

Science Age 12-13

(A) BIOLOGY: ORGANISMS, THEIR BEHAVIOUR AND THE ENVIRONMENT

1. Cells and their functions

- know that in multi-cellular organisms cells are massed together to form tissues, and tissues can be massed together to form organs
- understand the functions of chloroplasts and cell walls in plant cells and that a typical animal or plant cell has a nucleus, cytoplasm, mitochondria and cell surface membrane (state very briefly the function of each component)

2. Humans

Nutrition and digestion

- understand the principles of digestion, including the role of enzymes in breaking down large molecules into smaller ones and 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 is an example of an enzyme breaking starch into simple sugars)
- know that the products of digestion are absorbed into the bloodstream and transported throughout the body, and that waste material is egested (perhaps learn 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)

Respiration/Breathing

- understand the role of lung structure in gas exchange, including the effect of smoking
- study the structure of the lungs in outline only, i.e. the lung surface is greatly folded, creating a large surface area for gaseous exchange
- know that oxygen is taken into the lungs by breathing, and transported to the tissues by the circulatory system
- know that smoking is one of the causes of lung cancer and heart disease and that smoking reduces the surface area of the lungs, leading to severe breathing difficulties

Health

- understand that the abuse of alcohol, solvents and other drugs affects health
- understand the positive effects of exercise and healthy eating
- learn 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; the importance of cleanliness at personal and community levels as a defence against disease
- study one example of a bacterial disease and one example of a viral disease

3. Green plants as organisms

Nutrition and growth

- know that nitrogen and other elements, in addition to carbon, oxygen and hydrogen, are required for plant growth
- know that nitrates are needed for healthy growth; that magnesium is needed for chlorophyll

- understand the role of root hairs in absorbing water and minerals from the soil (root hairs increase the surface area for absorption of water and minerals such as nitrates)

Respiration

- know that plants carry out aerobic respiration

- understand how the carbon cycle maintains a balance between respiration and photosynthesis and the effect of this on the atmosphere

4. Living things in their environment

Habitats

- learn about ways in which living things and the environment can be protected, and the importance of sustainable development

- understand the importance of conserving local habitats, and that the resources of the Earth are limited and need to be managed

- know that habitats support a diversity of plants and animals that are interdependent. Study at least one habitat, e.g. a freshwater pond or a hedgerow, to show how the plants and animals there suit the conditions in their natural habitats 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.

Feeding relationships

- learn about food webs composed of several food chains; explore one simple food chain in one of the habitats studied. What is the difference between a food chain and a food web?

- understand how toxic materials can accumulate in food chains

(B) CHEMISTRY: MATERIALS AND THEIR PROPERTIES

1. Elements, compounds and mixtures

- learn 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

2. Changing materials

Physical changes

- know that when physical changes [*e.g. changes of state, formation of solutions*] take place, mass is conserved. Use the terms solution, solvent, solute, soluble, insoluble and dissolving.

- relate changes of state to energy transfers: use 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

- know that evaporation can occur at any temperature but boiling occurs at a specific temperature for a particular substance.

Chemical reactions

- understand how mass is conserved when chemical reactions take place because the same atoms are present, although combined in different ways. Construct word equations for simple chemical reactions. Recognise chemical change by the new substances which are formed.

- if possible, 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

3. Patterns of behaviour

Acids and bases

- use indicators to classify solutions as acidic, neutral or alkaline and use the pH scale as a measure of the acidity of a solution. Test substances with different indicators, including litmus paper and Universal Indicator. Use plant extracts, e.g. red cabbage, as indicators.
- learn how metals and bases, including carbonates, react with acids and the products of these reactions
- Learn about neutralisation and salt formation (use 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.*)
- learn about some everyday applications of neutralisations [*e.g. the treatment of acid indigestion, the treatment of acid soil, the manufacture of fertilizer*]
- understand how acids in the environment can lead to corrosion of metal and chemical weathering of rock; that carbon dioxide dissolves in water to form an acid and that rain is slightly acidic. Learn 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

(C) PHYSICS: ENERGY, FORCES AND SPACE

1. Electricity and magnetism

Magnetic fields

- learn about magnetic fields as regions of space where magnetic materials experience forces, that like magnetic poles repel and unlike magnetic poles attract and that both poles will attract unmagnetised iron
- know 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 northseeking pole and that repulsion by a known magnet is the only true test for another magnet

Electromagnets

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

2. Forces, motion and density

Force and linear motion

- determine the speed of a moving object and use the quantitative relationship between speed, distance and time about the timing of moving bodies to measure speed; understand the relationship between speed, distance and time; use this for simple quantitative work

- study ways in which frictional forces, including air resistance (drag), affect motion [*e.g. streamlining cars, friction between tyre and road*]
- study the different stopping distances as listed in the Highway Code

Force and pressure

- know that the unit of force is the newton and that forces can be measured using a force meter (newton meter);
- know that the weight of an object on Earth is the result of the gravitational attraction between its mass and that of the Earth
- understand 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 and that the weight of a body is the pull of gravity on it

3. Light and sound

Vibration and sound

- know that light can travel through a vacuum but sound cannot, and that light travels much faster than sound (sound travels through solids, liquids and air, but not through a vacuum. An event observed from a distance is seen before it is heard)
- understand the relationship between the loudness of a sound and the amplitude of the vibration causing it (increasing amplitude increases the loudness of a sound)
- understand the relationship between the pitch of a sound and the frequency of the vibration causing it (increasing frequency increases pitch)

4. Energy resources and energy transfer

Energy resources

- learn about the variety of energy resources, including oil, gas, coal, biomass, food, wind, waves and batteries, and the distinction between renewable and nonrenewable resources
- know 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 and learn some of the advantages and disadvantages of renewable and nonrenewable resources
- learn about the Sun as the ultimate source of most of the Earth's energy resources and relate this to how coal, oil and gas are formed
- understand the sun's part in the water cycle and formation of wind and waves.
- that electricity is generated using a variety of energy resources

