females have 23 pairs (including XX) – males have 22 pairs and **one** odd pair (XY). • Know that some genes are dominant and some are recessive. • Know how to use simple Punnett squares to show inheritance of genotype ratios.
• Watch video material describing genetic diseases. • Discuss viewpoints people may have about testing embryos for certain genes.	• Recall that some diseases are caused by faulty genes. • Know that embryos can be tested for certain genes. • Understand that people have different viewpoints about such testing.

Related Can-Do Tasks
(6) I can add results to a bar chart.
(13) I can read data from a graph.

Possible Practical Activity Comparing height and foot size.

B13 BODY WARS

Suggested Activities and Experiences	Content Statements
• Look at magnified white blood cells. • http://science.howstuffworks.com/blood.htm (Blood.) • Look at pictures (internet) of different microbes.	• Know that microbes are bacteria, fungi and viruses. • Understand that our bodies provide good conditions for microbes to reproduce rapidly. • Interpret data on microbial population size. • Know that white blood cells are part of the immune system. • Recall that the immune system fights infections.
• Test the effect of acidic pH (stomach acid) or protease (tears) on growth of bacterial agar plates.	• Know that a few types of microbes can make people ill. • Know that the skin, chemicals in tears, sweat, and stomach acid stop microbes getting in. • Know that microbes can enter the body through natural openings, or cuts in the skin.
• Identify good hygiene rules by looking at health education leaflets. • Arrange some common foodstuffs safely in a cut and stick fridge.	• Recall ways of reducing the risk of catching infections, e.g. washing hands after going to the toilet, before preparing or eating food. • Know that food should be stored carefully in a fridge, e.g. salad covered, raw meat below cooked meat. • Know that knives and chopping boards should be washed thoroughly after preparing meat, and that the food should be cooked thoroughly, in order to kill any microbes.
• Test the effect of antiseptics and / or antibiotic discs on growth of bacterial agar plate.	• Recall that antibiotics are chemicals that kill bacteria and fungi, but not viruses. • Know that some bacteria have evolved which are not killed by some antibiotics. • Know that there are some ways that people can reduce the risk of 'superbugs' developing: – only use antibiotics when needed – always finish a course of antibiotics.
• Find out what vaccinations you have had. • Discuss why vaccines are given – to protect the majority against a possible deadly disease. • Discuss why some parents don't have their children vaccinated (risk of side effects). • Match changing media headlines about the MMR vaccine over time to different pieces of evidence (source from the web).	• Know that vaccines can make people immune to a disease. • Know that a vaccine usually contains a safe form of a disease-causing microorganism. • Know that once you are immune you are protected from a particular disease. • Understand different viewpoints that parents may have about giving their child a vaccination. • Understand that media reports of health studies are not always accurate.

Related Can-Do Tasks (13) I can read data from a graph.

Possible Practical Activity Be able to compare bacterial growth in different conditions by estimating percentage cover on agar plates.

C1 ACIDS AND ALKALIS

Suggested Activities and Experiences	Content Statements
• Find / select and name the apparatus needed to obtain a dye from a plant. • Extract plant dyes from flowers, beetroot or red cabbage and use the solution to identify acids and alkalis. • Investigate how the colour of dyes changes when acids or alkalis are added. • Find the names and uses of common acids and alkalis.	• Be able to label simple laboratory apparatus used to obtain a dye from a plant (limited to beaker, stirring rod, heating apparatus, filter funnel, filter paper and mortar and pestle). • Know that lemons, limes and vinegar contain naturally occurring acids. • Know that the colour of some dyes can be changed by adding acids and alkalis. • Recall that alkalis are used to make oils into soap, chemicals for dyes, and glass. • Understand safety precautions when using acids or alkalis.
• Use other indicators such as litmus to identify solutions that are acidic, alkaline or neutral. • Use Universal Indicator to measure the pH of common substances. • Create a 'rainbow' of colours using Universal Indicator. • Measure the pH of solutions using a pH meter	• Interpret simple information about the use of indicators to classify solutions as acid, neutral or alkali. • Know how to use the pH scale. • Know that the colours of Universal Indicator show pH values. • Know that pH can be measured electronically.
• Investigate adding dilute acids to metal carbonates. • Bubble the gas produced through limewater. • Find which metals react with dilute acids. • Collect the gas and test with a lit splint.	• Know that acids fizz with carbonates to make carbon dioxide gas. • Know that magnesium, zinc and iron react with acids to make hydrogen gas. • Recall the tests for hydrogen and carbon dioxide.
• Investigate the reactions between acid drops and bicarbonate of soda or soda toothpaste and fruit juice. • Investigate the change in pH when acid and alkali are mixed. • Find out about the contents of different types of indigestion remedies. • Compare different indigestion remedies by finding out how much acid they neutralise	• Know that neutralisation occurs when acids and alkalis are mixed. • Understand the uses of neutralisation, limited to curing indigestion and reducing the acidity of soils. • Know that excess acid in the stomach is a cause of indigestion. • Interpret simple information comparing the effectiveness of different indigestion remedies [no recall expected].

Related Can-Do Tasks (9) I can use a measuring cylinder to measure volume. (17) I can carry out a test to show the presence of carbon dioxide.
(18) I can use Universal Indicator to find pH.

Possible Practical Activity What pH do different solutions have and how can we group them?

C2 COOKING AND CLEANING

Suggested Activities and Experiences	Content Statements
• Survey of the different types of food. • Look at different ways to cook food e.g. boiling, frying, grilling, steaming, oven, microwave. • Heat water contained in a block of ice shaped as a beaker in a microwave and watch the water boil. • Cook food using different methods to show chemical changes.	• Know two examples of foods that can be eaten raw. • Know examples of different ways to cook food (limited to boiling, frying, grilling, steaming, microwave and use of conventional oven). • Understand why food is cooked limited to improving texture, taste, flavour, making it easier to digest and killing microbes. • Know that the cooking food is an example of a chemical change. • Understand that a chemical change takes place if a new substance is formed and the process is not reversible.
• Investigate the effect of heat on baking powder. • Find out how baking powder is used in making cakes and making dough rise. • Make carbon dioxide using baking powder and vinegar, by fermentation and in pizza dough. • Collect and test the gas from activated yeast.	• Know that carbon dioxide is made when baking powder is heated. • Know that baking powder is a rising agent used in making cakes. • Be able to make a plan to compare different types of baking powder. • Know that yeast reacts with sugar to make carbon dioxide, and this is called fermentation. • Know that fermentation produces alcohol used in making beer and wine.
• Make soap. • Clean stains with detergents and soap. • Research and report about how detergents works • Survey (home or school) of which cleaning agents are used.	• Know that soap is made from animal fat or plant oils. • Know that synthetic detergents are made from chemicals found in crude oil. • Interpret simple diagrammatic representations showing how detergents can aid the removal of grease from a surface. • Interpret simple data relating to the effect of different cleaning agents [no recall expected].
• Investigate the effectiveness of biological washing powders. • Model the enzyme ‘lock and key’ • Find out about the contents of different washing powders. • Research about allergies to biological wash powders. • Find out about wash labels on fabrics.	• Understand why enzymes are added to washing powders. • Recall that biological washing powder contains enzymes. • Recall that some people are sensitive to biological washing powders. • Interpret information on biological and non-biological wash powders [no recall expected]. • Be able to interpret simple wash labels.

Related Can-Do Tasks (9) I can use a measuring cylinder to measure volume.
(17) I can carry out a test to show the presence of carbon dioxide.

Possible Practical Activity How much gas is released when baking powder is heated (different temperatures or different amounts)?

C3 COLOURS AND SMELLS

Suggested Activities and Experiences	Content Statements
• Make coloured substances by mixing together solutions. • Make up paints from powder. • Test how well paints cover different materials.	• Know that a pigment is a coloured substance used in paint. • Recall that paints contain a solvent, binding medium and pigment. • Know that paints are used to decorate or protect surfaces.
• Investigate thermochromic pigments (Middlesex University Teaching Resources) and people who use them in their jobs. • Make water based paints using pigments and pva glue, and use them to paint with. • Survey some advertisement leaflets about different types of paints. • Research different types of paints, ingredients and uses.	• Know that some paints can change colour when heated or cooled. • Recall one use of a paint that changes colour with temperature. • Know that oil paint has a pigment dispersed in oil and a solvent to dissolve the oil. • Know that water paint has a pigment dissolved in a mixture of water and a binder such as glue. • Interpret simple information on the content of paints [no recall expected].
• Investigate the action of some solvents to remove stains such as paints or nail varnish. • Investigate which solids dissolve in which solvent. • Investigate how temperature affects solubility. • Research and report on how to remove common stains.	• Understand the terms *solvent, soluble* and *insoluble*. • Know that different solids need different solvents. • Know that when a solid dissolves a solution is formed. • Understand that the amount of solid that dissolves depends on the temperature of the solvent. • Interpret simple information on the effectiveness of solvents [no recall expected].
• Find out about the range of cosmetics obtained from natural sources (e.g. Norfolk lavender). • Demonstrate extracting lavender oil by steam distillation. • Prepare an ester (e.g. ethyl ethanoate). • Discuss the properties needed by perfumes (e.g. evaporates easily, non-toxic, does not irritate skin). • Debate about 'is the testing of cosmetics on animals justified?'	• Know that many perfumes are made from natural sources. • Recall one example of a perfume made from a natural source. • Know that some perfumes are made synthetically using weak acids. • Know that perfumes have a pleasant smell. • Know that perfumes must evaporate easily. • Understand that all perfumes must be tested to ensure they are safe to use but there are different views on how they should be tested.

Related Can-Do Tasks (19) I can make a paint sample and prove that it works.
(26) I can use a thermometer to measure temperature accurately.

Possible Practical Activity How much salt dissolves in water of different temperatures?

C4 HEAVY METAL?

Suggested Activities and Experiences	Content Statements
• Extract unreactive metals from the Earth by panning, e.g. copper from a mixture of copper turnings and sand. e.g. 'gold' (brass or tin turnings) from sand. • Research facts and uses of gold. • Discuss the use of hallmarks. • Find out about allergies some people have to metals.	• Know that gold, silver and platinum can be found as metals in the Earth. • Know that panning can be used to obtain gold from rock. • Know that gold, silver and platinum are expensive, shiny and are heavy metals. • Understand that their lack of reactivity makes gold, silver and platinum suitable for jewellery. • Know that some jewellery is coated in gold to avoid allergic reaction to the metal that is coated.
• Extract copper by heating malachite and carbon. • Research some uses of copper • Discuss why recycling is cheaper than mining it (e.g. no mining costs, less processing and transport, less energy to make a product).	• Know that copper can be extracted by heating its ore with carbon. • Know that recycling copper is cheaper than making copper and that it saves resources and energy.
• Copper plate a nail. • Look at examples of electroplated metals. • Compare the physical properties of iron and aluminium by data search and/or by experiment. • Research uses of aluminium and iron.	• Understand that electroplating some metals with silver, gold or platinum enables cheaper jewellery to be made. • Know uses of electroplating, limited to silver plated cutlery and chromium plated steel. • Be able to describe similarities and differences between the properties of iron and aluminium, limited to: – iron is more dense than aluminium – iron is magnetic; aluminium is not – iron corrodes (rusts) easily and aluminium does not.
• Investigate the corrosion of aluminium and iron using different conditions e.g. salt water, acid rain and moist air. • Find out about corrosion prevention on large structures such as the Eiffel tower or Forth Road Bridge. • Discuss the advantages and disadvantages of aluminium cars e.g. the Audi A5.	• Know that rusting needs iron, water and oxygen. • Know that salt water speeds up rusting. • Know one advantage and one disadvantage of making cars from aluminium. • Interpret simple information about metals used to make cars [no recall expected].
• Find data about the amounts of metal ores remaining in the Earth's crust. • Research how much your local council recycles.	• Know that metals are a finite resource. • Understand why metals are worth recycling. • Interpret information on the recycling of materials [no recall expected].

Related Can-Do Tasks
(7) I can identify some common metals; iron (using a magnet), copper, aluminium and lead (by sight and touch).
(29) I can extract a sample of copper from its ore.

Possible Practical Activity How does increasing the current (or time) affect the mass of metal deposited by electrolysis?

C5 FIBRES AND FABRICS

Suggested Activities and Experiences	Content Statements
• Examine fibres and fabrics using eye and microscope. • Solve a mock crime from clues on fibre samples. • Produce a display on using natural and synthetic fibres. • Survey garment labels to find the fibres used in clothes and where they come from.	• Know that some fibres are natural to include cotton from cotton plants and wool from sheep. • Know that some fibres are synthetic, to include nylon, polythene and polyester, and are made by chemical reactions. • Be able to give examples of where artificial fibres have replaced natural fibres e.g. tents, sails and outdoor clothing. • Know that garment labels provide information on composition and care. • Interpret information from garment labels [no recall expected].
• Discuss the factors involved in buying clothing. • Test the strength of fibres. • Test the stretchiness of fibres. • Research how breathable fabrics work. • Test different materials for waterproofing e.g. cotton, waxed cotton, nylon and Gore-Tex®. • Present results as bar charts.	• Be able to relate given properties of fibres or fabrics to their uses in clothing [no recall expected]. • Interpret simple data on testing the stretchiness of fibres or fabrics. • Know one advantage and one disadvantage of waterproof clothing. • Know that fabrics such as Gore-Tex® are waterproof and breathable. • Understand that using Gore-Tex® type materials is an advantage in outdoor activities. • Interpret data about waterproof fabrics [no recall expected].
• Investigate which chemicals provide flameproofing. • Match fabrics to uses based on information about their resistance to catching fire. • Find out about people who use waterproof or flameproof clothing.	• Know that certain chemicals can help make clothes more flameproof. • Understand why flameproof fabrics are used. • Interpret simple data relating the properties of materials to their use as waterproof or flameproof clothing [no recall expected].
• Compare different types of plasters e.g. cotton / latex / hypoallergenic. • Watch a presentation or video about the uses of fibres or fabrics in health care such as stitching wounds, wound dressing, spare parts for surgery. • Compare the advice to patients on a range of wound dressings from pharmacy stores.	• Know that a fibre or fabric used in, or on, a patient must not harm the body. • Interpret simple data about the use of fibres or fabrics in heath care [no recall expected].

Related Can-Do Tasks (6) I can add results to a bar chart.
(20) I can make measurements to test a property of a fibre or fabric.

Possible Practical Activity How (strong or stretchy) are different fibres?

C6 CLEAN AIR?

Suggested Activities and Experiences	Content Statements
• Compare charts showing the composition of polluted and unpolluted air. • Watch a demonstration to show that not all of the air is reactive. • Draw pie charts to show the composition of the atmosphere.	• Know that the Earth is surrounded by a mixture of gases called the atmosphere. • Know that the atmosphere contains about 80% nitrogen and 20% oxygen. • Know that there are smaller amounts of water vapour, carbon dioxide and other gases in the air.
• Collect particles from the air in various sites with a simple home-made dust collector (double-sided sticky tape on a slide). • Burn small samples of fuels and compare the quantities of soot (carbon particles). • Design a poster describing the main causes of global warming.	• Know that fuels contain carbon, which forms carbon dioxide when the fuel burns. • Know how to test for the presence of carbon dioxide. • Know that the amount of carbon dioxide in the atmosphere is slowly increasing. • Know that the increasing levels of carbon dioxide is linked to global warming.
• Demonstrate that carbon dioxide and water form when fuels burn. • Research and present information on air pollution and health. • Look at maps showing levels of nitrogen oxides across a region. • Survey the number of asthma sufferers (class / form / school / family).	• Know that burning fuels may add harmful chemicals into the atmosphere. • Know that these harmful chemicals are called pollutants. • Interpret simple public information about air quality [no recall expected]. • Understand some of the problems these pollutants cause limited to nitrogen oxides (breathing problems and acid rain) and carbon particles (lung damage).
• Demonstrate (in a fume cupboard) burning sulfur in a gas jar, adding water and testing the pH to show SO_2 dissolves to form an acidic solution. • Produce a poster on acid rain.	• Know that fossil fuels contain small amounts of sulfur which are released as sulfur dioxide when the fuel is burnt. • Recall that sulfur dioxide is a cause of acid rain.
• Discuss the use of ventilation, extractor fans and air-conditioning systems e.g. clean rooms for electronic silicon wafer manufacture, operating theatres. • Look at the results from an MOT test on a car and work out why it has failed the test. • Research ways in which atmospheric pollution from motor vehicles can be reduced e.g. use more efficient engines, use low sulfur fuels, use catalytic converters, and have laws and tests on cars.	• Know that nitrogen and oxygen from the air can make nitrogen oxides in a car engine. • Recall that a catalytic converter gets rid of pollutants like nitrogen oxides. • Interpret simple data on the removal of pollutants from car exhausts. • Be able to state the benefits and drawbacks of using catalytic converters. • Know that exhaust gas emissions are part of an MOT vehicle test.

Related Can-Do Tasks (13) I can read data from a graph.
(17) I can carry out a test to show the presence of carbon dioxide.

Possible Practical Activity Does the amount of carbon particles decrease with distance from a road?

C7 STRONG STUFF

Suggested Activities and Experiences	Content Statements
• Discuss the materials needed to make a mountain bike and divide these into metallic and non-metallic materials. • Compare the simple properties of metals and non-metals. • Compare the ease of melting solder and pure lead or pure tin. • Demonstrate making an alloy of solder (in fume cupboard) by melting 60% lead and 40% tin. • Produce a poster to show uses of alloys / what elements are in different alloys. • Discuss the use of alloys in everyday life, e.g. bike frames, coins and window frames. • Investigate / demonstrate nitinol – a smart alloy.	• Understand the physical properties which distinguish metals from non-metals limited to conductivity (heat and electricity), hardness, strength, flexibility and ductility. • Know that an alloy is a mixture of two or more elements, at least one of which is a metal. • Know the names and one use of the alloys: steel, solder, aluminium alloy and brass. • Understand the term 'smart' alloy. • Know that the properties of alloys are different from the properties of the metals from which they are made.
• Compare the hardness of different rocks by rubbing them together. • Link hardness of minerals to Moh's scale. • Research the cost of minerals / gems used to make jewellery.	• Interpret information linking the properties of materials to their uses [no recall expected]. • Be able to use a key to rank materials in order of hardness. • Know that some hard minerals are used for making jewellery.
• Discuss the use of rocks as raw materials, e.g. building houses, road construction. • Make mortar and concrete using cement. • Compare air dried and kiln dried bricks make from clay. • Compare the strength of different samples of concrete	• Know that granite, limestone and marble are raw materials extracted from the Earth. • Understand that granite, limestone and marble are used as building materials because they are strong and hard. • Know that bricks are made from clay. • Know that concrete is made from cement, sand and small stones. • Be able to compare the strength of different types of concrete.
• Compare tennis rackets made from carbon fibre, metals and wooden frames. • Study data of different materials and make predictions about the suitability of particular materials for different uses. Produce a display about materials used for sports. • Make and compare reinforced concrete using iron nails to normal concrete.	• Know that wood, metals and carbon fibre are used in sports equipment. • Be able to give an advantage and disadvantage of using wood, metal and carbon fibre for sports equipment. • Know that a composite material contains at least two different materials. • Know one use for each of the composite materials: GRP, reinforced concrete and plywood. • Interpret simple data comparing the properties of different materials [no recall expected].

Related Can-Do Tasks
(9) I can use a measuring cylinder to measure volume.
(30) I can make and then test a sample of concrete for its strength.

Possible Practical Activity How does changing the amount of cement alter the strength of concrete?

C8 RESTLESS EARTH

Suggested Activities and Experiences	Content Statements
• Watch presentation or video clips showing an earthquake or volcano. • Make a model of the Earth's structure (e.g. cut up peach / nectarine) • Use ICT and/or other information sources to construct a global map showing where volcanoes and earthquakes happen. • Plot major earthquakes and volcanoes onto a map showing plate boundaries.	• Know that the Earth is a sphere with a core, mantle and thin rocky crust. • Know that the rocky crust and upper mantle together is split into sections called tectonic plates. • Know that volcanic activity and earthquakes are linked to the movement of tectonic plates. • Interpret simple data linking the position of earthquakes and volcanoes to the edges of tectonic plates.
• Find and watch an earthquake wave simulation. • Model an earthquake with bricks and a heavy elastic cord. • Make an advice leaflet for people living in earthquake zones. • Discuss the difficulty of predicting earthquakes.	• Know that large amounts of energy can be released in an earthquake. • Recall that underwater earthquakes may create tsunamis. • Recall possible effects of earthquakes on people and wildlife. • Understand some actions that public authorities can take to reduce damage caused by earthquakes. • Know that it is not possible to predict when earthquakes might happen.
• Make a model volcano. • Compare the crystal size in different igneous rocks • Grow crystals by cooling molten salol at different temperatures. • Produce a poster about the risks and benefits of living near an active volcano	• Know that molten rock under the surface of the Earth is called magma. • Know that molten rock erupts from volcanoes and is called lava. • Know that igneous rocks form when molten rock cools down. • Understand that igneous rocks, which have formed slowly, have large crystals (and vice-versa). • Know the risks and benefits of living near an active volcano.
• Consider evidence for Wegener's theory of continental drift. • Discuss some of the reasons why Wegener's theory was rejected at the time (movement not detectable; Wegener not a geologist; there were already simpler explanations). • Discuss that new evidence (sea floor spreading / subduction) has persuaded scientists to accept plate tectonic theory.	• Understand some of the evidence for continental drift (limited to jigsaw fit of continents, matching rocks and fossils). • Know that Wegener's idea of moving continents was not immediately accepted by scientists. • Recall that lots of new evidence later showed Wegener was right.

Related Can-Do Tasks
(26) I can use a thermometer to measure temperature accurately.
(31) I can find the locations of ten earthquakes or volcanoes and put them on a map.

Possible Practical Activity How does the temperature of water (in a beaker) affect the time taken for wax (in a boiling tube) to melt?

C9 HOW FAST? HOW SLOW?

Suggested Activities and Experiences	Content Statements
• Watch video clips of fires (including chip pan fires), rusting and explosions to illustrate different rates of chemical reactions. • Video clip (or demonstration) of flour/ *Lycopodium* explosions. • Look at reactions and separate them into fast and slow reactions. • Look at the application of rate of reaction in everyday life (e.g. speed of cooking with a pressure cooker, slowing up rusting, rate of dissolving tablets for medicinal use).	• Know that the rates of chemical reactions can vary greatly. • Interpret simple visual images showing different rates of chemical reactions. • Know that a reaction stops when one of the reacting substances is used up. • Know ways of monitoring the progress of a reaction. • Know that the rate slows as a reaction proceeds.
• Investigate the effect of temperature on the speed of dissolving indigestion tablets. • Investigate the effect of temperature when baking powder is added to vinegar.	• Interpret information from charts and graphs about rates of reaction. • Know that increasing temperature usually speeds up chemical reactions. • Know that lowering the temperature (in a refrigerator or freezer) slows down the changes that make food go bad.
• Investigate the effect of concentration on reaction time, e.g. magnesium ribbon and hydrochloric acid, resin and hardener in car body filler.	• Know that increasing the concentration increases the speed of a chemical reaction. • Be able to label simple laboratory apparatus used to find out about rates of reaction: limited to beaker, flask, measuring cylinder, thermometer, stirring rod, test tube, gas syringe, top pan balance, stop clock/digital watch.
• Investigate the effect of particle size on reaction time, e.g. magnesium and hydrochloric acid.	• Know that the rate of reaction is increased when several small lumps of solid are used rather than a few large lumps. • Understand that a difference in the rate of reaction can be explained by a difference in the surface area.
• Investigate the effect of metal oxides as catalysts on a solution of hydrogen peroxide and washing up liquid. • Design a poster to show how different factors affect reaction rate.	• Know that catalysts can alter the rate of a reaction but are not used up in the reaction. • Interpret simple information on the use of different catalysts [no recall expected]. • Understand how particle collisions can be used to explain reaction rates.

Related Can-Do Tasks

(8) I can measure reaction time.
(9) I can use a measuring cylinder to measure volume.
(26) I can use a thermometer to measure temperature accurately.
(32) I can measure time accurately e.g. to time a chemical reaction.

Possible Practical Activity How does temperature or concentration or the size of particles affect reaction rate?

C10 SORTING OUT

Suggested Activities and Experiences	Content Statements
• Look at various ways to separate mixtures in everyday life e.g. sieves, vacuum cleaner filters, car air-intake filters. • Choose how to separate a mixture (by dissolving and filtering), e.g. salt and sand. • Discuss how filtering works. • Discuss how filters separate different types of mixtures, e.g. air filters, extracting poison from air, tea bags and coffee filters. • Investigate the best paper for tea bags or coffee filters.	• Know that a mixture contains two or more uncombined substances. • Know that mixtures contain substances that can be separated from each other. • Be able to plan how to separate a soluble substance (e.g. salt, copper sulfate or sugar) from an insoluble substance e.g. sand by dissolving and filtration. • Know that filtering can be used to separate a solid from a solution.
• Use chromatography to solve a simple forensic problem or to investigate food colours. • Use and make chromatograms. • Investigate which metals are magnetic. • Make a poster about uses of magnets.	• Know how chromatography is used to separate mixtures into their constituents. • Interpret simple chromatograms. • Know that magnetism can be used to separate iron from a mixture of iron and aluminium. • Know iron and steel are magnetic and give some uses: limited to motors, compasses, credit card strips, and fridge doors.
• Demonstration of the use of a centrifuge. • Watch a presentation about the separation techniques used in hospitals: – dialysis uses thin membrane to separate the waste in blood – centrifuging used to separate a suspended solid from a liquid.	• Know that decanting can be used to separate a solid in a suspension. • Know how to use centrifuging to separate mixtures. • Know one medical application for each of centrifuging and dialysis. • Know that dialysis is used to remove salts from blood. • Interpret simple information about the use of dialysis in the population [no recall expected].
• Investigate the freezing and boiling point of pure water, and how impurities such as salt affect this. • Discuss why rock salt is used on roads in winter. • Look at how height above and below sea level affects boiling point.	• Know that pure water freezes and melts at 0°C. • Know that pure water boils and condenses at 100°C. • Interpret information about melting points and boiling points [no recall expected].
• Watch a video about the use of distillation in industry. • Distil pure water from salt water.	• Know that distillation can be used to obtain fresh water from sea water. • Understand that distillation is used to separate liquids with different boiling points. • Know that distillation is used to produce some alcoholic drinks, e.g. whisky.

Related Can-Do Tasks
(5) I can separate a simple mixture e.g. iron from aluminium or salt from sand.
(21) I can make a chromatogram.

Possible Practical Activity How does adding salt affect the boiling point of water?

C11 CSI PLUS

Suggested Activities and Experiences	Content Statements
• Observe evidence at a crime scene, then again after it has been tampered with. • Practise collecting evidence without contaminating or mixing it up. • Discuss the types of evidence that could be left at a crime scene.	• Know that anyone present at a crime scene will leave some evidence behind. • Understand why crime scene investigators wear special clothing to avoid leaving evidence at a crime scene. • Know how an investigator collects evidence at a crime scene – in precisely labelled evidence bags.
• Use sealed jars containing iodine crystals to develop prints on filter paper. • Dust for prints using fine aluminium powder. • Investigate the best method to take fingerprints from different surfaces. • Use ink pads to make a record of fingerprints.	• Know fingerprints are left on a surface because oils from the skin are deposited. • Recall how dusting a surface with a special powder can make fingerprints show up. • Recall how fingerprints can be removed from a surface. • Know how to make a record of a person's fingerprints.
• Research the main ways of classifying fingerprints • Compare fingerprints to recognise simple arches, loops and whorls. • Discuss why the police keep fingerprints from convicted criminals on file, but not from innocent people.	• Understand that innocent people have their fingerprints taken for elimination. • Recognise loop, arch and whorl as features of fingerprints. • Know that no two people have identical fingerprints – not even identical twins.
• Make a model of blood e.g. pop bottle containing water, dried peas, red lentils. • Research the different blood groups, and blood transfusions. • Discuss why people volunteer to be blood donors, and why some people cannot give blood.	• Know that blood contains red blood cells, white blood cells, platelets and plasma. • Recall that the main blood groups are A, B, AB and O.
• Separate dyes using chromatography e.g. in a made up solution containing different dyes. • Compare inks from a forged cheque.	• Know how chromatography can be used to separate colours in ink. • Understand how the results of separating colours can identify a particular ink as being used e.g. to write a forged cheque.
• Make a simple model of a DNA double chain using twisted pipe cleaners. • Produce a poster showing evidence from a made up crime scene.	• Recall that DNA is inherited from parents. • Know that identical twins have identical DNA but otherwise DNA is unique. • Interpret data from a crime scene and decide whether or not it confirms a suspect's presence.

Related Can-Do Tasks (10) I can take a set of fingerprints.
(21) I can make a chromatogram.

Possible Practical Activity Collect and analyse data from a (made up) crime scene to decide if a suspect is guilty.

C12 FUELS

Suggested Activities and Experiences	Content Statements
• Watch a demonstration of distillation of artificial crude oil in the laboratory. • Watch a demonstration that some fuels catch fire more easily than others. • Make a virtual visit to an oil refinery on the internet or watch a video about refining. • Make models of hydrocarbon chains of various lengths.	• Know that crude oil is a toxic, dark, sticky liquid. • Know that crude oil is a mixture that is separated into more useful parts at an oil refinery. • Know that petroleum gases, petrol, kerosene and diesel come from crude oil. • Know that hydrocarbons are only composed of hydrogen and carbon. • Recall that crude oil is made mainly of hydrocarbons in chains of varying length.
• Investigate the ease of lighting small samples of different fuels. • Construct a presentation or display matching each of the fractions to their uses.	• Understand that some fuels ignite more easily than others do and that this is important for their uses. • Know the uses of these fuels: – petroleum gases, such as propane, in portable gas cylinders – petrol in cars – kerosene in airplanes – diesel in lorries, buses, trains and cars. • Know that burning fuels produces energy for heating, transport and making electricity in power stations.
• Compare the advantages of different fuels – solids, liquids and gases. • Burn a fuel and use the energy to heat water. • Compare the energy values of various fuels.	• Be able to label the apparatus used to find out how much energy a flame gives out. • Interpret data to decide which fuel gives out most energy when the same amount burns.
• Look at advice to the public about carbon monoxide poisoning and how to avoid the accidents that it can cause. • Examine a carbon monoxide detector and the instructions for its use.	• Know that carbon monoxide forms when fuels from crude oil burn in a limited supply of air. • Know that carbon monoxide is a poisonous, colourless gas with no smell. • Interpret information about carbon monoxide poisoning.
• Compare information for customers about diesel cars and petrol cars e.g. fuel consumption, 0–60 mph time, pollution and cost. • Watch or read news reports about a way of reducing pollution from burning fuels.	• Give one advantage and one disadvantage of petrol and diesel for transport. • Interpret simple information about the use of different fuels [no recall expected]. • Understand that people can make choices about which fuels to use.
• Make polymer chains from monomer paper clips. • Find the names of different monomers and link these to the polymer names	• Know that plastics are made from small molecules called monomers. • Know that lots of monomers join together to form a long chain polymer.

Related Can-Do Tasks (22) I can make a poster to warn about the dangers of carbon monoxide poisoning.
(32) I can measure time accurately (e.g. to time a fuel burning).

Possible Practical Activity Which fuel gives out most energy when the same amount burns?

C13 WHAT'S ADDED TO OUR FOOD?

Suggested Activities and Experiences	Content Statements
• Look at food labels to see what additives they contain. • Look at food labels to see which types of food contain antioxidants, flavour enhancers and food colourings. • Discuss the advantages and disadvantages of using food additives. • Match E numbers to their job. • Research and make a poster about food allergies.	• Know that some foods contain chemicals put there by people and that these are called additives. • Know that there are different types of food additives: limited to antioxidants, flavour enhancers and food colours. • Know that food additives have to be tested and are given E numbers before they can be used. • Know that some additives may be harmful to some people. • Interpret information about food additives [no recall expected].
• Compare methods of stopping apple slices going brown in the air. • Investigate the effect of different antioxidant solutions on peas over a few days.	• Know that oxygen from the air can affect food. • Understand that antioxidants preserve food by stopping the effects of oxygen. • Interpret information on simple experiments to show the effect of oxygen (or its absence) on foods [no recall expected].
• Look at the information for users in packs of vitamin C tablets. • Check the vitamin C content of a typical diet to see if a vitamin supplement is needed. • Measure the vitamin C content (using dcpip solution) of different foods before and after cooking or in different fruit juices.	• Know that vitamins are added to certain foods to supplement the diet. • Be able to compare information about a person's diet with the recommended daily intake of a vitamin [no recall expected]. • Know how to test the vitamin C content in different foods.
• Compare the energy values of portions of food or drink with sugars or artificial sweeteners. • Look at information about changes in the energy in the diet and patterns of obesity. • Present an advice sheet about the dangers of excess sugar.	• Know that sugar is a natural sweetener. • Understand that too much sugar in the diet can be harmful to health. • Know that diet drinks and some slimming foods contain artificial sweeteners.
• Evaporate and crystallise salty water to obtain salt crystals. • Extract salt from rock salt. • Find out about the environmental impact of mining. • Present an advice leaflet about the dangers of eating too much salt.	• Know that salt (sodium chloride) is used in the food industry for flavouring and as a preservative. • Recall that salt can be obtained from the sea or from underground salt deposits. • Understand that the methods of obtaining salt can have an impact on the environment. • Recall the health implications of eating too much salt.

Related Can-Do Tasks (22) I can make a poster to warn about the dangers of excess sugar or salt.
(33) I can do a test to compare the quantities of vitamin C in fruit juices.

Possible Practical Activity How does vitamin C change during cooking in different foods?

P1 GETTING THE MESSAGE

Suggested Activities and Experiences	Content Statements
• Play a game of Chinese Whispers. • Send a coded message by hand signals. • Investigate mobile phone 'texting'. • Investigate the range of spoken messages in the playground.	• Know that coding a message increases its security. • Know that errors can happen when messages are sent. • Recall that light travels through space at a speed of 300 000 km/s. • Understand how using light allows messages to be transmitted quickly.
• Examine a remote control device and use an infrared detector to show that infrared is emitted from it. • Discuss how the everyday life of a student would be different without a mobile phone.	• Know that household remote control devices use infrared radiation. • Know that wireless communication devices use radio waves. • Understand the advantages of wireless technology for radio, mobile telephones and laptop computers.
• Compare mobile and fixed phones. • Find out how the mobile phone system works. • Discuss the advantages and disadvantages of wireless links for computers. • Write a letter to the Headteacher to protest at the mobile phone mast he wants to install at school.	• Recall that mobile phones use microwave signals. • Know that there is some concern amongst scientists about children using mobile phones. • Know ways of reducing the risk of using mobile phones: limited to shorter time of use, hands free kit, texting. • Understand that microwave aerials need to be sited close together or high up because they must be in 'line of sight'. • Understand reasons for and against the siting of mobile phone masts. • Interpret information about siting of mobile phone masts [no recall expected].
• Use a rope to demonstrate a transverse wave and identify its features. • Examine the motion of a floating object in a water tank to show that the water does not move in the same direction as the wave. • Use an oscilloscope and microphone to look at voice patterns.	• Know that a wave transfers energy without transferring matter. • Know that analogue signals have a continuously variable value. • Know the main features of a transverse wave: – wavelength – frequency – amplitude.
• Send a Morse code message by turning a lamp on and off. • Find out about historical uses of using light or sound for communication e.g. semaphore, ASDIC. • Investigate making smoke signals. • Investigate binary code. • Contrast vinyl analogue music with digital music.	• Know that digital signals are either on (1) or off (0). • Know that Morse code uses a digital code. • Recall that sound and images can be transmitted digitally. • Know that the main reason for switching to digital television and radio is the improved quality of picture and sound. • Recall that modern IT equipment relies on digital signals.

Related Can-Do Tasks (12) I can produce a poster on the safe use of mobile phones.

Possible Practical Activity Investigate how the number of errors in a nonsensical message sent by Chinese Whispers changes with the length of message or number of people.

P2 OUR ELECTRICITY SUPPLY

Suggested Activities and Experiences	Content Statements
• Make a fruit battery and investigating its properties. • Make a chemical battery. • Discuss appropriate uses for different batteries.	• Know that electricity is 'made' by chemical reactions in a battery. • Know that two different metals are needed for the terminals of a battery. • Be able to choose suitable batteries for different situations.
• Watch an animation showing how a power station works. • Find out about the parts of a power station. • Model a power station with a bicycle dynamo or steam engine. • Discuss the reasons why only 1% of energy in coal used in a power station ends up as light from a bulb in the home. • Investigate the implications of global warming.	• Recall that crude oil, coal and natural gas are fossil fuels used in power stations. • Understand that every power station needs an energy source. • Know the main stages in the production of electricity: – heat from the energy source changes water into steam – the steam is used to rotate turbines – turbines turn a generator – the generator produces electricity. • Understand that energy is wasted at each stage. • Recall that burning fossil fuels produces carbon dioxide which is a greenhouse gas. • Know that greenhouse gases contribute to global warming.
• Assemble and test transformers with AC supplies and oscilloscopes. • Demonstrate a model transmission line system. • Design a leaflet to warn of the dangers of transformers or overhead power lines.	• Know that electricity is transferred from a power station through a grid of high voltage transmission lines. • Understand that transformers are required at either end of the transmission lines to increase or decrease voltage. • Know that a transformer is two coils of wire wound onto a core of iron.
• Discuss electricity bills and meters and economy – e.g. TV on 'standby'. • Demonstration of electricity meter. • Worksheet related to paying for electricity and how long each item will run for one unit.	• Know that we pay for electricity by the unit. • Know that some appliances use more electricity than others. • Be able to read a digital electricity meter. • Interpret data on an electricity bill: how many units have been used. • Know ways of reducing energy loss from the home. • Interpret data for different energy saving strategies [no recall expected].

Related Can-Do Tasks (23) I can read a domestic electricity meter.

Possible Practical Activity Investigate how the distance between the electrodes of a fruit battery affects the voltage produced.

P3 ATTRACTIVE FORCES

Suggested Activities and Experiences	Content Statements
• Test materials to see if they are magnetic. • Investigate games using magnets (fishing, theatre). • Use iron filings to see magnetic fields. • Find where magnetic fields are strongest and weakest on a bar magnet. • Find the magnetic field of a magnet by using iron filings.	• Know that iron and steel are magnetic. • Know how to induce magnetism in a pin. • Know that magnets attract magnetic materials: limited to iron and steel. • Know that like poles repel and unlike poles attract. • Know how iron filings or a compass can be used to show up a magnetic field.
• Make a compass. • Use a compass to plan a route around a school. • Follow a route using a compass. • Find out about the Earth's magnetic field. • Use the internet to find out about the 'Northern Lights'.	• Know that a freely swinging magnet comes to rest in a N-S direction. • Recall that the Earth has a magnetic field around it. • Understand how a compass works and why it is so useful. • Know that the Earth's magnetic field protects us from cosmic rays. • Interpret information about the effects of cosmic rays on the Earth [no recall expected]. • Know that the 'Northern Lights' are caused by the interaction between cosmic rays and the Earth's magnetic field.
• Make and use a loudspeaker.	• Know that a current-carrying wire behaves like a magnet. • Know that increasing the current or number of turns wrapped onto a coil increases the strength of a magnet. • Be able to label the magnet, core and cone in a loudspeaker. • Be able to plan how to compare how the number of turns on the coil (or strength of magnet) affects how well a loudspeaker works.
• Make a pin magnetic using: (i) a permanent magnet (ii) a current-carrying wire. • Make an electromagnet and use it to sort aluminium and steel drinks cans. • Devise ways of improving the electromagnet.	• Know how to construct an electromagnet. • Understand how the strength of an electromagnet depends on: – the number of turns on the coil – the current in the coil. • Understand that the core of an electromagnet is made of iron because iron is a temporary magnet. • Recall uses of electromagnets limited to: MRI scan, sorting scrap metals, lifting iron/steel/cars.

Related Can-Do Tasks (34) I can use a compass to map a magnetic field.

Possible Practical Activity Investigate the relationship between current in the coil of an electromagnet and the number of paper clips it will pick up.

P4 PUSHES AND PULLS

Suggested Activities and Experiences	Content Statements
• Explore the size and feel of a range of forces. • Investigate types and operation of screwdrivers, spanners, levers etc. • Make and testing a newtonmeter (spring-balance). • Measure gravity force using a newtonmeter. • Test the breaking strain of a fishing line.	• Recall that forces can be pulls, pushes, twists or bends. • Recall that forces are measured in newtons. • Understand that unbalanced forces change the motion of an object.
• Measure the speed of falling objects. • Make parachutes. • Investigate gliders and airplanes.	• Know that gravity is a force pulling things towards the Earth. • Understand that weight is due to the force of gravity. • Know that falling objects are acted on by gravity and drag. • Understand the effect of air resistance on falling objects. • Know that falling objects can reach a maximum speed.
• Make model bungee ropes and test them. • Look at the design of cushioned trainers.	• Know that an increased force increases the length of an elastic material. • Know that a stretched elastic band exerts a force. • Know that elastic materials return to their original shape unless the force becomes too big.
• Watch a road safety video. • Talk about the links between traffic speed and injury. • Build crumple zones on model cars and test them.	• Know that crumple zones in vehicles reduce the impact force. • Know that air bags and seatbelts reduce impact forces for occupants. • Know traffic speed can be reduced e.g. speed humps, chicanes, speed cameras. • Interpret information about the relative effects of traffic calming measures [no recall expected]. • Recall and be able to use speed = distance ÷ time.
• Discuss how gravity needs to be overcome to put objects into space. • Test a compressed air and water rocket. • Find out about chemically-fuelled rockets used in firework displays.	• Know that large rockets are needed to put things in space. • Know that some parts of some rockets/shuttles return to Earth and can be reused. • Know that many objects burn up in the atmosphere.

Related Can-Do Tasks

(24) I can use a newtonmeter to measure force.
(35) I can measure the speed of a moving object.
(32) I can measure time accurately (e.g. to time a chemical reaction).

Possible Practical Activity Investigate the relationship between the surface area of a parachute, or the mass on a parachute, and the time taken for it to fall.

P5 LET THERE BE LIGHT!

Suggested Activities and Experiences	Content Statements
• Recognise the difference between luminous and non-luminous objects.	• Recall that luminous objects produce their own light. • Understand that non-luminous objects are only seen because they reflect light from other sources. • Interpret information about the link between the temperature of stars and their colour [no recall expected]. • Know that you can see things when light from them reaches the eye.
• Look in a mirror and recognise the orientation of the image. • Make mirror writing and symmetrical drawings. • Count the number of images in **two** mirrors held at different angles to each other.	• Know that rays of light travel in straight lines. • Be able to complete a diagram to show how light reflects from a mirror. • Know that smooth shiny surfaces reflect light to give a clear reflection. • Know that the image in a mirror is the same way up and the same size as the object but is the other way around.
• Draw diagrams of parallel rays of light passing through lenses and/or being reflected by mirrors. • Examine simple optical instruments to see what the lens does in each of them.	• Recall that light changes direction when it passes from one material into another. • Be able to complete a diagram to show how a convex (converging) lens forms an image on a screen. • Recall uses of convex lenses limited to: spectacles for long sight, camera, projector, magnifying glass, telescope.
• Find out about total internal reflection with Perspex blocks and ray boxes. • Discuss the uses of optical fibres for communication. • Investigate the operation of 'cats eyes'. • Use optical fibres to send messages in code.	• Know that light can be totally reflected from a transparent surface. • Understand how light travels along an optical fibre from one end to the other by reflection. • Know that optical fibres transmit data very quickly. • Understand that using light for communication requires the use of digital code.
• Investigate the effect of shining different coloured lights onto a white screen. • Look at the appearance of different coloured objects in different coloured lights. • Discuss the difference between the primary colours for light and the primary colours for paint.	• Recall the primary and secondary colours for light. • Know how two primary colours are combined to form a secondary colour: – red + blue = magenta – blue + green = cyan – green + red = yellow. • Know that all three primary colours add to form white light.

Related Can-Do Tasks (11) I can write a message in mirror writing.

Possible Practical Activity Investigate the relationship between the angle of incidence and the angle of reflection for a plane mirror.

P6 FINAL FRONTIER

Suggested Activities and Experiences	Content Statements
• Find out about our Sun. • Find out the name of the nearest stars to our Solar System.	• Know that Space contains many stars of which the Sun is one. • Know that the Sun is at the centre of our Solar System. • Know that the Sun is a source of light. • Know that it is dangerous to look at the Sun.
• Make a simple model of the Solar System. • Devise a mnemonic to remember the names of the planets in our solar system.	• Know the order of the eight planets in the Solar System. • Know that the Earth orbits the Sun. • Understand that other planets take longer/shorter times to orbit the Sun if they are further/nearer to the Sun. • Recall that the Earth moves in its orbit through space at an enormous speed. • Interpret information about the planets and other bodies in the Universe [no recall expected].
• Find out about the Moon. • Discuss the uses of artificial satellites. • What causes an eclipse of the Sun?	• Know that the Moon orbits the Earth. • Know that other (artificial) satellites orbit the Earth and are used for communication, mapping, spying and tracking. • Know that planets and moons reflect light which enable them to be seen. • Know that some planets have moons.
• Use the internet to find out about planets around stars other than the Sun. • Discuss the chances of life on other planets.	• Recall that the Sun is a star in the Milky Way galaxy. • Recall that there are billions of stars in the Milky Way. • Recall that there are billions of galaxies in the Universe. • Be able to compare the sizes of the Moon, the Earth, the Sun, the Milky Way and the Universe.
• Use a telescope to look at the Moon. • Discuss why you must **NEVER** look at the Sun with a telescope. • Plan a space expedition to the Moon. • Discuss what would be different if the expedition was going to Mars or to another galaxy.	• Know that astronomers use astronomical telescopes to study the sky. • Understand that light pollution and dust in the atmosphere interferes with observations by astronomers. • Recall that astronomers have discovered planets around other stars. • Understand that manned spacecraft need resources that unmanned spacecraft do not e.g. oxygen, food, water.

Related Can-Do Tasks (28) I can measure length/distance accurately.

Possible Practical Activity Using secondary data, investigate the relationship between the orbit radius of a planet and its period.

P7 ALTERNATIVE ENERGY

Suggested Activities and Experiences	Content Statements
• Research to find different energy sources. • Discuss renewable energy resources. • Investigate a hydro-electric installation. • Discuss energy needs and wants.	• Recall that the Sun is a stable source of energy. • Understand that fossil fuels are a limited energy source. • Understand that the demand for energy is increasing and this means that renewable sources will become more important. • Know that some energy sources are renewable: wind, sunlight, waves, tide, geothermal, hydro-electric, biomass. • Interpret information about the demand for energy and the availability of energy sources [no recall expected].
• Make a model windmill and investigate the angle of the blades and the use of a rudder.	• Know that wind turbines use energy from the wind to generate electricity. • Be able to evaluate windmill design in terms of blade size and use of a rudder. • Recall advantages and disadvantages of using wind turbines to generate electricity.
• Use a photocell to make electricity. • Discuss appropriate uses of photocells. • Find out how photocells can be connected to increase their voltage. • Find out how the voltage of a photocell depends on distance from a lamp.	• Know that photocells transform light into electrical energy. • Know that photocells produce direct current. • Understand that photocells are useful sources of electricity for remote locations. • Recall advantages and disadvantages of using photocells to generate electricity.
• Compare energy absorption by different coloured surfaces. • Make a model solar panel using black rubber tubing and a small water pump e.g. from a windscreen washer to circulate the water.	• Recall that radiation from the Sun can be absorbed by a surface and transferred into heat. • Be able to describe an experiment to show that black matt surfaces absorb more energy than white shiny surfaces. • Recall that solar panels have circulating water which is heated by radiation from the Sun.
• Research biomass power plants in the UK. • Make a model 'bobbing duck' to produce electricity.	• Recall that biomass can be burned to generate heat or fermented to produce methane. • Understand that tidal barrages should be sited where there is a large tidal range to obtain the most energy. • Recall that the up and down movement of water in a wave can be used to turn a turbine and so generate electricity.

Related Can-Do Tasks (13) I can read data from a graph.
(33) I can plot a line graph.
(33) I can measure length/distance accurately.

Possible Practical Activity Investigate the relationship between the distance from a light source to a photocell and the voltage produced.

P8 DEEP IMPACTS

Suggested Activities and Experiences	Content Statements
• Search the internet for photographs of asteroids. • Find out about the NASA Moon landings. • Discuss the evidence for the creation of the Moon	• Know that the Moon may be the remains of a planet which collided with Earth billions of years ago. • Know that asteroids are rocks left over from the formation of the Solar System. • Recall that large asteroids have collided with the Earth in the past.
• Search the internet for images of comets. • Calculate when a comet, such as Halley, will return.	• Know that comets are lumps of dust and ice. • Know that a comet has a tail formed from trail debris which is formed as the ice melts on its approach to the Sun. • Know that the orbit of a comet is elliptical, passing inside the orbit of Mercury and beyond the orbits of Neptune and Pluto.
• Discuss what we can tell from the elements in meteorites. • Investigate claims that comets might carry bacteria.	• Know that meteors are rocks that burn as they move through the Earth's atmosphere. • Know that meteorites are rocks from space that have landed on Earth.
• Study craters on the Moon for evidence of the early history of the Solar System. • Find out about the craters on Mars. • Find out about recent NEOs. • Discuss what we should do about NEOs.	• Know that asteroids, comets and meteors, move through space and may hit the Earth/Moon or other planets. • Know that astronomers monitor the paths of asteroids with large telescopes. • Know that a Near Earth Object (NEO) is an asteroid or comet on a possible collision course with Earth. • Understand how scientists know that an object may be on a collision course with the Earth, and why uncertainty gets smaller as the object gets closer.
• Survey the evidence for the destruction of the dinosaurs by an asteroid. • Discuss what happens when a Near Earth Object (NEO) hits the Earth. • Use different shape/sizes of balls to investigate craters in sand. • Drop marbles from different heights onto sand to investigate impact damage.	• Understand the consequences of a collision between Earth and a large NEO: ejection of hot rocks, fires, sunlight blocked by dust, climate change, species extinction. • Understand that speed and 'weight' affect the damage caused by objects. • Know that bombardment causes craters. • Interpret data showing the risk associated with possible NEO collisions [no recall expected].

Related Can-Do Tasks
(7) I can add results to a bar chart.
(28) I can measure length/distance accurately.

Possible Practical Activity Investigate the relationship between the height of an object falling into sand and the diameter of the crater produced.

P9 DRIVING ALONG

Suggested Activities and Experiences	Content Statements
• Search the internet to find a simulation of a four stroke engine. • Survey the class for types of fuel used by family cars. • Examine a spark plug.	• Know the action of a four stroke engine. • Recall that petrol, diesel, LPG, biofuel are used as fuels for transport. • Recall that a spark plug provides the source of ignition in a petrol engine. • Recall that when diesel vapour is compressed, it ignites.
• Use model pulleys, gears, wheels and axles e.g. from Lego Technic®, to construct different machines.	• Recall examples of machines and where they are used in a car limited to: pulley for fan belt, gears in gear box, wheel and axle on steering column. • Understand that machines allow a greater load to be moved for less effort. • Know that gear ratio is a measure of how much easier a machine makes the task. • Be able to calculate the gear ratio using number of teeth on driving wheel / number of teeth on driven wheel for simple ratios.
• Make a model motor.	• Be able to label a DC motor to show magnets, coil, brushes, commutator. • Recall where motors are used in cars limited to: starter, windscreen wiper. • Recall that electric cars need charging from the mains. • Know that solar powered cars have both advantages and disadvantages.
• Survey speeds outside the school by timing cars over a given distance. • Mark out thinking distances, braking distances and stopping distances on playground or field for speeds up to 100 mph. • Measure reaction time by dropping calibrated 'ruler' between fingers. • Design a poster for a road safety campaign to reduce speeding.	• Recall and be able to use: speed = distance ÷ time. • Understand that speed limits were introduced to save fuel and improve road safety. • Know that the national speed limit is 60 mph on most roads, 70 mph on motorways and dual carriageways. • Understand why speed limits are less than the national limits in towns, outside schools and other areas. • Know that thinking distance is the distance travelled between seeing danger and starting to brake. • Know that braking distance is the distance travelled whilst braking. • Know that: stopping distance = thinking distance + braking distance. • Interpret data from table of thinking, braking and stopping distances [no recall expected]. • Know that speed cameras, sleeping policemen and hazard warning signs are used to reduce speed of traffic.

Related Can-Do Tasks (8) I can measure reaction time.

Possible Practical Activity Investigate the relationship between the current in a motor and the speed of rotation using a tachometer.

P10 HOT STUFF!

Suggested Activities and Experiences	Content Statements
• Circus of energy experiments. • Record energy transfers as block flow charts. • Discuss why a lump of ice held in the hand melts and why the hand feels cold.	• Recall that energy can be transferred as heat. • Know that the main uses of heat: generating electricity, heating, cooking. • Know that heat energy flows from a hot to a cooler body. • Know that temperature is measured in ºC and that heat is measured in J.
• Examine thermograms to see where hot spots occur. • Carry out experiments to measure the energy required to change the temperature of objects.	• Understand that the energy to change the temperature of a body depends on: – its mass – the material it is made from – the temperature change. • Interpret simple data on heating/cooling experiments [no recall expected]. • Recall and use the words: *melting, boiling, freezing, condensing, evaporating.*
• Build a solar collector from aluminium foil and an umbrella.	• Know that light from the Sun is reflected to a focus by a curved mirror. • Understand that when light is absorbed by a material the energy of the material increases and it becomes hotter. • Recall that a solar furnace uses radiation from the Sun focussed by a curved mirror. • Know that a solar furnace is used for heating water which can be used for cooking or electricity generation.
• Apply the terms *conductor* and *insulator* to different materials. • Investigate the insulating properties of packaging for takeaway foods. • Compare temperature changes in insulated and non-insulated model houses. • Find optimum thickness for loft insulation.	• Know that hot air rises and is replaced by colder air. • Know that metals are good conductors of heat and that trapped air and plastics are good insulators. • Know that insulation reduces heat loss. • Understand the terms *insulator* and *conductor*. • Be able to design and carry out a test to evaluate the effectiveness of takeaway food packaging. • Interpret simple data on home insulation [no recall expected].

Related Can-Do Tasks (26) I can use a thermometer to accurately measure temperature.
(36) I can plot line graph.

Possible Practical Activity Investigate how different thicknesses of lagging affects the rate of cooling of water in a copper can.

P11 NUCLEAR POWER

Suggested Activities and Experiences	Content Statements
• Make and improve a generator.	• Know that electricity is made by changing the magnetic field through a coil of wire. • Understand that the amount of electricity can be increased by spinning the magnet faster, using a stronger magnet, using more turns of wire. • Be able to label a diagram of a generator to show magnet, coil and meter. • Know that generators in power stations use electromagnets.
• Design a radiation-proof suit. • Design a poster for use in school reminding teachers how to handle radioactive material safely.	• Understand how radioactive materials are handled safely: – keeping at a distance by handling with tongs – using shielding – using labelled storage – monitoring time of exposure – using protective clothing. • Know that exposure to radioactivity is monitored with a film badge.
• Watch an animation of a nuclear reactor to see how fission boils water in the steam generator. • Simulate the fission of a large atom into smaller radioactive atoms.	• Know that uranium is a non-renewable resource. • Know that in a nuclear power station, the uranium provides the source of energy. • Know that a lot of energy is released by the splitting of uranium atoms.
• Watch a demonstration showing the penetration of radioactivity through different materials. • Investigate different types of nuclear waste and how they are stored. • Consider the need for security of nuclear installations.	• Know that a nuclear power station produces harmful radioactive waste. • Know that waste from nuclear power is: – harmful – radioactive – not a cause of global warming. • Know that nuclear waste can be disposed of: – low level waste in land fill sites (low level waste) – by burying deep underground – by reprocessing. • Know that plutonium is a waste product from the nuclear power industry. • Know that plutonium can be used to make nuclear bombs.
• Discuss the government's plans for disposing of nuclear waste. • Discuss the safe siting of nuclear power stations. • Find out about commissioning, operating and decommissioning nuclear power stations.	• Understand why there is a need for a government agency responsible for nuclear safety. • In the context of nuclear power, understand that people can make choices about the best use of science and technology. • Recall one risk and one benefit of nuclear power.

Related Can-Do Tasks (36) I can plot a line graph.

Possible Practical Activity Investigate the relationship between the speed of rotation of a hand-cranked dynamo and the voltage produced.

P12 FULL SPECTRUM

Suggested Activities and Experiences	Content Statements
• Use a mnemonic such as Roll Out Your Guinness Boys In Vats or Rural Old Yokels Guzzle Beer In Volumes. • Make a rainbow using water from a garden hose.	• Know that visible light is part of a group of waves called the electromagnetic spectrum. • Know that all waves from the electromagnetic spectrum travel at the speed of light. • Be able to list the colours of the visible spectrum in order from red to violet. • Know that a rainbow is a naturally occurring example of the visible spectrum. • Recall that a visible spectrum can be produced when white light passes through a prism.
• Research uses for lasers.	• Know that a laser produces a narrow, intense beam of light. • Recall uses of lasers limited to: read CDs, light shows, pointers, weapon guidance, cutting tools.
• Use an infrared detector to show there is radiation beyond red. • Look at examples of photographs taken at night, e.g. from surveillance cameras. • Identify household objects which work by using infrared radiation.	• Recall that warm and hot objects emit infrared radiation. • Know that passive infrared sensors and thermal imaging cameras work by detecting body heat. • Know that infrared is useful for: – remote control for TV etc. – short distance data links for computer or mobile phone – night photography – burglar alarms – heating things, e.g. electric fire, toaster, grill.
• Listen to the quality of reception from different radio frequency bands. • Invite local police to demonstrate a radar gun.	• Recall two examples of uses of microwave radiation from: – cooking – mobile phones – radar – communication with satellites. • Recall that microwaves cause heating when absorbed by water or fat and this is the basis of microwave cooking. • Recall some concerns about children using mobile phones. • Interpret information from different studies into the effects of mobile phone usage [no recall expected].
• Discuss the advantages and disadvantages of wireless links for communication. • Compare mobile and fixed phones. • Find out how the mobile phone system works.	• Know that radio waves produce electrical signals in metal aerials. • Recall two examples of uses of radio waves: – radio – wireless links for laptop computers. • Understand the advantages of wireless technology for global communications.

Related Can-Do Tasks (20) I can produce a poster on the safe use of mobile phones.

Possible Practical Activity Investigate the relationship between the width of the visible spectrum produced using a prism and the angle of incidence of white light.

P13 MEDICAL RAYS

Suggested Activities and Experiences	Content Statements
• Consider why a doctor may need to see inside a patient's body to confirm a diagnosis. • Discuss the risks of exploratory surgery.	• Understand the difference between the diagnosis of an illness and its treatment. • Recall some benefits of a doctor being able to see inside a patient's body. • Know that all surgical procedures have risks.
• Use case studies to learn about medical uses of UV radiation e.g. treating eczema and jaundice, revealing the presence of bacteria, setting dental fillings.	• Recall some medical uses of UV radiation. • Know that exposure to UV radiation can cause suntan, sunburn and skin cancer. • Understand that the use of UV radiation involves balancing benefits against risk. • Recall some ways of reducing the risk of exposure to UV radiation. • Interpret data on the use of sunscreens [no recall expected].
• Look at X-rays of normal and broken bones. • Discuss advantages and disadvantages of X-rays in medicine.	• Understand that bone absorbs X-rays and so produces shadow pictures. • Know that too much exposure to X-rays is dangerous. • Understand that the use of X-rays involves balancing benefits against risk.
• Look at gamma camera images of the thyroid. • Watch a demonstration / simulation of the penetrating power of gamma radiation. • Discuss how radioactive chemicals can produce an image outside the patient's body.	• Know that gamma radiation is very penetrating. • Know that a gamma camera detects gamma radiation and that a computer linked to it can make pictures. • Know that exposure to gamma rays is dangerous. • Understand that the use of gamma rays involves balancing benefits against risk.
• Watch a video showing procedures in the radiology department in a hospital to see how staff and patients are protected from unnecessary doses of X-rays. • Find out how gamma rays are used in nuclear medicine.	• Recall that UV radiation, X-rays and gamma rays are part of a family called the electromagnetic spectrum. • Recall that UV radiation, X-rays and gamma rays can damage living cells. • Know that some radiation is natural, and this is called background radiation. • Interpret simple data on radiation doses and possible harmful effects [no recall expected].

Related Can-Do Tasks (36) I can plot a line graph.

Possible Practical Activity Using data from a class demonstration, investigate how the thickness of lead shielding affects the amount of gamma radiation transmitted.

3.1 Overview of the assessment in Entry Level Certificate in Science

There is one unit made up of three assessment elements and the credit for each element is aggregated by the centre to produce a final points total for each candidate.

Entry Level Science (R591)

Element 1: End-of-Item Tests

70% of the total
70 points

- Candidates may submit the results of a maximum of 35 out of 39 tests. This number should consist of a minimum of nine items from each of Biology, Chemistry and Physics to provide an appropriate overall balance.
- All tests carry 15 marks and are approximately 10 minutes in duration.
- The marks for each test are converted into points. Each test yields a maximum of two points.

Element 2: Can-Do Tasks

10% of the total
10 points

- Each task is marked out of 1 mark, 2 marks or 3 marks. A maximum of 10 assessed tasks can be used for the final points total giving a maximum of 30 marks. This mark is divided by 3 to give a maximum of 10 points.
- Assessed in practical situations.

Element 3: Practical Tasks

20% of the total

20 points

- Centres are able to devise their own practical tasks or may use ones suggested in the teacher support handbook
- Candidates can attempt more than one of these tasks but the points submitted must be based on each candidate's response to the *whole of one task.*
- The task is assessed by the teacher using performance descriptors for five aspects, awarding marks out of 4 for each.
- The total mark, out of a maximum of 20, is directly converted into points. Suggested time: 4 hours.

Postal moderation of a sample of candidates' work takes place at the end of the course. Marked end-of-item tests and evidence from all other elements must be retained for all candidates in case it is required for moderation.

3.2 Assessment availability

There is one assessment series each year in June.

The first series that candidates may be awarded this qualification is June 2013.

3.3 Assessment objectives

Candidates are expected to demonstrate their ability to:

AO1	Recall, select and communicate their knowledge and understanding of science;
AO2	Apply skills, knowledge and understanding of science in practical and other contexts;
AO3	Collect, present and recognise patterns in data, draw conclusions and comment on methods used to collect data.

3.4 Assessment objective weightings

The relationship between the elements of assessment and the assessment objectives is shown in the following grid:

Element of assessment	% of Entry Level Science			
	AO1	AO2	AO3	Total
End-of-Item Tests	37	28	5	70
Can-Do Tasks	–	10	–	10
Practical Task	2	2	16	20
Total	39	40	21	100

3.5 Awarding of grades

The grades awarded for the Entry Level Certificate will be at three levels: Entry 1, Entry 2 and Entry 3.

All mark schemes have been written to address the following targeted thresholds:

Specification Grade	Entry 3	Entry 2	Entry 1
Target	**80%**	**60%**	**40%**

Internal Assessment

4

4.1 Nature of assessment

Principles of assessment

- Teachers record the raw marks generated from their candidates' work for the three elements of assessment (end-of-item tests, can-do tasks and the practical task).
- These raw marks are converted into points for each element (using separate conversion scales in order to preserve the overall weightings of the assessment).
- The aggregation of these points leads to the award of Bronze, Silver and Gold interim certificates by the centre. Following final entry, OCR will certificate a candidate's overall level of achievement at Entry Level 1, 2 or 3 following moderation.

Introduction to skills assessment

End-of-Item Tests (70%)

An end-of-item test is an integral part of each of the 39 items forming the specification. It is accepted that absence through illness, or other unforeseen circumstances, may affect candidates' assessment and they are therefore expected to submit the results for a **maximum** of 35 of these tests. (When candidates are able to take more than 35, the results of the best 35 tests may be submitted for certification.) There is no minimum requirement.

The tests are supervised by teachers in normal lesson time and will be taken at times convenient to the centre. Teachers are required to ensure that normal examination conditions for supervision and invigilation are maintained. Candidates who miss a test may take it on another occasion convenient to the centre. Further details are available in the teacher support handbook for centres.

For each item, candidates are only allowed **one** attempt at the associated end-of-item test. Candidates are **not** allowed to retake any end-of-item tests or take an alternative version of any end-of-item test.

All tests carry 15 marks and are constructed to a common format. The breakdown of marks will be:

Assessment Objectives		Marks
AO1	Recall, select and communicate their knowledge and understanding of science.	8 ± 2
AO2	Apply skills, knowledge and understanding of science in practical and other contexts.	6 ± 2
AO3	Collect, present and recognise patterns in data, draw conclusions and comment on methods used to collect data.	1 ± 1

There is no formal time limit for these tests, but it is expected that most candidates will be able to complete a test within 10 minutes.

Marking of the tests will be carried out by teachers according to the detailed mark schemes provided by OCR. All test papers and mark schemes should be retained securely until the end of the course and will be sampled during the moderation process.

The raw **marks** obtained from these tests are converted into points according to the following scale:

Raw Mark	2–4	5–7	8–11	12–15
Points	0.5	1	1.5	2

The maximum **points** total for this element of the assessment is **70** (= 35 tests × 2).

Can-Do Tasks (10%)

These tasks are designed to provide, at frequent intervals, positive reinforcement of candidates' attainment and generate an assessment of the practical application of their knowledge, understanding and skills.

The tasks enable all candidates to achieve success but still provide challenge and reward for high attaining candidates. The tasks are set at three levels.

Basic Skills: 1 Mark Tasks	Simple practical skills, which should be within the reach of all candidates.
Intermediate Skills: 2 Mark Tasks	More complex tasks which require more than one practical skill.
Advanced Skills: 3 Mark Tasks	Extended activities which require a candidate to perform a sequence of more demanding operations.

Opportunities to demonstrate proficiency in can-do tasks are indicated throughout the specification content and are summarised in **Appendix B**. Frequent opportunities will arise during the course for candidates to attempt these tasks.

It is expected that during their course candidates will attempt a wide range of tasks at a variety of levels and that all candidates will be able to achieve success at their level. A total of **36** tasks is available and candidates may gain credit from a **maximum** of **10** of them. Thus, candidates can gain a maximum of 10 marks from ten basic skills tasks or 20 marks by matching 10 intermediate skills tasks or 30 marks by successfully completing 10 advanced skills tasks. However, any combination of basic, intermediate and advanced tasks may be taken.

There is no formal time for these can-do tasks. It is expected that candidates are assessed by their teachers in their practical lessons.

Practical Task (20%)

Candidates are assessed on their ability to:

- plan a suitable safe procedure
- display data in a suitable format
- recognise patterns in data
- interpret data and relate to relevant science
- comment on the method used to collect data.

The performance descriptors for the practical task are provided in Appendix C.

Since the collection of data is not assessed in the practical task it is not essential for candidates to collect all of the data which is to be used in the task. Their own primary data may be supplemented with extra data from other candidates or classes, demonstrations or other sources.

The practical task is expected to take approximately four to five hours.

Links with GCSE

It is recognised that many candidates, initially of low attainment at the start of the Entry Level course, will make sufficient progress to warrant an entry to GCSE Science.

The practical task is a useful preparation for undertaking a GCSE Controlled Assessment task. The task and the performance descriptors have been developed to allow an easy progression from the requirements for Entry Level to those for GCSE Science in the Gateway or Twenty First Century suites.

4.2 Supervision and authentication of internally assessed work

OCR expects teachers to supervise and guide candidates who are undertaking work that is internally assessed. The degree of teacher guidance will vary according to the kind of work being undertaken. It should be remembered, however, that candidates are required to reach their own judgments and conclusions.

When supervising internally assessed tasks, teachers are expected to:

- offer candidates advice about how best to approach such tasks
- exercise supervision of the work in order to monitor progress and to prevent plagiarism
- ensure that the work is completed in accordance with the specification requirements and can be assessed in accordance with the specified mark descriptions and procedures.

The centre must ensure that sufficient work takes place under direct supervision to allow the teachers concerned to authenticate each candidate's work with confidence.

4.3 Production and presentation of internally assessed work

Candidates must observe certain procedures in the production of internally assessed work:

- any copied material must be suitably acknowledged
- where work is based on the use of secondary data, the original sources must be clearly identified
- each candidate's work for the assessed practical task should be stapled together at the top left-hand corner and have a completed cover sheet as the first page.

4.4 Annotation of candidates' work

Each piece of assessed work should show how the marks have been awarded in relation to the performance descriptors.

The writing of comments on candidates' work provides a means of dialogue and feedback between teacher and candidate and a means of communication between teachers during internal standardisation of coursework.

The use of a completed cover sheet, available for each candidate's practical task, provides a means of communication between teacher and moderator and might replace the need for annotation.

4.5 Marking internally assessed work

Element 1: End-of-Item Tests (Points total out of 70)

A detailed mark scheme is provided with each end-of-item test. It is essential that all teachers mark the tests consistently and accurately according to the guidance provided.

All marking must be done in red ink/biro and acceptable answers need to be indicated using a tick (✓). All answers which are wrong or are too vague should have a cross (✗) against them.

Omissions should be indicated by the use of the ∧ sign. All responses given by the candidate must show clearly that the teacher has considered the answer given.

It is not necessary to total the mark for each question.

In rare cases a candidate may give an answer which is not provided on the mark scheme. If the teacher considers that the answer is worth the mark, then it should be awarded. In such cases the test paper should be annotated and the notice of the moderator be drawn to it when the sample for moderation is despatched during the final certification process.

The raw **marks** obtained from these tests are converted into points according to the following scale:

Raw Mark	2–4	5–7	8–11	12–15
Points	0.5	1	1.5	2

The marks and points are then entered on each candidate's record card.

The total number of marks required for certification is 35. The **maximum points** total for this element of the assessment is 70 (= 35 tests x 2). Further tests may be sat to achieve this; however candidates may only sit end-of-item tests once.

Element 2: Can-Do Tasks (Points total out of 10)

When a task has been successfully completed, the number of marks allocated to the task (1, 2 or 3, depending on the level of the task) are awarded and recorded on candidates' record cards. No credit is available for partial completion, so that a 3 mark task can only have 3 or 0 marks awarded; it is not possible to award 1 or 2 marks for a 3 mark task.

A successfully completed task is where the candidate, working independently without significant teacher intervention or assistance, has:

- collected appropriate materials and equipment to perform the task
- worked safely, maintaining an organised working environment
- produced evidence to show that the outcome identified by the task has been achieved.

At the end of the course, results for the highest scoring ten tasks should be identified and the total mark calculated out of a maximum of 30. This is then divided by three to give a final points total out of 10, which should be entered on each candidate's record card.

Candidates can attempt any number of can-do tasks.

Element 3: Practical Task (Points total out of 20)

Marks are awarded for each of five aspects of the task (see Appendix C). Each aspect carries a maximum of four marks. The award of marks is based on the professional judgement of the science teacher, working within a framework of descriptions of performance (see Appendix C). Different aspects of performance are identified in the marking grid. For each of these, two descriptions of performance (for 1–2 and 3–4 marks) identify what is expected for candidates working at different levels.

The task should be marked using a 'best fit' approach. For each of the aspects, teachers should first use their professional judgement to select one of the two band descriptors provided in the marking grid that most closely describes the quality of the work being marked.

To select the most appropriate mark within the band descriptor, teachers should use the following guidance:

- where the candidate's work *convincingly* meets the statement, the higher mark should be awarded
- where the candidate's work *just* meets the statement, the lower mark should be awarded.

Marking should be positive, rewarding achievement rather than penalising failure or omissions. The award of marks **must be** directly related to the marking criteria.

Teachers should use the full range of marks available to them and award *full* marks in any band for work which fully meets that descriptor. This is work which is 'the best one could expect from candidates working at that level'.

Marking decisions should be recorded on a candidate cover sheet. This cover sheet can be downloaded from the OCR website www.ocr.org.uk. For any aspect, a tick on the grid should be used to indicate the performance statement that best matches the work. When each aspect of performance has been assessed in this way, the addition gives a total in the range of 0–20 points.

Each candidate's total mark for the practical task must come from a single task.

The maximum total mark is 20 and this is converted directly into points which should be entered on each candidate's record card.

Recording and Submitting Marks

Teachers are required to record each candidate's achievement on a candidate record card.

The candidate record card is a four-sided document. Page 1 has spaces to indicate the total points accumulated at the time the course is completed. Pages 2, 3 and 4 deal with the can-do tasks, the practical task and the end-of-item test results.

The candidate record card also forms a useful 'wrap-round' cover for the portfolio of assessed work from the candidate.

All assessed work which has contributed to the final total for each candidate must be available for moderation.

For each candidate selected at the time of moderation, the moderator is sent a *copy* of the candidate record card.

The totals of the three elements are added to establish each candidate's final points total and this should be submitted to OCR on form MS1 or by Interchange, by the published deadline in the year of entry for Entry Level certification. These forms are produced and despatched at the relevant time based on entry information provided by the centre.

4.6 Moderation

All internally assessed work is marked by the teacher and internally standardised by the centre. Points totals are then submitted to OCR, after which moderation takes place in accordance with OCR procedures. The purpose of moderation is to ensure that the standard of the award of marks/points for work is the same for each centre and that each teacher has applied the standards appropriately across the range of candidates within the centre.

All centres entering candidates are subject to quality control via moderation of a sample of candidates' work towards the end of the course. This specification offers the opportunity for moderation evidence to be submitted electronically via the OCR Repository (see Entry codes in Section 7.1 Registration and entries of this specification).

OCR will select the sample and inform the centre where the sample of work is to be sent. Materials must be despatched to arrive with the moderator within 5 days of receipt of the sample request. Any delays may affect the issue of candidates' results. In the case of centres using the OCR Repository, moderators will access coursework directly:

- if there are 10 or fewer candidates the complete work of all candidates should be sent to the moderator (or be uploaded to the OCR Repository) without the need to wait for a request from OCR
- any correspondence with OCR relating to Special Arrangements and the work of the appropriate candidates should be sent to the moderator (or be uploaded to the OCR Repository) with the sample
- completed form CCS160 should accompany the work (or be uploaded to the administration section of the OCR Repository) – candidate authentication forms should be retained by the centre
- centres are advised to have the work of all candidates available in case a further sample is required by the moderator
- **postal moderation only** – it is advisable to remove the covers of coursework where they might add unnecessary bulk to the parcel and increase the cost of its despatch
- centres should use a system that provides for tracking should the parcel delivery be delayed
- cover sheets must be attached to each candidate's practical task work (or be uploaded to the OCR Repository).

Any subsequent requests from the moderator e.g. to reconsider the centre's order of merit or to supply further samples of work should be acted upon with the minimum of delay.

The outcome of moderation will be notified to the centre in due course, at which stage the centre will have the right to submit a result enquiry, requesting a re-moderation.

After moderation has been completed, all candidates' work must be kept securely in the centre until the results have been published and until any results enquiries/appeals have been concluded.

4.7 Minimum requirements for internally assessed work

If a candidate submits no work for this internally assessed unit, then the candidate should be indicated as being absent from that unit on the mark sheets submitted to OCR. If a candidate completes any work at all for this internally assessed unit, then the work should be assessed according to the criteria or mark scheme and the appropriate mark awarded, which may be zero.

4.8 Submitting the moderation samples via the OCR Repository

The OCR Repository, which is accessed via Interchange, is a system which has been created to enable centres to submit candidate work electronically for moderation. It allows centres to upload work for several candidates at once but does not function as an e-portfolio for candidates.

The OCR Entry Level Certificate in Science Unit R591 can be submitted via the OCR Repository.

Once you receive your sample request, you should upload the work to the OCR Repository within three days of receiving the request. Instructions for how to upload files to OCR using the OCR Repository can be found on the OCR website.

It is the centre's responsibility to ensure that any work submitted to OCR electronically is virus-free.

4.9 Linking of points to interim awards

The centre may award interim certificates at Bronze, Silver and Gold, as described below. These interim awards provide motivation and maintain engagement by recognising candidates' progress.

Awards are based on credit accumulation. **Any** combination of points gained from the assessment elements is used to reach the threshold total for each level of interim award.

Teachers will need to monitor the performance of the candidates at frequent intervals during the course. As they approach the three key points for the interim awards of Bronze, Silver and Gold the candidates should be aware of how close they are to achieving their award.

Bronze Award (40%)

An example of a performance for Bronze award would be:

End-of-Item Tests	–	30 points out of 70
Can-Do Tasks	–	5 points out of 10
Practical Task	–	5 points out of 20

This represents an overall achievement of 40%.

Silver Award (60%)

An example of a performance for Silver award would be:

End-of-Item Tests	–	43 points out of 70
Can-Do Tasks	–	7 points out of 10
Practical Task	–	10 points out of 20

This represents an overall achievement of 60%.

Gold Award (80%)

An example of a performance for Gold award would be:

End-of-Item Tests	–	55 points out of 70
Can-Do Tasks	–	9 points out of 10
Practical Task	–	16 points out of 20

This represents an overall achievement of 80%.

5 Support for Entry Level Certificate in Science

5.1 Free resources available from the OCR website

The following materials will be available on the OCR website www.ocr.org.uk:

- Entry Level Certificate in Science Specification
- Specimen assessment materials
- Teachers' Handbook

5.2 Other resources

OCR offers centres a wealth of high quality published support with a choice of 'Official Publisher Partner' and 'Approved Publication' resources, all endorsed by OCR for use with OCR specifications.

5.3 Training

For more information go to www.ocr.org.uk/training/.

5.4 OCR Support Services

OCR Interchange has been developed to help you to carry out day-to-day administration functions online, quickly and easily. The site allows you to register and enter candidates online. In addition, you can gain immediate and free access to candidate information at you convenience. Sign up at https://interchange.ocr.org.uk.

Access arrangements for Entry Level Certificate in Science

6

Arrangements for candidates with special needs for Entry Level Certificate specifications are based on the principle that the centre is best able to assess the needs of the candidate and the appropriateness of the arrangement required. Arrangements for candidates with special needs should not advantage nor disadvantage a particular candidate, nor should they reduce the reliability and validity of the assessment.

The arrangements for candidates with special needs are more flexible than those currently available at GCSE and as such it should not be assumed that any arrangements made at Entry Level Certificate Level will automatically be available at GCSE or GCE Level. Please consult the JCQ booklet *Access Arrangements, Reasonable Adjustments and Special Consideration*, chapter 8. Entry Level Forms are available on the JCQ website (Forms 11–13).

The following arrangements can be made for candidates without permission being sought:

- mechanical and technological aids may be used by candidates who are physically dependent on them; (screen readers must not be used in reading texts)
- instructions regarding the conduct of any In-Course tests may be simplified
- language support staff may provide linguistic help; (please see regulations relating to readers and scribes, sign language and oral language modifiers)
- bilingual and word exchange lists may be used.

For information relating to permission to use the following special arrangements, please consult the JCQ booklet *Access Arrangements, Reasonable Adjustments and Special Consideration, chapter 9*.

Under certain circumstances:

- the teacher may act under the candidate's instructions to perform simple physical actions which the candidate is unable to undertake; (please see regulations on the use of practical assistants)
- mechanical and technological aids may be used by candidates who generally use them in their normal work; (for screen readers, please see regulations relating to readers)
- communicators or signers may be used
- readers and amanuenses may be used
- the tests may be modified as necessary for visually impaired candidates. It is the responsibility of the centre to Braille or enlarge the tests.

It is expected that, generally, the candidate's own teacher will act as a communicator, a signer, a reader or an amanuensis.

Further clarification of any special arrangements may be obtained by consulting the JCQ booklet *Access Arrangements, Reasonable Adjustments and Special Consideration* or by contacting OCR Special Requirements Team.

7 Administration of Entry Level Certificate in Science

7.1 Registration and entries

Centres must be registered with OCR in order to make any entries, including estimated entries. It is recommended that centres apply to OCR to become a registered centre well in advance of making their first entries.

Both estimated and final entries must be made in the certification year. Estimated entries, giving estimated numbers only, are needed for the appointment of the centre moderators and final entries provide the necessary individual candidate details.

Candidates should be entered for the qualification code **R591**.

It is essential that entry codes are quoted in all correspondence with OCR.

For this qualification candidates must be entered for either component 01 (electronic submission via the OCR Repository) or 02 (postal moderation). Centres must enter all of their candidates for ONE of these components. It is not possible for centres to offer both components within the same series.

Entry option code	Component code	Submission method
R591A	01	*OCR Repository*
R591B	02	*Postal moderation*

7.2 Entry deadlines

Candidate entries must be made by the dates published on the OCR website.

7.3 Grading and award of certificates

Interim certificates for Bronze, Silver and Gold awards can be awarded by centres at any time during the course, but final certificates will be issued by OCR when the candidates have completed the course.

Final certification is available from OCR on a three-point scale of grades: Entry 1, Entry 2 and Entry 3, where Entry 3 is the highest grade available.

7.4 Qualification re-sits

Candidates may re-sit the qualification an unlimited number of times.

7.5 Enquiries about results

Under certain circumstances, a centre may wish to query the result issued to one or more candidates. Enquiries about results must be made immediately following the series in which the relevant unit was taken (by the enquiries about results deadline).

Please refer to the *JCQ Post-Results Services* booklet and the *OCR Admin Guide* for further guidance about action on the release of results. Copies of the latest versions of these documents can be obtained from the OCR website.

7.6 Restrictions on candidates' entries

Candidates who enter for this Entry Level specification **may not** also enter for any Entry Level specification with the certification title Science in the same examination series.

They may, however, also enter for any GCSE or equivalent qualification.

8 Other information about Entry Level Certificate in Science

8.1 Overlap with other qualifications

There is some overlap of content with the OCR GCSE Science A and B, although the assessment requirements are different.

8.2 Progression from this qualification

This Entry Level qualification is a general qualification designed to enable candidates to progress either directly to employment or to Level 1 (Foundation) courses, for example to GCSE Science, GCSE Additional Applied Science or GCSE Environmental and Land-Based Science.

The progress of some candidates during the course might be sufficient to allow their transfer to a GCSE Science course.

8.3 Avoidance of bias

OCR has taken great care in preparation of this specification and assessment materials to avoid bias of any kind.

8.4 Regulatory requirements

This specification complies in all respects with *The Statutory Regulation of External Qualifications 2004.*

8.5 Language

This specification and associated assessment materials are in English only.

8.6 Spiritual, moral, ethical, social, legislative, economic and cultural issues

During the course there are opportunities to promote candidates' spiritual, moral, social and cultural development.

Issue	Opportunities for Teaching the Issues in the Units of the Course
The endeavour of science in describing the structure and functioning of the natural and modern world.	B.3, C.8, P.6
The ethical and moral implications of some of the applications of science and technology.	B.1, B.2, B.12
A sense of awe and wonder at the atomic and molecular workings of the material world.	B.2, B.12
The endeavour of scientists in the development of knowledge and understanding of the material world.	B.1, C.7, C.8
Pollution.	B.7, C.6

8.7 Sustainable development, health and safety considerations and European developments, consistent with international agreements

OCR has taken account of the 1988 Resolution of the Council of the European Community in preparing this specification. European examples should be used where appropriate in the delivery of the subject content.

Issue	Opportunities for Teaching the Issues in the Units of the Course
Environmental issues:	
Energy and mineral recycling.	C.4
The positive steps taken to reduce environmental pollution.	B.7
The conservation of resources.	C.4, P.2, P.7
Environmental monitoring.	B.7, B.8, C.6, C.12
Health and Safety issues:	
Safe practice in the laboratory.	C.1, C.9, P.13
Diet and malnutrition.	B.5
Diabetes and its treatment.	B.6
Smoking and related diseases.	B.7

Although this specification does not make specific reference to the European Dimension it may be drawn into the course of study in a number of ways.

8.8 Key skills

This specification provides opportunities for the development of the Key Skills of *Communication*, *Application of Number*, *Information Technology*, *Working with Others*, *Improving Own Learning and Performance* and *Problem Solving* at Levels 1 and/or 2. However, the extent to which this evidence fulfils the Key Skills criteria at these levels will be totally dependent on the style of teaching and learning adopted for each unit.

The following table indicates where opportunities may exist for at least some coverage of the various Key Skills criteria at Levels 1 for each unit.

Unit	C 1	AoN 1	IT 1	WwO 1	IoLP 1	PS 1
R591	✓		✓	✓	✓	v

8.9 Citizenship

Since September 2002, the National Curriculum for England at Key Stage 4 has included a mandatory programme of study for Citizenship. Parts of the programme of study for Citizenship (2007) may be delivered through an appropriate treatment of other subjects.

A Appendix A: Grade descriptions

Grade descriptions are provided to give an indication of the standards of achievement likely to have been shown by candidates awarded particular grades. The descriptions should be interpreted in relation to the content specified in the specification: they are not designed to define the content. The grade awarded will depend in practice upon the extent to which the candidate has met the assessment objectives overall. Shortcomings in some aspects of the assessment may be balanced by better performance in others.

Entry 1

Knowledge and Understanding of Science

Candidates recall, understand and apply knowledge from a limited range of the defined specification content. For example: they are able to label a diagram of a plant to show roots, stems, leaves, flowers and buds; they know that gold and silver are expensive, shiny and heavy; they know that forces can be pulls, pushes, twists or bends. They are able to communicate simple ideas using everyday language.

Can-Do Tasks

Candidates show that they are able to carry out some simple tasks, some of which involve the use of scientific equipment, safely. For example: 'I can match an animal to where it lives or when it lived'; 'I can separate a simple mixture'; 'I can write a message in mirror'.

Practical Task

Candidates can carry out simple investigative work with help. They can work safely to collect at least one piece of evidence. They can state simply what they have found out, can comment on the procedures used or the evidence obtained.

Entry 2

Knowledge and Understanding of Science

Candidates recall, understand and apply knowledge from a range of the defined specification content. For example: they know that animals get their food from eating plants and other animals; know that a mixture contains two or more non-combined substances and know about using mobile phones safely. They communicate ideas making limited use of scientific and technical vocabulary.

Can-Do Tasks

Candidates show that they are able to carry out simple tasks, some of which involve the manipulation of scientific equipment safely. For example: 'I can use Universal Indicator solution to find pH'; 'I can carry out a test to show the presence of carbon dioxide'; 'I can use a newtonmeter to measure force'.

Practical Task

Candidates carry out some investigative work in which they research and collect some evidence. They can process, in simple terms, the data that has been collected and make a relevant comment about the procedures used or the evidence obtained.

Entry 3

Knowledge and Understanding of Science

Candidates recall, understand and apply knowledge from a wide range of the defined specification content. For example: understand that different people have different lifestyles and therefore dietary requirements; know the physical differences between metals and non-metals; know that unbalanced forces make things move. Candidates obtain information from simple tables and charts and are able to link cause and effect in simple contexts. They communicate ideas well making some use of scientific and technical vocabulary.

Can-Do Tasks

Candidates show that they are able to carry out simple tasks, including those which involve the manipulation of scientific equipment, safely and with confidence. These may require candidates to take accurate measurements. For example: 'I can use a thermometer to measure temperature accurately'; 'I can do a test to compare quantities of Vitamin C in fruit juice'.

Practical Task

Candidates carry out work in which they plan, research, collect and record evidence, and present data in the form of simple tables or charts. They identify a straightforward trend or pattern in their results and make summarising comments on the procedures used and the evidence obtained. In a simple way they relate their investigative work to appropriate scientific knowledge and understanding.

B Appendix B: List of Can-Do Tasks

Can-do tasks provide progression in the attainment of skills. Candidates will have different levels of skills at the start of the course and will progress to different levels at different rates.

Basic Skills: 1 Mark Tasks

The **12** tasks listed below represent basic skills and are suitable for candidates working towards an interim **Bronze award** and a final certification at **Entry 1**.

Level 1	Item	Details
1	**B1**	I can measure a person's breathing rate or pulse.
2	**B3** **B8**	Given information I can match an animal to where it lives or when it lived.
3	**B9** **B11**	I can measure the effect of caffeine on heart rate.
4	**B10**	I can safely carry out a food test for starch.
5	**C1** **C9**	I can use a measuring cylinder to measure volume.
6	**C7**	I can identify some common metals: iron (using a magnet) copper, aluminium and lead (by sight and touch).
7	**C9**	I can add results to a bar chart.
8	**C9** **P9**	I can measure reaction time.
9	**C10**	I can separate a simple mixture (e.g. iron filings/aluminium, salt/sand).
10	**C11**	I can take a set of fingerprints.
11	**P5**	I can write a message in mirror writing.
12	**P12**	I can produce a poster on the safe use of mobile phones.

Intermediate Skills: 2 Mark Tasks

The **12** tasks listed below represent intermediate skills and are suitable for candidates working towards an interim **Silver award** and a final certification at **Entry 2**.

Level 2	Item	Details
13	**B2**	I can read data from a graph.
14	**B3**	I can collect (scientific) information about an endangered or extinct species.
15	**B5**	I can safely carry out a food test for glucose.
16	**B6**	I can make a leaflet to warn old people of the dangers of hypothermia.
17	**B7 C1 C6**	I can carry out a test to show the presence of carbon dioxide.
18	**B10 C1**	I can use Universal Indicator solution to find pH.
19	**C3**	I can make a paint sample and prove that it works.
20	**C5**	I can make measurements to test a property of a fibre or fabric.
21	**C10 C11**	I can make a chromatogram.
22	**C12**	I can make a poster to warn about the dangers of CO poisoning.
23	**P2**	I can read a domestic electricity meter.
24	**P4**	I can use a newtonmeter to measure force.

Level 3 Tasks

The **12** tasks listed below represent advanced skills and are suitable for candidates working towards an interim **Gold award** and a final certification at **Entry 3.**

Level 3	Item	Details
25	**B5**	I can record my daily protein intake.
26	**B6 P10**	I can use a thermometer to measure temperature accurately.
27	**B8**	I can carry out a simple survey of a habitat.
28	**B12 P8**	I can measure length / distance accurately.
29	**C4**	I can extract a sample of copper from its ore.
30	**C7**	I can make and then test a sample of concrete for its strength.
31	**C8**	I can find the location of ten earthquakes or volcanoes and put them on a map
32	**C9 P4**	I can measure time accurately (e.g. to time a chemical reaction).
33	**C13**	I can do a test to compare the quantity of Vitamin C in fruit juices.
34	**P3**	I can use a plotting compass to map a magnetic field.
35	**P4**	I can measure the speed of a moving object.
36	**P10**	I can plot a line graph.

The Level 1 task (4), I can safely carry out a food test for starch, links to the Level 2 task (15), I can safely carry out a food test for glucose.

In the Level 3 task (36) I can plot a line graph, some candidates may not achieve this task but may be awarded the Level 2 task (13), I can read data from a graph.

The Level 2 task (20), I can take measurements to test the property of a fibre or a fabric may be extended for some candidates to allow achievement of the Level 3 task (30), I can make and then test a sample of concrete for its strength

More details on the use of can-do tasks to provide progression in skills development can be found in the OCR Teacher support handbook and at OCR INSET sessions.

Appendix C: Performance descriptors for Practical Task

C

Performances are described at the 1 – 2 mark and 3 – 4 mark standards.

Aspects	0	1 – 2 marks	3 – 4 marks	Assessment Objectives
A Planning to collect data	*	outlines a simple plan which would enable a limited amount of data to be collected	describes the method and apparatus selected to collect data makes an appropriate comment about safe working	AO1 – 2 AO2 – 2
B Processing the data	*	displays a few results in charts or graphs, using given axes or scales	constructs simple charts or graphs to display data in an appropriate way, allowing some errors in scaling or plotting	AO3 – 4
C Patterns in the data	*	notes at least one difference between situations/cases, or compares individual results	identifies trend(s) or pattern(s) in the data	AO3 – 4
D Interpreting the data	*	makes a simple attempt to interpret the data	relates the trend(s) or pattern(s) to the relevant science	AO3 – 4
E Reviewing the method	*	makes a simple comment about the method used to collect data	comments on the method used and how it affects the quality of data collected	AO3 – 4

* no response or the response is not sufficient for the award of 1 mark

D Appendix D: Mathematics skills

Candidates are permitted to use calculators in all assessments.

Candidates should be able to:

At Entry 1:

- Recognise and use whole numbers to one decimal place
- Take measurements to whole divisions using simple equipment – ruler, thermometer, measuring cylinder, stop-clock, balance, newtonmeter and electrical meters
- Draw or complete bar charts or pictograms
- Select information from tables and charts.

At Entry 2:

- Recognise and use numbers to one decimal place
- Take accurate measurements using simple equipment – ruler, thermometer, measuring cylinder, stop-clock, balance, newtonmeter and electrical meters
- Read data from charts and graphs
- Estimate quantities such as length, volume, mass
- Record measurements in tables accurately
- Extract and interpret information from charts, graphs and tables.

At Entry 3:

- Carry our single calculations involving +, – , x, ÷
- Plot simple line graphs or pie charts
- Calculate arithmetical means
- Measure speed using distance and time
- Substitute numerical values into simple formulae and equations using appropriate units.

Appendix E: Guidance for the production of electronic internal assessment

E

Structure for evidence

An internal assessment portfolio is a collection of folders and files containing the candidate's evidence. Folders should be organised in a structured way so that the evidence can be accessed easily by a teacher or moderator. This structure is commonly known as a folder tree. It would be helpful if the location of particular evidence is made clear by naming each file and folder appropriately and by use of an index called 'Home Page'.

There should be a top level folder detailing the candidate's centre number, candidate number, surname and forename, together with the unit code R591, so that the portfolio is clearly identified as the work of one candidate.

Each candidate produces an assignment for internal assessment. The evidence should be contained within a separate folder within the portfolio. This folder may contain separate files.

Each candidate's internal assessment portfolio should be stored in a secure area on the centre's network. Prior to submitting the internal assessment portfolio to OCR, the centre should add a folder to the folder tree containing internal assessment and summary forms.

Data formats for evidence

In order to minimise software and hardware compatibility issues it will be necessary to save candidates' work using an appropriate file format.

Candidates must use formats appropriate to the evidence that they are providing and appropriate to viewing for assessment and moderation. Open file formats or proprietary formats for which a downloadable reader or player is available are acceptable. Where this is not available, the file format is not acceptable.

Electronic internal assessment is designed to give candidates an opportunity to demonstrate what they know, understand and can do using current technology. Candidates do not gain marks for using more sophisticated formats or for using a range of formats. A candidate who chooses to use only word documents will not be disadvantaged by that choice.

Evidence submitted is likely to be in the form of word processed documents, PowerPoint presentations, digital photos and digital video.

To ensure compatibility, all files submitted must be in the formats listed below. Where new formats become available that might be acceptable, OCR will provide further guidance. OCR advises against changing the file format that the document was originally created in. It is the centre's responsibility to ensure that the electronic portfolios submitted for moderation are accessible to the moderator and fully represent the evidence available for each candidate.

E Accepted File Formats

Movie formats for digital video evidence
MPEG (*.mpg)
QuickTime movie (*.mov)
Macromedia Shockwave (*.aam)
Macromedia Shockwave (*.dcr)
Flash (*.swf)
Windows Media File (*.wmf)
MPEG Video Layer 4 (*.mp4)

Audio or sound formats
MPEG Audio Layer 3 (*.mp3)

Graphics formats including photographic evidence
JPEG (*.jpg)
Graphics file (*.pcx)
MS bitmap (*.bmp)
GIF images (*.gif)

Animation formats
Macromedia Flash (*.fla)

Structured markup formats
XML (*xml)

Text formats
Comma Separated Values (.csv)
PDF (.pdf)
Rich text format (.rtf)
Text document (.txt)

Microsoft Office suite
PowerPoint (.ppt)
Word (.doc)
Excel (.xls)
Visio (.vsd)
Project (.mpp)

YOUR CHECKLIST

OUR AIM IS TO PROVIDE YOU WITH ALL THE INFORMATION AND SUPPORT YOU NEED TO DELIVER OUR SPECIFICATIONS.

- ☑ Bookmark **www.ocr.org.uk/science**
- ☑ Be among the first to hear about support materials and resources as they become available. Register for email updates at **www.ocr.org.uk/updates**
- ☑ Book your INSET training place online at **www.ocr.org.uk/eventbooker**
- ☑ Find out about controlled assessment support at **www.ocr.org.uk/science2011/support**
- ☑ Learn more about Active Results at **www.ocr.org.uk/activeresults**
- ☑ Join our social network community for teachers at **www.social.ocr.org.uk**

NEED MORE HELP?

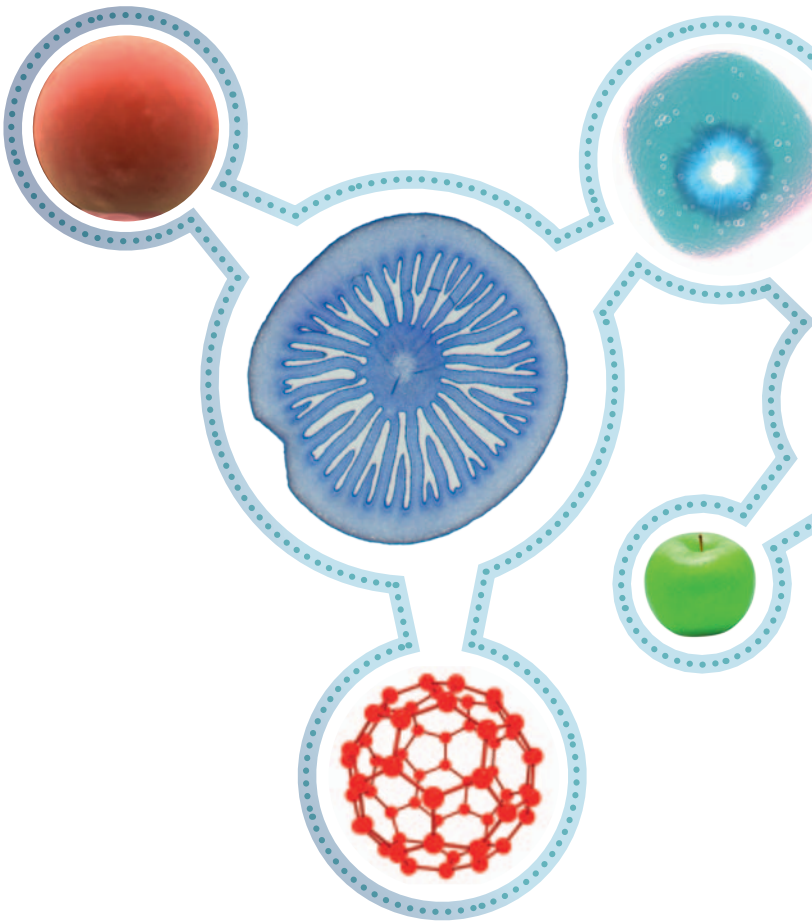
Here's how to contact us for specialist advice

Phone:	01223 553998
Email:	science@ocr.org.uk
Online:	http://answers.ocr.org.uk
Fax:	01223 552627
Post:	Customer Contact Centre, OCR, Progress House, Westwood Business Park, Coventry CV4 8JQ

WHAT TO DO NEXT

1) Sign up to teach – let us know you will be teaching this specification to ensure you receive all the support and examination materials you need. Simply complete the online form at **www.ocr.org.uk/science/signup**

2) Become an approved OCR centre – if your centre is completely new to OCR and has not previously used us for any examinations, visit **www.ocr.org.uk/centreapproval** to become an approved OCR centre.



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