Biology

<u>Definitive list of learning objectives and topics to learn for CE/Scholarship</u> <u>biology</u>

The topics outlined below are usually taught sequentially.

Pupils should know and understand:

Unit 1: Features of living organisms, and how they are organised		
the seven life processes and how they relate to animals.		
that animal and plant cells can form tissues, and tissues can form organs; that organs work		
together in systems; organ systems work together in an organism; examples of organ		
systems in humans and in flowering plants (roots, shoots).		
the names and positions of the following related organs: brain, heart, lungs, stomach,		
intestines, liver, kidneys.		
the seven life processes and how they relate to plants		
the names and positions of root, stem, leaves and flower in a flowering plant.		

Unit 2: Habitats, adaptation and feeding relationships		
how animals and plants in two different habitats are suited to their environments (e.g		
desert or hedgerow)		
detailed features of at least one animal and one plant in a chosen and named habitat -		
which should include size, shape, colour and, where possible, methods of movement,		
feeding and protection, as well as how they are adapted to the conditions of their natural		
habitat at different times of the day, and in different seasons of the year; measure at least		
one physical factor (e.g. temperature, light intensity) in the habitat.		
the wide variety of ways animals have developed for living in different situations		
that some animals are nocturnal		
that the activity of living things can be related to the time of day and season of the year -		
hibernation and migration		
how some organisms are adapted to survive daily and seasonal changes in their habitats		
how predation and competition for resources affect the size of populations (e.g. bacteria,		
growth of vegetation)		
describe simple methods of estimating the population size of one type of organism by		
means of a quadrat		
how to place organisms in order in a food chain, and how food chains show feeding		
relationships in a habitat		
the relationship between predator and prey		
the terms producer, consumer (herbivore, carnivore, omnivore)		
how nearly all food chains begin with a green plant		
know the difference between food chains and food webs		
know about one simple food chain in one of the habitats studied		

habitats support a wide range of plants and animals that depend on each other		
interpret data on how toxic materials can accumulate in food chains		
Covered in Year 8		
About ways in which living things and the environment can be protected and the		
importance of sustainable development		
About the importance of conserving local habitats; that the resources of the Earth are		
limited and need to be managed		

Unit 3: Variation & inheritance		
how to detect and describe variation within and between species, and suggest possible		
causes		
genes are passed from parents to offspring and are a cause of inherited variation		
Know the difference between continuous and discontinuous variation and can give		
examples and the causes i.e. genes, environment or both		
That differences exist between species e.g. the similarities and differences between the		
Great Apes (including chimpanzees and gorillas) and humans		

Unit 4: Classification of animals and plants		
how to use a simple key to identify the group to which a specimen belongs		
animals and plants are classified into separate kingdoms		
bacteria, fungi and single-celled organisms are placed in other kingdoms		
Give an example of a unicellular protist such as euglena or amoeba and how these cells are		
adapted to feed, exchange gases and move		
the characteristic features of the plant and animal kingdoms, and why fungi are not		
included with the plants		
the diagnostic (recognizable) features of single-celled organisms, fungi, arthropods		
(including differences between		
Insects and spiders), fish, amphibians, reptiles, birds, mammals and flowering plants.		

Unit 5: Life cycles		
Can identify the stages of the life cycle of a butterfly and housefly		
Can describe the effect of the exoskeleton on the growth of a caterpillar and compare this		
to the growth of a human		
Know what metamorphosis is		
Know about the economic importance of life cycles to man		

Unit 6: Microscopes and cells		
How to use a microscope to observe plant and animal cells		
How to prepare temporary microscope slides using methylene blue as a stain for nuclei		
of animal cells or iodine as a stain for plant cells		
How to use simple scale diagrams		
Can give examples of specialised cells and explain how they are adapted to their function		
(sperm, ciliated epithelial, egg, nerve and root hair cells)		
Know that a typical plant or animal cells has a nucleus, cytoplasm, mitochondria and cell		
surface membrane (and label these)		
The role of diffusion in the movement between plant and animal cells (look what things		
might need to move into and out of plant and animal cells)		
Know that the nucleus contains genes which control the production of protein in the cell		
Know that genes are made of DNA which determines an organism's characteristics		
Plant cells have additional features: cellulose cell wall, vacuole and in green plants,		
chloroplasts		

Unit 7: Reproduction in plants		
Can identify the main parts of a plant		
Know that the root anchors the plant		
water and minerals are taken in through the root and transported through the stem to		
other parts of the plant.		
mineral salts are nutrients which are needed for healthy growth.		
nitrogen and other elements, in addition to carbon, hydrogen and oxygen are required		
for plant growth		
nitrates are needed by plants to make proteins for growth, and poor growth results if a		
plant is deprived of nitrates		
root hairs increase the surface area for absorption of water and mineral salts		
details of flower structure and terms carpel (stigma, style, ovary, ovule), stamen		
(anther, filament), petal, sepal		
how sexual reproduction occurs in flowering plants		
pollination is the transfer of pollen from an anther to a stigma		
fertilisation is the fusing together of the male and females sex cells which produces a		
fertilised egg and then a seed		
fruit formation and seed dispersal		
germination of seeds and main parts of a germinating seed: embryo shoot, embryo root,		
food store, seed coat		
how to demonstrate the effect of variation in light, temperature and water on plant		
growth		

Photosynthesis		
that air supplies a plant with carbon dioxide for making food by photosynthesis		
that plants need oxygen for respiration		
the global importance of photosynthesis in producing food and maintaining the		
composition of the atmosphere		
gas (oxygen) production during photosynthesis (e.g. in Elodea or pondweed)		
how to perform a controlled experiment to show that light is needed for starch		
production by a potted plant		
the role of the leaf in producing new material for growth		
green plants use energy from the sun to produce food (glucose)		
the part played by the green pigment, chlorophyll, in capturing light energy		
that nearly all food chains begin with green plants		
that photosynthesis can be summarised by the word equation: (look up and learn)!		
in most plants, glucose is converted to starch which can be tested for using iodine solution		
how to carry out the starch test safely		
In outline only: about the role of cells containing chloroplasts as sites of photosynthesis;		
the role of xylem in transporting water to the leaf; the role of phloem transporting sugar		
to the growing parts of the plant; the role of stomata in gas exchange during daylight.		

Unit 8: Human biology		
Diet and nutrition		
the value of a balanced diet, composed of carbohydrates, lipids (fats), proteins, vitamins,		
mineral salts, dietary fibre and water, in the maintenance of good health, and examples of		
the foods that are sources of these		
glucose and starch are examples of carbohydrates, vitamin C is an example of a vitamin		
and calcium salts are an example of a mineral.		
that carbohydrates are energy-containing foods, proteins are needed for growth and		
repair, fats are an energy source and are also needed for insulation.		
how to carry out the iodine test for starch and the Benedict's test for sugar		
that food is used as a fuel during respiration to maintain the body's activity and as a raw		
material for growth and repair		
The consequences of imbalances in the diet including deficiency diseases (vitamins C and		
D), obesity and starvation		
the dangers of an excessive intake of animal fats		

Unit 8: Human biology		
Digestion		
the main kinds of teeth (incisors, canines, molars and pre-molars) and their functions		
the effect of bacteria (plaque), fluoride and diet on dental decay		
the importance of dental care and hygiene		
the principles of digestion, including the role of enzymes in breaking down large		
molecules into smaller ones.		
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.		

Gas exchange and aerobic respiration		
the structure of the lungs in outline only, i.e. the lung surface is greatly folded, creating a		
large surface for gaseous exchange, and that they have thin walls and rich blood supply		
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		
the mechanism of breathing to move air in and out of the lungs, using a pressure model to		
explain the movement of gases, including simple measurements of lung volume		
the terms <i>inspiration</i> and <i>expiration</i> ; about the role of the diaphragm and the intercostal muscles		
in the rib cage; that vital capacity is a measure of lung volume		
How to test the products of respiration using limewater i.e. carbon dioxide		
That aerobic respiration involves a reaction in cells between oxygen and food, in which		
glucose is broken down to carbon dioxide and water and where in the cell this reaction takes		
place (role of the mitochondria)		
Summarise the word equation for aerobic respiration		
The process of anaerobic respiration in humans including fermentation, and a word equation		
for anaerobic respiration		
The differences between aerobic and anaerobic respiration (that for each mole of glucose		
respired, aerobic respiration yields (gives) more energy than anaerobic respiration.		

Circulation, the effects of exercise, the skeleton and muscles		
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 (not the names of chambers and valves)		
that the heart forces blood around the body to the organs through arteries and that the		
blood returns to the heart through veins		
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 effects of exercise on the body and the benefits to health (e.g. reducing obesity, increasing		
stamina)		
the location of the skull, backbone (vertebral column), rib cage, pelvis, collar-bone and		
shoulder blade.		
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.		

Unit 9: Keeping healthy		
that the abuse of alcohol, solvents and other drugs affects health		
The impact of exercise, asthma and smoking on the human gas exchange 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; the importance of		
inhalers to treat asthma; the effects of athletic training on lung volume and heart rate;		
about pulse rate as a measure of heart rate.		
The effects of recreational drugs including substance misuse on behaviour, health and life		
processes. The effects of tobacco, alcohol and marijuana on behaviour and long-term		
physical and mental health; the potential for addiction, the positive effects of exercise and		
healthy eating		

Micro-organisms		
how the growth and reproduction of bacteria and the replication of viruses can affect health		
one example of a bacterial disease (cholera, tuberculosis) and one example of a viral disease		
('flu, AIDS)		
the importance of cleanliness at the personal and community levels as a defence against		
disease		
that the body's natural defences can be supplemented by artificial methods		
micro-organisms are living organisms that are often too small to be seen, and they may be		
beneficial or harmful.		
the need to protect and conserve living things and their environment (e.g. endangered species,		
effects of pollution,		

Unit 10: Human Reproduction		
the principal changes which occur at adolescence and an understanding of why these occur		
the terms gamete (reproductive cell) and zygote (fertilised female cell which has not yet		
begun dividing)	1	
the relative numbers and sizes 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	1	
the structure and functions of the human reproductive system and how sperm and eggs are		
brought together		
the menstrual cycle in outline only (hormonal control is not required)		
how the foetus is protected and nourished in the uterus, and how its waste materials are		
eliminated. That molecules such as nicotine and alcohol can pass across the placenta and affect		
foetal development	1	