Independent Schools
Examinations Board

COMMON ENTRANCE EXAMINATION AT 11+ AND 13+

COMMON ACADEMIC SCHOLARSHIP EXAMINATION AT 13+

SCIENCE SYLLABUS

(Revised Spring 2010 for first examination in Autumn 2011;
Scholarship updated Summer 2013)

INTRODUCTION

The revised Common Entrance science syllabus for examination at 11+ and 13+ is based upon the programmes of study for key stage 2 and key stage 3 respectively of the National Curriculum for Science (2007 revision). At 11+ it is expected that material in key stage 1 has already been fully covered. At 13+, knowledge of the 11+ syllabus will be assumed and can be examined in the context of questions based on the content of the 13+ syllabus.

The syllabus content is presented in a two-column format. The first column locates the content within the framework of the relevant programme of study. The second column gives a detailed description of the content to be taught and examined, with Level 2 only topics underlined. Examination questions will be drawn from all parts of the syllabus. Candidates will also be expected to analyse and evaluate scientific knowledge, and apply it to unfamiliar situations.

The examination papers will contain questions about practical techniques and scientific processes. Candidates should be taught to record observations and measurements with appropriate precision. The analysis, interpretation, explanation and evaluation of their methods, results and conclusions will be examined. The impact of their own and others' experimental and investigative activities will also be tested. This is outlined in *How Science Works* below.

AIMS

A course leading to this examination should:

(i) stimulate curiosity, interest in and enjoyment of science;

(ii) help candidates to acquire a systematic body of scientific knowledge and to develop an understanding of science, recognising connections between different areas of science;

(iii) enable candidates to use scientific ideas and models to explain phenomena and events and to understand applications of science;

(iv) develop an awareness of the impact of developments in technology on the environment and in other contexts;

(v) develop experimental and investigative abilities, paying due regard to safe practice (see *How Science Works* below);

(vi) develop an ability to evaluate and communicate scientific evidence, and understand the importance of experimental evidence in supporting scientific ideas (see *How Science Works* below);

(vii) develop an awareness of science as a social and cultural activity which has strengths and limitations (see *How Science Works* below);

(viii) enable candidates to acquire a sound foundation of knowledge and understanding for future studies, and to facilitate the smooth transfer between schools in the independent and maintained sectors of education.

ASSESSMENT OBJECTIVES

Candidates should develop their knowledge, skills and understanding in the four attainment targets:

AO1 How science works (AT1);

AO2 Biology, including organisms, their behaviour and the environment (AT2);

AO3 Chemistry, including materials, their properties and the Earth (AT3);

AO4 Physics, including energy, forces and space (AT4).

HOW SCIENCE WORKS

This section is adapted from the programme of study for key stage 3 of the National Curriculum for Science (2007 revision).

There are a number of key concepts, skills and processes which pupils need to experience in order to deepen and broaden their understanding of science. These underpin science and how science works, and complement the scientific content of the syllabus.

Scientific thinking

a) using scientific ideas and models to explain phenomena and developing them creatively to generate and test theories;

b) analysing and evaluating evidence critically from observations and experiments;

Applications and implications of science

a) exploring how the creative application of scientific ideas can bring about technological developments and consequent changes in the way people think and behave;

b) examining the ethical and moral implications of using and applying science;

Cultural understanding

a) recognising that modern science has its roots in many different societies and cultures, and draws on a variety of valid approaches to scientific practice;

Collaboration

a) sharing developments and common understanding across disciplines and boundaries;

Practical and enquiry skills

a) using a range of scientific methods and techniques to develop and test ideas and explanations;

b) assessing risk and working safely in the laboratory, field and work place *;

c) planning and carrying out practical and investigative activities, both individually and in groups;

Critical understanding of evidence

a) obtaining, recording and analysing data from a wide range of primary and secondary sources, including ICT sources, using their findings to provide evidence for scientific explanations;

b) evaluating scientific evidence and working methods;

Communication

a) using appropriate methods, including ICT, to communicate scientific information and contribute to presentations and discussions about scientific issues.

*** Important note: teachers should assess risk and pay due regard to safety when planning and supervising practical activities. CLEAPPS and the Association of Science Education are valued and trusted sources of important information.**

SYLLABUS CONTENT

11+: Range and breadth of content

Energy, movement and forces

a. the effect of changes in electrical circuits

b. the properties and behaviour of light and sound in order to describe and explain familiar effects

c. combinations of forces

Material behaviour

a. reversible and non-reversible changes which occur in the environment

b. how changes can be used to create new and useful materials

Life and living things

a. the structure and function of key human body systems, including reproduction

b. the structure, function, life cycle and growth of flowering plants and how these grow and are used around the world

c. the benefits of micro-organisms and the harm they can cause

The environment, Earth and solar system

a. how plants and animals are interdependent and are diverse and adapted to their environment as a result of evolution

b. how scientific and technological developments affect the physical and living worlds

c. practical ways in which science can contribute to a more sustainable future

d. how time measurement relates to day and night and the Earth's place in the solar system

13+: Range and breadth of content

Energy, electricity and forces

a. energy can be transferred usefully, stored, or dissipated, but cannot be created or destroyed

b. forces are interactions between objects and can affect their shape and motion

c. electric current in circuits can produce a variety of effects

Chemical and material behaviour

a. the particle model provides explanations for the different physical properties and behaviour of matter

b. elements consist of atoms which combine together in chemical reactions to form compounds

c. elements and compounds show characteristic chemical properties and patterns in their behaviour

Organisms, behaviour and health

a. life processes are supported by the organisation of cells into tissues, organs and body systems

b. the human reproductive cycle includes adolescence, fertilisation and fetal development

c. conception, growth, development, behaviour and health can be affected by diet, drugs and disease

d. all living things show variation, can be classified and are interdependent, interacting with each other and their environment

e. behaviour is influenced by internal and external factors and can be investigated and measured

The environment, Earth and universe

a. geological activity is caused by chemical and physical processes

b. astronomy and space science provide insight into the nature and observed motions of the Sun, Moon, stars, planets and other celestial bodies

c. human activity and natural processes can lead to changes in the environment

11+

AT2: ORGANISMS, THEIR BEHAVIOUR AND THE ENVIRONMENT

LEARNING OBJECTIVES	AMPLIFICATION
1. Life processes	
Pupils should be taught:	Candidates should know:
a. that the life processes common to humans and other animals include nutrition, movement, growth and reproduction	the names and positions of the following related organs: brain, heart, lungs, stomach, intestines, liver and kidneys in humans, and the root, stem, leaves and flower of a flowering plant
b. that the life processes common to plants include growth, nutrition and reproduction	*For humans, this can be based on pictures and models; for flowering plants, real specimens should be examined.*
c. to make links between life processes in familiar animals and plants and the environments in which they are found	how living things, e.g. pets, farm animals, wildlife found in parks and gardens and the associated plant life, carry out these life processes within their respective habitats
2. Humans and other animals	
Pupils should be taught:	Candidates should know:
Nutrition	
a. about the functions and care of teeth	the main kinds of teeth (incisors, canines, pre-molars and molars) and their functions; the effect of bacteria (plaque), fluoride and diet on dental decay; the importance of dental care and hygiene
b. about the need for food for activity and growth, and about the importance of an adequate and varied diet for health	the value of a balanced diet, composed of carbohydrates, fats, proteins, vitamins, mineral salts, fibre and water, in the maintenance of good health; how to carry out the iodine test for starch
Circulation	
c. that the heart acts as a pump to circulate the blood through vessels around the body, including through the lungs	the structure of the heart through the use of appropriate models or diagrams; that the heart forces blood round the body to the organs through arteries and that the blood returns to the heart through veins

	The names of the chambers and valves of the heart will not be examined.
d. about the effect of exercise and rest on pulse rate	that during exercise the body needs more oxygen and food to provide the necessary energy, and that this can be demonstrated by comparing pulse rates at rest and after exercise; the effect of exercise on the body and the benefits to health, e.g. reducing obesity, increasing stamina *The term respiration will not be used.*
Movement	
e. that humans and some other animals have skeletons and muscles to support and protect their bodies and to help them to move	that animals with internal skeletons are called vertebrates; the role of the skeleton in providing support, protection and movement; the location of the skull, backbone (vertebral column), rib cage, pelvis, collarbone and shoulder blade
Growth and reproduction	
f. about the main stages of the human life cycle	*This topic will not be examined but should have been taught by the end of year 6.*
Health	
g. about the effects on the human body of tobacco, alcohol and other drugs, and how these relate to personal health	examples of the harmful effects on the body of tobacco and alcohol; that other drugs can seriously affect health
h. about the importance of exercise for good health	*See 2d above.*

3. Green plants

Pupils should be taught:	Candidates should know:
Growth and nutrition	
a. the effect of light, air, water and temperature on plant growth	how to demonstrate the effect of variation in light, temperature and water on plant growth; that the air supplies a plant with carbon dioxide for making food; that plants also need oxygen *Respiration will not be examined.*

b. the role of the leaf in producing new material for growth	that green plants use energy from the Sun to produce food (photosynthesis); the role of the green pigment (chlorophyll) in the leaf and stem in capturing this light energy; that nearly all food chains start with green plants
c. that the root anchors the plant, and that water and minerals are taken in through the root and transported through the stem to other parts of the plant	that mineral salts are nutrients which are needed for healthy growth

Reproduction

d. about the parts of the flower *[e.g. stigma, stamen, petal, sepal]* and their role in the life cycle of flowering plants, including pollination, seed formation, seed dispersal and germination	how sexual reproduction occurs in flowering plants, including details of flower structure; the terms carpel (stigma, style, ovary, ovule), stamen (anther, filament), petal, sepal; that pollination is the transfer of pollen from an anther to a stigma; that fertilisation is the fusing together of the male and female sex cells which produces a fertilised egg leading to the formation of a seed; about fruit formation and seed dispersal; about the germination of seeds; the main parts of a germinating seed: embryo shoot, embryo root, food store and seed coat

4. Variation and classification

Pupils should be taught:	Candidates should know:
a. to make and use keys	how to make and use simple keys based on observable external features to help them to identify and group living things systematically
b. how locally occurring animals and plants can be identified and assigned to groups	the terms vertebrate and invertebrate; how to distinguish between insects and spiders; that there are flowering and non-flowering groups of plants
c. that the variety of plants and animals makes it important to identify them and assign them to groups	*Taxonomic groups will not be examined.*

5. Living things in their environment

Pupils should be taught:	Candidates should know:
a. about ways in which living things and the environment need protection	about the need to protect and conserve living things and their environment, e.g. endangered species, effects of pollution, habitat destruction etc.
Adaptation	
b. about the different plants and animals found in different habitats	the features of animals and plants in one chosen habitat (these should include size, shape, colour and, where possible, methods of movement, feeding and protection); the wide variety of responses to which animals living in different situations have developed; that some animals are nocturnal; that the activity of living things can be related to the time of day and season of the year; the terms hibernation and migration
c. how animals and plants in two different habitats are suited to their environment	
Feeding relationships	
d. to use food chains to show feeding relationships in a habitat	how to place organisms in order in a food chain; the terms producer, consumer (herbivore, carnivore and omnivore); the relationship between predator and prey
e. about how nearly all food chains start with a green plant	
Micro-organisms	
f. that micro-organisms are living organisms that are often too small to be seen, and that they may be beneficial *[e.g. in the breakdown of waste, in making bread]* or harmful *[e.g. in causing disease, in causing food to go mouldy]*	*This topic will not be examined but should have been taught by the end of year 6.*

AT3: MATERIALS, THEIR PROPERTIES AND THE EARTH

LEARNING OBJECTIVES	AMPLIFICATION
6. Grouping and classifying materials	
Pupils should be taught:	Candidates should know:
a. to compare everyday materials and objects on the basis of their material properties, including hardness, strength, flexibility and magnetic behaviour, and to relate these properties to everyday uses of the materials	the terms metal, non-metal, magnetic and non-magnetic *A wide range of materials should be tested and included in as many practical situations as possible (see Appendix I).*
b. that some materials are better thermal insulators than others	that air is a good insulator; examples of situations where trapped air is used for insulation in everyday life, e.g. winter clothing, sleeping-bags, expanded polystyrene for cups
c. that some materials are better electrical conductors than others	that metals and carbon (graphite) are conductors of electricity, e.g. copper for household wiring; that most other materials are insulators, e.g. plastic for plug covers
d. to describe and group rocks and soils on the basis of their characteristics, including appearance, texture and permeability	about different kinds of soils, e.g. sand, clay, loam; how particle size affects drainage; the term humus and how this enriches the soil *Rocks will not be examined but should have been taught by the end of year 6.*
e. to recognise differences between solids, liquids and gases, in terms of ease of flow and maintenance of shape and volume	how to use simple particle theory to describe the arrangement of particles in solids, liquids and gases *The use of technical terms such as viscosity is not expected.*
7. Changing materials	
Pupils should be taught:	Candidates should know:
a. to describe changes that occur when materials are mixed *[e.g. adding salt to water]*	how to carry out simple dissolving experiments

b. to describe changes that occur when materials *[e.g. water, clay, dough]* are heated or cooled	that heating or cooling can cause a change of state; the names given to these changes, i.e**.** melting, boiling, condensing, evaporating, freezing/solidifying; that water expands on freezing, causing pipes to burst and rocks to crack; how to compare different temperatures by feel and by the use of a thermometer; how to read a thermometer scale including values below 0 ºC; the boiling point and freezing point of water and the temperature of a healthy human
c. that temperature is a measure of how hot or cold things are	
d. about reversible changes, including dissolving, melting, boiling, condensing, freezing and evaporating	
e. the part played by evaporation and condensation in the water cycle	how to carry out simple experiments on evaporation and condensation; how these processes relate to the water cycle
f. that non-reversible changes *[e.g. vinegar reacting with bicarbonate of soda, plaster of Paris with water]* result in the formation of new materials that may be useful	examples of useful non-reversible changes, e.g. making concrete, baking; that air and water are both needed for rusting to occur; simple methods of preventing rusting, e.g. oiling, painting, galvanising, coating with plastic
g. that burning materials *[e.g. wood, wax, natural gas]* results in the formation of new materials and that this change is not usually reversible	simple burning experiments to demonstrate that burning is not reversible; the term fuel; the term fossil fuel and examples of solid, liquid and gaseous fossil fuels *Knowledge of the formation of fossil fuels will not be examined.*

8. Separating mixtures of materials

Pupils should be taught:	Candidates should know:
a. how to separate solid particles of different sizes by sieving *[e.g. those in soil]*	how to carry out simple experiments to separate solid particles of different sizes
b. that some solids *[e.g. salt, sugar]* dissolve in water to give solutions but some *[e.g. sand, chalk]* do not	the terms soluble*,* insoluble, solute, solvent, solution; factors affecting the rate of dissolving everyday substances in water, i.e. the temperature of the solvent, particle size of the solute and stirring; the concept of fair testing to compare rates of dissolving in water; that a solution contains at least two substances: water and the dissolved substance; how to draw and interpret bar charts and line graphs using data from dissolving experiments

c. how to separate insoluble solids from liquids by filtering	how to carry out simple filtration experiments and decanting as another simple method of separating a solid from a liquid; the terms filtrate and residue
d. how to recover dissolved solids by evaporating the liquid from the solution	how to carry out simple evaporation experiments, e.g. evaporation of a salt solution; that salt solutions should not be dried completely when heated
e. to use knowledge of solids, liquids and gases to decide how mixtures might be separated	how to take an investigative approach to separate a variety of mixtures

AT4: ENERGY, FORCES AND SPACE

LEARNING OBJECTIVES	AMPLIFICATION
9. Electricity	
Pupils should be taught:	Candidates should know:
Simple circuits	
a. to construct circuits, incorporating a battery or power supply and a range of switches, to make electrical devices work *[e.g. buzzers, motors]*	how to construct series circuits involving up to three cells, up to three bulbs, a motor, a buzzer and a switch; that electrical devices will only work if they are part of a complete circuit between the terminals of an electrical supply, and that each part of the circuit must be a conductor of electricity; the term in series
b. how changing the number or type of components *[e.g. batteries, bulbs, wires]* in a series circuit can make bulbs brighter or dimmer	the relative brightness of bulbs in series circuits *It is recommended that normal brightness describes one bulb lit by one cell. Other circuits can be compared with this.*
c. how to represent series circuits by drawings and conventional symbols, and how to construct series circuits on the basis of drawings and diagrams using conventional symbols	the electrical symbols for all the components mentioned above *(see Appendix III)*; how to interpret and draw circuit diagrams where the components are connected in series; how to recognise a short circuit and be aware of the safety implications

10. Forces and motion

Pupils should be taught:	Candidates should know:
Types of force	
a. about the forces of attraction and repulsion between magnets, and about the forces of attraction between magnets and magnetic materials	how to classify materials into magnetic and non-magnetic groups; that magnetic materials such as iron and steel are attracted to a magnet; how to carry out experiments to discover that a magnet exerts a force on another magnet or any piece of magnetic material which is placed close to it; that a magnet has north-seeking and south-seeking poles and why they are so called; that a freely suspended bar magnet comes to rest in a north-south direction and acts as a compass; that like poles repel and unlike poles attract each other; that magnetic effects will pass through some materials; how to compare the strength of two or more magnets
b. that objects are pulled downwards because of the gravitational attraction between them and the Earth	*The distinction between mass and weight will not be examined.*
c. about friction, including air resistance, as a force that slows moving objects and may prevent objects from starting to move	about the concept of friction as a force which opposes the relative movement of surfaces, with reference to everyday situations, e.g. the effect of friction between the wheels of a bicycle and the road, the effect of air resistance on the cyclist; how to carry out investigations involving friction, e.g. a toy car running over different surfaces
d. that when objects *[e.g. a spring, a table]* are pushed or pulled, an opposing pull or push can be felt	how to carry out simple experiments to experience these opposing forces
e. how to measure forces and identify the direction in which they act	different types of force: push, pull, frictional (including air resistance), magnetic, gravitational, support (reaction) and upthrust; how to use arrows to show the direction in which these forces are acting on an object; that the newton (N) is the unit of force; how to use a force meter (newton spring balance) to investigate the force required to do various jobs

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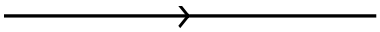
11. Light and sound

Pupils should be taught:	Candidates should know:
Everyday effects of light	
a. that light travels from a source	that a luminous source gives out light; examples of luminous sources; that light travels in straight lines; how to indicate a ray of light like this: 
b. that light cannot pass through some materials, and how this leads to the formation of shadows	the terms opaque, translucent and transparent; how shadows are formed by opaque objects, investigating the effect of different distances between source, object and screen
c. that light is reflected from surfaces *[e.g. mirrors, polished metals]*	*Quantitative experiments with mirrors will not be examined.*
Seeing	
d. that we see things only when light from them enters our eyes	how we see luminous objects; how to draw simple diagrams to show that light rays, travelling in straight lines, enter the eye(s) directly from the luminous object *Details of the structure of the eye will not be examined.*
Vibration and sound	
e. that sounds are made when objects *[e.g. strings on musical instruments]* vibrate but that vibrations are not always directly visible	the terms vibrate and vibration; that sound is emitted when an object vibrates, e.g. a stringed instrument, a tuning fork, a rubber band, a ruler, or when the air inside an object vibrates, e.g. a recorder, a milk bottle; how to demonstrate that vibrations are not always visible, e.g. vibrations in a drum skin shown by using rice grains

f. how to change the pitch and loudness of sounds produced by some vibrating objects *[e.g. a drum skin, a plucked string]*	the term pitch; how the properties of sound such as pitch and loudness can be changed; that an increase/decrease in the size of the vibration produces a louder/quieter sound, and a faster/slower vibration produces a higher/lower-pitched sound; that on a stringed instrument, changing the length, tightness and thickness of a string will affect the pitch of a note *The terms frequency and amplitude are not required.*
g. that vibrations from sound sources require a medium *[e.g. metal, wood, glass, air]* through which to travel to the ear	that sound travels through solids, liquids and gases but not through a vacuum; these vibrations are detected by the ear *The ear and hearing will not be examined.*

12. The Earth and beyond

Pupils should be taught:	Candidates should know:
The Sun, Earth and Moon	
a. that the Sun, Earth and Moon are approximately spherical	
Periodic changes	
b. how the position of the Sun appears to change during the day, and how shadows change as this happens	how to use a globe and lamp representing the Earth and Sun in order to show how day and night arise; about practical examples relating to the apparent movement of the Sun, e.g. sundials
c. how day and night are related to the spin of the Earth on its own axis	
d. that the Earth orbits the Sun once each year, and that the Moon takes approximately 28 days to orbit the Earth	*A small ball representing the Moon should be added to the model.*

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NB: additional topics for Level 2 are underlined

AT2: ORGANISMS, THEIR BEHAVIOUR AND THE ENVIRONMENT

LEARNING OBJECTIVES	AMPLIFICATION
1. Cells and cell functions	
Pupils should be taught:	Candidates should know:
a. that animal and plant cells can form tissues, and tissues can form organs	that in multi-cellular organisms cells are massed together to form tissues, and tissues can be massed together to form organs
b. the functions of chloroplasts and cell walls in plant cells and the functions of the cell surface membrane, cytoplasm, mitochondria and nucleus in both plant and animal cells; <u>vacuole in plant cells</u>	that a typical animal or plant cell has a nucleus, cytoplasm, mitochondria and cell surface membrane; that plant cells contain permanent fluid-filled <u>vacuoles</u>; the function of each component, stated very briefly; that the nucleus contains genes which control the production of protein in the cell; that genes are made of DNA which determines an organism's characteristics; how to use a microscope to observe plant and animal cells and how to prepare a temporary microscope slide, e.g. using methylene blue as a stain for nuclei
c. ways in which some cells, including ciliated epithelial cells, sperm, ova, and root-hair cells, are adapted to their functions	*This section can be taught in the context of other parts of the syllabus. Candidates will not be expected to draw these cells in an examination.*
d. about fertilisation in humans and flowering plants as the fusion of a male and female cell	that fertilisation in humans occurs when the head of a sperm (a male cell) enters the ovum (a female cell) <u>and the nuclei fuse together</u> *See also 2g.* that fertilisation in flowering plants occurs when a male nucleus in a pollen tube fuses with a nucleus in a female egg cell (ovum) in an ovule
e. to relate cells and cell functions to life processes in a variety of organisms	*Questions will be restricted to animal and plant cells only.*

2. Humans as organisms

Pupils should be taught:	Candidates should know:
Nutrition	
a. about the need for a balanced diet containing carbohydrates, proteins, fats, minerals, vitamins, fibre and water, and about foods that are sources of these	that glucose and starch are examples of carbohydrates, vitamin C is an example of a vitamin, and calcium salts are an example of a mineral; the effects on humans of lack of vitamin C and calcium; the dangers of an excessive intake of animal fats; one good source of each food component; how to carry out the iodine test for starch *No other food tests will be examined.*
b. the principles of digestion, including the role of enzymes in breaking down large molecules into smaller ones; amylase is an example of an enzyme	that digestive enzymes in the gut break down food substances into soluble substances capable of being absorbed across the lining of the intestine into the bloodstream; amylase as an example of an enzyme breaking starch into simple sugars *Names, sources and actions of particular enzymes will not be examined.*
c. that the products of digestion are absorbed into the bloodstream and transported throughout the body, and that waste material is egested	that the products of digestion are absorbed through the gut into the bloodstream across the villi in the small intestine; that the waste products are egested (not excreted) from the anus
d. that food is used as a fuel during respiration to maintain the body's activity and as a raw material for growth and repair	that carbohydrates are energy-containing foods, proteins are needed for growth and repair, fats are an energy source and are also needed for insulation
Movement	
e. the role of the skeleton and joints and the principle of antagonistic muscle pairs *[e.g. biceps and triceps]* in movement	that the skeleton protects delicate organs, supports the body and provides attachment for muscles; that muscles can contract and are pulled back to their original length by the contraction of antagonistic muscles; that muscles usually operate across moveable joints
Reproduction	
f. about the physical and emotional changes that take place during adolescence	the principal changes which occur at adolescence

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g.	about the human reproductive system, including the menstrual cycle and fertilisation	the terms gamete and zygote; the relative sizes and numbers of eggs and sperm and their roles; that fertilisation is the union of a sperm with an egg, bringing together through the genes some of the characteristics of both parents; the structure and functions of the human reproductive system and how sperm and egg are brought together; the menstrual cycle in outline only *Hormonal control will not be examined.*
h.	how the fetus develops in the uterus, including the role of the placenta	how the fetus is protected and nourished in the uterus and how its waste materials are eliminated
	Breathing	
i.	the role of lung structure in gas exchange, including the effect of smoking	the structure of the lungs in outline only, i.e. the lung surface is greatly folded, creating a large surface area for gaseous exchange; that oxygen is taken into the lungs by breathing, and transported to the tissues by the circulatory system; that smoking is one of the causes of lung cancer and heart disease; that smoking reduces the surface area of the lungs, leading to severe breathing difficulties
	Respiration	
j.	that aerobic respiration involves a reaction in cells between oxygen and food, <u>in which glucose is broken down to carbon dioxide and water</u>	the difference between breathing and respiration
k.	<u>to summarise aerobic respiration in a word equation</u>	<u>that energy is made available by aerobic respiration, summarised by the word equation</u> glucose+oxygen $\longrightarrow$ water+carbon dioxide+energy how to test exhaled air for carbon dioxide using limewater
l.	that the reactants and products of respiration are transported throughout the body in the bloodstream	that oxygen and carbon dioxide are carried in the blood and exchanged with the atmosphere through the lungs

Health

m. that the abuse of alcohol, solvents and other drugs affects health	the positive effects of exercise and healthy eating
n. how the growth and reproduction of bacteria and the replication of viruses can affect health, and how the body's natural defences may be enhanced by medicines	one example of a bacterial disease and one example of a viral disease; the importance of cleanliness at personal and community levels as a defence against disease; that the body's natural defences can be supplemented by medicines

3. Green plants as organisms

Pupils should be taught:	Candidates should know:
Nutrition and growth	
a. that plants need carbon dioxide, water and light for photosynthesis, and produce biomass and oxygen	the global importance of photosynthesis in producing food and maintaining the composition of the atmosphere; about gas production during photosynthesis in, e.g. *Elodea*; how to perform a controlled experiment to show that light is needed for starch production by a potted plant, e.g. *Pelargonium*
b. <u>to summarise photosynthesis in a word equation</u>	<u>that photosynthesis is summarised by the word equation</u> carbon dioxide + water $\xrightarrow[\text{chlorophyll}]{\text{light energy}}$ glucose + oxygen that in most plants the glucose is then converted into starch which can be tested, using iodine solution
c. that nitrogen and other elements, in addition to carbon, oxygen and hydrogen, are required for plant growth	that nitrates are needed for healthy growth; that magnesium is needed for chlorophyll
d. the role of root hairs in absorbing water and minerals from the soil	that root hairs increase the surface area for absorption of water and minerals such as nitrates
Respiration	
e. that plants carry out aerobic respiration	that animals and plants respire and plants photosynthesise; how the carbon cycle maintains a balance between respiration and photosynthesis and the effect of this on the atmosphere

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4. Variation, classification and inheritance

Pupils should be taught:	Candidates should know:
Variation	
a. about environmental and inherited causes of variation within a species	blood groups as an example of discontinuous variation and height as an example of continuous variation; how to detect and describe variation within and between species and suggest possible causes
Classification	
b. to classify living things into the major taxonomic groups	how to use a simple key to identify the group to which a specimen belongs; that animals and plants are classified into separate kingdoms; that bacteria, fungi and single-celled organisms are placed in other kingdoms; the characteristic features of the animal and plant kingdoms and why fungi are not included with plants; the diagnostic features of: single-celled organisms, fungi, arthropods (knowing the difference between insects and spiders), fish, amphibians, reptiles, birds, mammals and flowering plants *Candidates will not be asked to make their own keys.*
Inheritance	
c. that selective breeding can lead to new varieties	one example of selective breeding, such as dogs

5. Living things in their environment

Pupils should be taught:	Candidates should know:
Adaptation and competition	
a. about ways in which living things and the environment can be protected, and the importance of sustainable development	the importance of conserving local habitats, that the resources of the Earth are limited and need to be managed
b. that habitats support a diversity of plants and animals that are interdependent	at least one habitat, e.g. a freshwater pond or a hedgerow

c. how some organisms are adapted to survive daily and seasonal changes in their habitats	about the habitat of at least one animal and one plant, understanding how they are adapted to the conditions in their natural habitats at different times of the day, and in different seasons of the year; how to measure at least one physical factor, e.g. temperature, light intensity in the habitat
d. how predation and competition for resources affect the size of populations *[e.g. bacteria, growth of vegetation]*	simple methods of estimating the population size of one type of organism by means of a quadrat; that population size is affected by predation and competition
Feeding relationships	
e. about food webs composed of several food chains	about one simple food chain in one of the habitats studied; the difference between a food chain and a food web
f. how toxic materials can accumulate in food chains	*Questions will be restricted to data interpretation.*

AT3: MATERIALS AND THEIR PROPERTIES

LEARNING OBJECTIVES	AMPLIFICATION
6. Classifying materials	
Pupils should be taught:	Candidates should know:
Solids, liquids and gases	
a. how materials can be characterised by melting point, boiling point and density	*Measurement of the mass and volume and calculation of the density of regularly-shaped solids and of irregularly-shaped solids (using the displacement of water to find the volume) and of liquids will usually be examined in the physics section of the Common Entrance examination. So too will the fact that air has mass and that it is possible to measure its density.*
b. how the particle theory of matter can be used to explain the properties of solids, liquids and gases, including changes of state, gas pressure and diffusion	the meaning of the words atom and molecule *A knowledge of ions and of diffusion will not be examined.*

13+

Elements, compounds and mixtures

c.	that elements are shown in the periodic table and consist of atoms which can be represented by symbols	the term element as used in chemistry and the idea that samples of the same element contain the same type of atom; that the elements are organised in the periodic table; the symbols for the elements H, C, O, N, S, Mg, Na, Cl, Ca, Cu, Fe and He; that the symbol can represent one atom of that element *Details of the periodic table will not be examined.*
d.	how elements vary widely in their physical properties, including appearance, state at room temperature, magnetic properties and thermal and electrical conductivity, and to use these properties to classify elements as metals or non-metals	the terms conductor and insulator in both electrical and thermal contexts; the grouping of elements into metals and non-metals according to physical characteristics, such as electrical conductivity, shininess, malleability and according to whether they give acidic or basic oxides *Carbon, copper, iron, magnesium, sulphur and zinc are suitable examples for experiments on burning the elements in air and testing the oxides. Calcium and sodium, if included, must be handled only by the teacher.*
e.	how elements combine through chemical reactions to form compounds *[e.g. water, carbon dioxide, magnesium oxide, sodium chloride, most minerals]* with definite composition	the idea that elements combine to give compounds whose properties differ from those of the constituent elements; what happens when some elements are burned in oxygen, e.g. carbon, sulphur, iron, magnesium; the reaction between pairs of elements, e.g. iron + sulphur, copper + sulphur, aluminium + iodine (in a fume cupboard or outside) *Knowledge of the reaction of sodium with chlorine will not be examined.*
f.	to represent compounds by formulae and to summarise reactions by word equations	simple formulae: H_2O, CO_2, O_2, CH_4, NaCl, HCl, NaOH, $CaCO_3$ *Equations using formulae will not be examined.*

g. that mixtures *[e.g. air, sea water and most rocks]* are composed of constituents that are not combined	that air is a mixture of gases; the approximate percentages of nitrogen, oxygen and the relatively small proportion of other gases in the air; the uses of oxygen; that carbon dioxide is a product of respiration and a raw material for photosynthesis
h. how to separate mixtures into their constituents using distillation and chromatography and other appropriate methods	the following methods of separation: evaporation to recover a solute and the testing of water purity by measurement of its boiling point and freezing point; simple distillation to recover a solvent from a solution, e.g. how to obtain a sample of pure water from seawater or washable ink; of the need to prevent suck-back of the distilled sample if simple apparatus is used, and how to prevent it; fractional distillation to recover ethanol (alcohol) from wine or beer; use of the Liebig condenser; paper chromatography to separate a mixture of two or more coloured solutes from a solution, e.g. coloured inks, food dyes, Smartie-type sweets; how to interpret simple chromatograms; about filtration to remove insoluble solids from a suspension; the terms filtrate and residue; how to purify rock salt

7. Changing materials

Pupils should be taught:	Candidates should know:
Physical changes	
a. that when physical changes *[e.g. changes of state, formation of solutions]* take place, mass is conserved	the terms solution, solvent, solute, soluble, insoluble and dissolving

13+

b. about the variation of solubility with temperature, the formation of saturated solutions and the differences in solubility of solutes in different solvents	that when soluble solids form a solution, a chemical change is not involved; that a solution is a mixture which may be separated using physical techniques; about the abundance of water in nature, including its existence as vapour in the air; the water cycle; about the use of anhydrous copper sulphate and anhydrous cobalt chloride to test for the presence of water vapour in the air; the effect of air flow and temperature changes on evaporation from oceans or in laboratory experiments; how to make predictions about the amount of water lost; the need for filtration; the differences between sea, tap and distilled water, demonstrated by evaporation; the importance of water as a solvent; that ethanol and propanone are alternative solvents to water *Chlorinated hydrocarbons must not be used.*
c. to relate changes of state to energy transfers	the terms melting, freezing, boiling, condensation, evaporation and sublimation; that most solids, liquids and gases expand on heating and contract on cooling, e.g. the use of mercury or alcohol in thermometers; that evaporation can occur at any temperature but boiling occurs at a specific temperature for a particular substance
Chemical reactions	
d. how mass is conserved when chemical reactions take place because the same atoms are present, although combined in different ways	how to use the Bunsen burner for gentle warming, vigorous heating etc.; about the effect of air supply on the flame and relative temperatures of different parts of the roaring flame; about the experiment to demonstrate the conservation of mass in which lead iodide, or another suitable solid, is produced by mixing two solutions in a stoppered conical flask; how to construct word equations for simple chemical reactions; about recognising chemical change by the new substances which are formed

e. that virtually all materials, including those in living systems, are made through chemical reactions, and to recognise the importance of chemical change in everyday situations, *[e.g. ripening fruit, setting superglue, cooking food]*	*Many examples of such reactions are given in other sections. Copper oxide, zinc oxide and magnesium oxide (previously dried in an oven) may be used to illustrate that some substances do not change chemically when heated.* that chemical reactions are needed for the extraction of copper, iron and aluminium from their ores
f. about possible effects of the burning of fossil fuels on the environment *[e.g. production of acid rain, carbon dioxide and solid particles]* and how these effects can be minimised	that when things burn in air they react with oxygen; the glowing splint test for oxygen and the limewater test for carbon dioxide; how to identify the products of combustion, e.g. of a candle; the importance of oxygen as a reactant in respiration; the effect of burning fossil fuels; that air is often polluted by sulphur dioxide and carbon monoxide and the sources of these pollutants *Production and effects of ozone and oxides of nitrogen will not be examined.*

8. Patterns of behaviour

Pupils should be taught:	Candidates should know:
Metals	
a. how metals react with oxygen, water and acids and oxides of other metals, and what the products of these reactions are	how to apply the lighted splint test for hydrogen; about the rusting of iron; that oxygen in the air is involved in the rusting process *Simple rusting experiments should be extended to show that air contains 20% oxygen. Copper, iron, magnesium and zinc are suitable examples for experiments.*
b. about the displacement reactions that take place between metals and solutions of salts of other metals	about displacement reactions between metals and solutions of the sulphates of other metals

13+

c.	how a reactivity series of metals can be determined by considering these reactions, and used to make predictions about other reactions	how to use the reactivity series of metals to deduce that those higher in the series might burn more vigorously in air, react faster with water and dilute acids, and replace a lower metal from its oxide; about the uses of metals low down the series, such as lead and copper, for roofing and piping; about the need for methods of covering the surface when the more reactive iron is used; about the exceptional lack of reactivity of silver and gold which makes them useful for jewellery and electrical contacts *Reference should be made to the fact that most metals are not found in their free state and that chemical reactions are necessary to extract metals from their ores.*
	Acids and bases	
d.	to use indicators to classify solutions as acidic, neutral or alkaline and to use the pH scale as a measure of the acidity of a solution	about experiments which test substances with different indicators, including litmus paper and Universal Indicator; that substances can be acidic, alkaline or neutral; about the use of plant extracts, e.g. red cabbage, as indicators; colour changes for litmus; the pH scale; pH numbers for strong and weak acids and alkalis and a neutral solution
e.	how metals and bases, including carbonates, react with acids and the products of these reactions	about neutralisation and salt formation; about the addition of dilute sodium hydroxide solution to dilute hydrochloric acid and evaporation of the neutral solution, to illustrate neutralisation and salt formation *Alternatively, salt formation could be illustrated by adding copper oxide or copper carbonate to warm dilute sulphuric acid and evaporating gently.* *Titration will not be examined.*
f.	about some everyday applications of neutralisations *[e.g. the treatment of acid indigestion, the treatment of acid soil, the manufacture of fertilizer]*	about medical and agricultural applications of neutralisation

g. how acids in the environment can lead to corrosion of metal and chemical weathering of rock *[e.g. limestone]*	that carbon dioxide dissolves in water to form an acid and that rain is slightly acidic; about limestone: its chemical composition, its decomposition when heated, its reaction with dilute hydrochloric acid, its uses as a building material and for the production of agricultural lime; about the weathering effect of acid rain on limestone
h. to identify patterns in chemical reactions	the terms oxidation, reduction, neutralisation and decomposition; about the use of carbon to illustrate reduction; about the action of heat on copper and magnesium in air to illustrate oxidation; about the combustion of methane and similar fuels; about hydrated copper sulphate, hydrated cobalt chloride, copper carbonate and potassium permanganate to illustrate thermal decomposition

AT4: ENERGY, FORCES AND SPACE

LEARNING OBJECTIVES	AMPLIFICATION
9. Electricity and magnetism	
Pupils should be taught:	Candidates should know:
Circuits	
a. how to design and construct series and parallel circuits, and how to measure current and voltage	about parallel and series circuits, involving cells, lamps, switches (push button, SPST, reed switches), resistors, variable resistors, motors, buzzers, LDRs, LEDs, fuses, AND and OR circuits (as constructed using switches); about truth tables for these *Logic gates, SPDT switches and the use of the voltmeter will not be examined.*
b. that the current in a series circuit depends on the number of cells and the number and nature of other components and that current is not 'used up' by components	that the unit of current is the ampere (amp); that current is measured with an ammeter and that it should be connected in series in the circuit *Knowledge of resistors should be qualitative and no formal statement of Ohm's Law or definition of resistance will be required.*

13+

c. that energy is transferred from batteries and other sources to other components in electrical circuits	that a battery or cell transforms chemical energy into electrical energy and that electrical energy is converted into other forms in electrical components

Magnetic fields

d. about magnetic fields as regions of space where magnetic materials experience forces, and that like magnetic poles repel and unlike magnetic poles attract	that like poles repel and unlike poles attract, and that both poles will attract unmagnetised iron; that the Earth has a magnetic field, and that a freely-suspended bar magnet will align itself north–south; the terms north-seeking and south-seeking poles; that lines showing the direction of the field should have arrows pointing away from the north-seeking pole; that repulsion by a known magnet is the only true test for another magnet

Electromagnets

e. that a current in a coil produces a magnetic field pattern similar to that of a bar magnet	how to use plotting compasses and/or iron filings to show that current in a coil produces a magnetic field
f. how electromagnets are constructed and used in devices *[e.g. lifting magnets, relays]*	how to construct a simple electromagnet using an iron core and insulated wire, and that the strength of the electromagnet depends on the number of turns on the coil and on the current; how to use relays

10. Forces, motion and density

Pupils should be taught:	Candidates should know:

Force and linear motion

a. scientific units	that scientists use the following units: for mass – kilogramme or gram; for length – metre, kilometre, centimetre or millimetre; for time – second, minute or hour; the abbreviations for the above units and their relative sizes (e.g. 1 m = 100 cm); that area can be measured in m^2 or cm^2; that volume can be measured in m^3 or cm^3
b. how to determine the speed of a moving object and to use the quantitative relationship between speed, distance and time	about the timing of moving bodies to measure speed; the relationship between speed, distance and time; how to use this for simple quantitative work
c. about forces	that the unit of force is the newton and that forces can be measured using a force meter (newton meter)

d.	that the weight of an object on Earth is the result of the gravitational attraction between its mass and that of the Earth	that there is a gravitational force of attraction between any two masses; that this force causes bodies to fall towards the centre of the Earth; that the weight of a body is the pull of gravity on it
e.	that unbalanced forces change the speed or direction of objects and that balanced forces produce no change in the movement of an object	the concept of constant speed and of speeding up and of slowing down, without a formal definition of acceleration; about the effects of forces on an object; that forces can act in different directions; about experiments and calculations with springs and combinations of springs *Knowledge of elastic limit and limit of proportionality will not be examined.*
f.	ways in which frictional forces, including air resistance, affect motion *[e.g. streamlining cars, friction between tyre and road]*	about the force of friction, including air resistance (drag), and its applications; the different stopping distances as listed in the Highway Code *Candidates do not have to memorise the different stopping distances.*
	Force and rotation	
g.	that forces can cause objects to turn about a pivot	about the use of levers to change direction and magnitude of a force and their use in simple machines, e.g. crowbars, pliers, scissors
h.	the principle of moments and its application to situations involving one pivot	simple quantitative examples involving moments about a single pivot; that the unit of a moment is a newton metre (or newton centimetre)
	Force and pressure	
i.	the quantitative relationship between force, area and pressure and its application *[e.g. the use of skis and snowboards, the effect of sharp blades]*	the relationship between force**,** area and pressure; how to use this for simple quantitative work *(Level 1 candidates will be given the pressure relationship arranged appropriately for the question)*; that the unit of pressure is N/m^2 or N/cm^2

13+

Density

j. density and its measurement	the relationship between density, mass and volume; how to use this for simple quantitative work *(Level 1 candidates will be given the density relationship arranged appropriately for the question)*; that the unit of density is kg/m^3 or g/cm^3; the measurement of the mass and volume of regularly-shaped solids and of irregularly-shaped solids (using the displacement of water to find a volume), and of liquids to calculate their density; that air has mass and that it is possible to measure its density

11. Light and sound

Pupils should be taught:	Candidates should know:
The behaviour of light	
a. that light travels in a straight line at a finite speed in a uniform medium	that light comes from a luminous source and travels in straight lines
b. that non-luminous objects are seen because light scattered from them enters the eye	*Details of the structure of the eye will not be examined.*
c. how light is reflected at plane surfaces	how a plane mirror alters the path of a ray of light; the meaning of the angle of incidence and angle of reflection; how to measure these angles using a protractor, and that they are equal; practical applications of mirrors, e.g. construction of a periscope
d. how light is refracted at the boundary between two different materials	that, on a qualitative basis, light changes direction when it reaches the boundary between two different materials and that this phenomenon is called refraction *Snell's Law and knowledge of optical devices which require the use of lenses will not be examined.*
e. that white light can be dispersed to give a range of colours	how a prism disperses white light and that a similar effect occurs naturally in a rainbow
Hearing	
f. that sound causes the eardrum to vibrate and that different people have different audible ranges	*Questions will not be set which require candidates to have experienced the use of a signal generator.*

g. some effects of loud sounds on the ear *[e.g. temporary deafness]*	that loud sounds can cause temporary or permanent damage to hearing

Vibration and sound

h. that light can travel through a vacuum but sound cannot, and that light travels much faster than sound	that sound travels through solids, liquids and air, but not through a vacuum; that an event observed from a distance is seen before it is heard *Candidates will not be expected to memorise the numerical values for the speeds of sound and light but merely the comparison between the two.*
i. the relationship between the loudness of a sound and the amplitude of the vibration causing it	that increasing amplitude increases the loudness of a sound
j. the relationship between the pitch of a sound and the frequency of the vibration causing it	that increasing frequency increases pitch

12. The Earth and beyond

Pupils should be taught:	Candidates should know:

The solar system

a. how the movement of the Earth causes the apparent daily and annual movement of the Sun and other stars	that the Earth is one of several planets which orbit the Sun; the reasons for the changes causing night and day, <u>seasons and eclipses of the Sun and Moon</u>
b. the relative positions of the Earth, Sun and planets in the solar system	the concept of a moon as a satellite, as shown by our Moon and the moons of other planets; that the solar system is part of the Milky Way galaxy, and that the Universe contains many such groups of stars or galaxies; about the scale of astronomical distances *Planetary and stellar distances need not be remembered.*
c. about the movements of planets around the Sun and to relate these to gravitational forces	that it is gravitational forces which keep the Moon in orbit round the Earth and planets in orbit round the Sun
d. that the Sun and other stars are light sources and that the planets and other bodies are seen by reflected light	why the planets and our Moon are visible even though they are not light sources

13+

e. about the use of artificial satellites and probes to observe the Earth and to explore the solar system	*Factual details about Man's exploration of space will not be examined, but candidates should have heard of the development of manned space flight and of the use of satellites for communication, for monitoring conditions on Earth and for exploration of the solar system.*

13. Energy resources and energy transfer

Pupils should be taught:	Candidates should know:
Energy resources	
a. about the variety of energy resources, including oil, gas, coal, biomass, food, wind, waves and batteries, and the distinction between renewable and non-renewable resources	that energy is a quantity which can be measured and that the unit of energy is the joule; that a renewable resource is one which can be replenished within a lifetime; some of the advantages and disadvantages of renewable and non-renewable resources *Calculations involving this unit in the context of 'work' will not be examined.*
b. about the Sun as the ultimate source of most of the Earth's energy resources and to relate this to how coal, oil and gas are formed	the role of the Sun as the ultimate source of the energy in fossil fuels; its part in the water cycle and formation of wind and waves
c. that electricity is generated using a variety of energy resources	that a variety of processes is used to generate electricity
Conservation of energy	
d. ways in which energy can be usefully transferred and stored	that energy can exist in many different forms: chemical, electrical, gravitational, kinetic, light, sound, strain (elastic) and thermal (internal); the form in which energy is stored in a particular situation (e.g. a stretched spring stores energy as strain energy); how to describe the energy transformation taking place in simple situations (e.g. a lamp transforming electrical energy into light and thermal energy)
e. that although energy is always conserved, it may be dissipated, reducing its availability as a resource	the significance of the Law of Conservation of Energy

SCHEME OF ASSESSMENT

11+ (80 marks; 60 minutes)

The paper will test Organisms, their Behaviour and the Environment; Materials, their Properties and the Earth; Energy, Forces and Space, with approximately equal weighting. Questions will be included to enable candidates to demonstrate their developing skills in *How science works*. Each paper may contain a question giving candidates the opportunity for free writing to a maximum of 4 marks.

There will be no choice of questions. The use of calculators will be allowed in the examination.

13+

Assessment of the 13+ syllabus can occur at two levels: Level 1 and Level 2. The syllabus is common for both levels, although those parts of the syllabus which are underlined will only be assessed on Level 2 papers. It is envisaged that candidates who are expected to achieve less than an average of 40% on the three Level 2 papers should consider using the Level 1 paper.

Level 1 (80 marks; 60 minutes)

There will be one paper with approximately equal numbers of questions based on the 13+ biology, chemistry and physics syllabuses. The paper will consist of a mixture of closed items, e.g. multiple choice, matching pairs, completing sentences and some open questions. Open questions will have several parts, some of which will require answers of one or two sentences. These parts will carry a maximum of two marks. Up to 10% of the marks on the paper will be available for plotting graphs or making simple calculations, such as calculating means from data or using a formula.

There will be no choice of questions. The use of calculators and protractors will be allowed in the examination.

Level 2 (60 marks per paper; 40 minutes per paper)

There will be three papers, one in each of biology, chemistry and physics. Some of the questions may be closed, although most will be open with several parts requiring candidates to answer in sentences. These parts will carry a maximum of three marks. In addition, one mark may be given for an acceptable standard of spelling, punctuation and grammar in one part of the paper. The maximum number of marks per question will be twelve. At least 25% of the paper will be testing how science works.

There will be no choice of questions. The use of calculators and protractors will be allowed in the examination.

SCHOLARSHIP *(See Appendix IV)*

Scholarship papers are based on this syllabus. The examination (90 minutes) will be divided into three sections: **A (Biology), B (Chemistry)** and **C (Physics)**. Candidates will be required to attempt all the questions. Each section is worth 25 marks but the number of questions will vary. The use of calculators and protractors will be allowed in the examination.

APPENDIX I

SUGGESTED MATERIALS FOR GROUPING AND CLASSIFYING MATERIALS

aluminium	glass	polystyrene
brass	granite	polythene
bronze	hardwood	PVC
carbon (graphite)	iron	rubber
ceramic	lead	slate
chalk	leather	soft wood
clay	limestone	steel
copper	marble	wool
cork	nylon	zinc
cotton cloth	paper	
expanded polystyrene	Perspex	

APPENDIX II

The terminology used in the biology papers is based on *Biological Nomenclature*: *Standard Terms and Expressions used in the Teaching of Biology*, Institute of Biology, 2000.

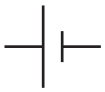
Other useful sources are:

Association of Science Education: www.ase.org.uk
CLEAPSS: www.cleapss.org.uk
QCA: curriculum.qca.org.uk
Standards: www.standards.dfes.gov.uk

APPENDIX III

ELECTRICAL SYMBOLS
WHICH MAY BE USED IN COMMON ENTRANCE PAPERS

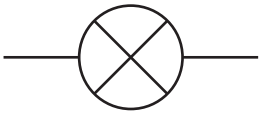
11+



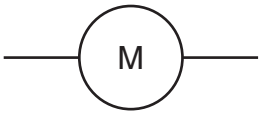
cell

terminals

buzzer



lamp / bulb

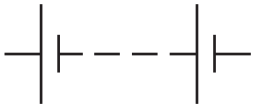


motor

switch
(open)

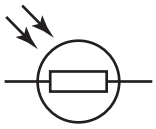
switch
(closed)

Additional symbols required for 13+

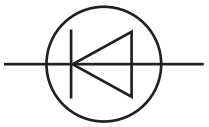


battery

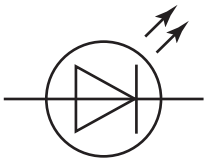
fuse



light dependent
resistor

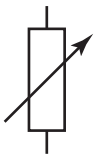


semiconductor
diode



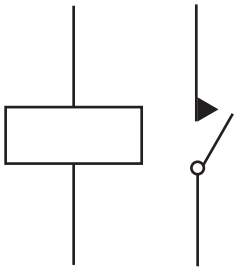
light emitting
diode

resistor

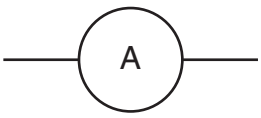


variable
resistor

push-button
switch

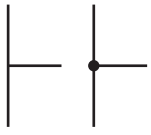


relay
(normally open)



ammeter

reed switch



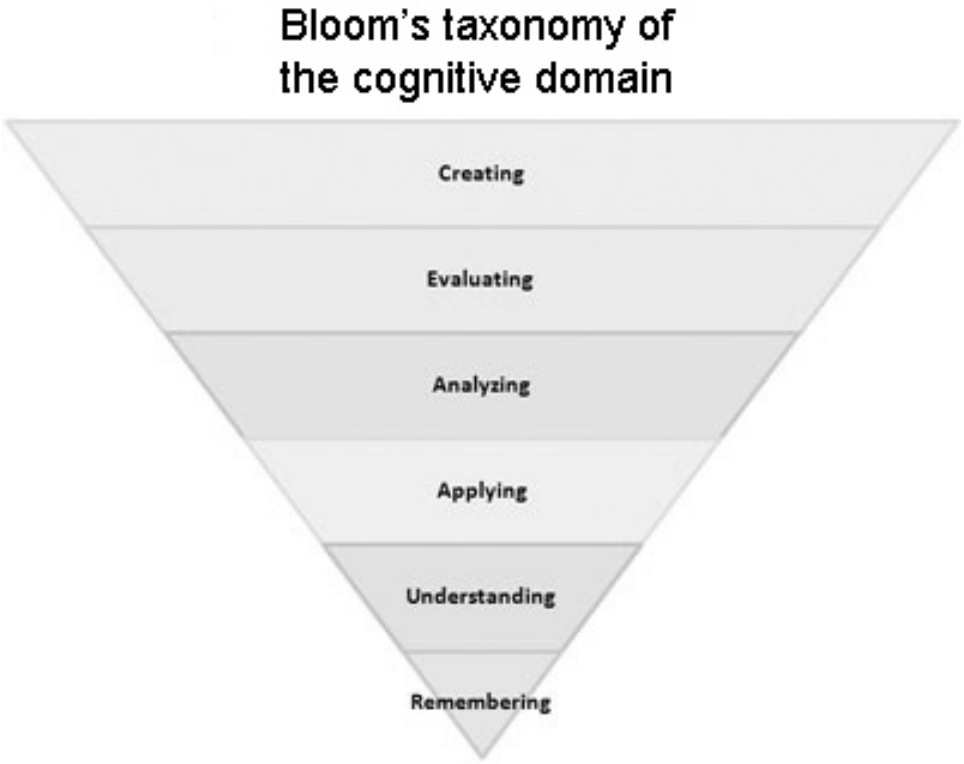
junction of
conductors

APPENDIX IV

SCHOLARSHIP EXAMINATION

The Common Academic Scholarship papers are designed for able students who are seeking scholarships to independent senior schools. There are two examination sessions, one in February and the other in May. Senior schools can enter candidates for either session. Papers are based on the 13+ syllabus; knowledge of the 11+ syllabus is assumed. Questions requiring detailed recalled knowledge from topics solely located in the 11+ syllabus will not be set. A minimum of 25% of the marks in the whole paper will be based on the *How Science Works* section of the syllabus.

The examination is designed to test candidates' thinking skills and is based on Bloom's Taxonomy of cognitive learning. A revised version of this appears below.



The examination (90 minutes) will be divided into three sections: **A (Biology), B (Chemistry)** and **C (Physics)**. Candidates will be required to attempt all the questions. Each section is worth 25 marks but the number of questions will vary. The use of calculators and protractors will be allowed in the examination.

Within each subject section, marks will be allocated according to the following assessment objectives:

assessment objective	description	minimum % mark allocation
O1	remembering and understanding	25
O2	applying and analysing	25
O3	evaluating and creating	25