GCSE
ADDITIONAL SCIENCE, BIOLOGY
UNIT B2 – Example 1
4463, 4411

Scheme of Work

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Introduction

This Outline Scheme of Work is one of a number of schemes prepared by practising teachers for the new AQA GCSE Sciences suite. It is hoped that other teachers will find them helpful as the basis for the fully detailed schemes prepared for teaching from September 2006. Each outline scheme covers one unit (B1, B2, B3, C1, C2, C3, P1, P2, P3) and for some units more than one outline scheme is available. This is because there are different, equally valid ways of approaching the teaching of the specifications and a single scheme would not show the range of possible approaches.

The AQA specifications are designed to be used with a wide range of resources, so this scheme does not assume the availability of any particular printed or electronic publications, or any special equipment. Teachers are enabled to use existing resources, including their own, together with resources specially purchased for the new specifications.

The outline scheme is arranged under the section headings of the relevant specification, for example, *11.1/12.1 What are animals and plants built from?* The content in the section is further subdivided with a brief statement given of the coverage of each subdivision, together with activities that relate to that content and an indication of the number of hours it is suggested are needed to deliver that part of the content.

Opportunities to deliver 'How Science Works' and to use ICT are highlighted using the same icons as used in the specifications.

This identifies parts of the content which lend themselves to extended investigative work of the type needed to explore Sections 10.3–10.7 of the specifications. These sections are about obtaining valid and reliable scientific evidence.

This identifies parts of the content which lend themselves to activities which allow Sections 10.2 and 10.8–10.9 to be considered. These sections are about using scientific evidence, for example, how scientific evidence can contribute to decision making and how scientific evidence is limited.

This identifies where there are opportunities to use ICT sources and tools in teaching the specifications.

Based on 3 lessons/ week. Please see specification for more details about topics.

Assessment:

- Written Paper for Unit Biology 2 in June or January.
- ISA practicals for data collection and practice.

UNIT B2			
11.1/12.1 What are animals and plants built from?			
Topic outline		**Teaching approach including possible experiments/investigation opportunities**	**Additional notes**
Intro Cells		• Look at egg yolk (giant cell), live or prepared slides of unicellular organisms, link to bacteria in 11.4 • Relate structure of different types of cells to their function in a tissue or an organ e.g. a nerve cell compared to a white blood cell • Link to nervous system in 11.1, white blood cells in 11.4	http://www.cellsalive.com

Topic outline		Teaching approach including possible experiments/investigation opportunities	Additional notes
Animal cells		• Structure and function of human cells: nucleus, cytoplasm, cell membrane, mitochondria, ribosomes • Briefly - role of enzymes • Look at range of prepared slides of human cells listing specialisations • Cheek cell preparation	http://www.cellsalive.com http://www.bbc.co.uk/schools/gcsebitesize/teachers/biology/activities.shtml good animations of diffusion and osmosis Build “edible cells” with rice paper as a background, and a variety of sweets as organelles: e.g. red strawberry laces as cell membranes etc. Attach “organelles” to rice paper with readymade icing in tube dispensers.
Plant cells		• Structure and function of plant cells to include above and cell wall, chloroplasts, permanent vacuole • Briefly - role of enzymes • Look at range of live and prepared slides of plant cells listing specialisations	Ditto all of above: edible cells could be built with double layer of green apple/lime laces as cell walls. Scope for a class competition of most specialised cell.

11.2/12.2 How do dissolved substances get into and out of cells?			
Topic outline		**Teaching approach including possible experiments/investigation opportunities**	**Additional notes**
Diffusion	 	• Definition of diffusion • Simple demos and/or models of diffusion • Importance of diffusion of oxygen in and out of respiring plants and animal cells • Role of the cell membrane • Use IT to create animations of diffusion	Agar impregnated with indicator and placed in acid solutions, time how long for different sized cubes to completely change colour http://www.bbc.co.uk/schools/gcsebitesize/teachers/biology/activities.shtml good animation of diffusion

Topic outline		Teaching approach including possible experiments/investigation opportunities	Additional notes
Osmosis	  	• Definition of osmosis • Simple demos and/or models of osmosis • Importance of osmosis to plant and animal cells • Investigate the differences in the concentrations of the solutions inside and outside a cell and whether water moves into or out of the cell by osmosis • Role of cell membrane • Use IT to create animations of osmosis	Osmometers set up with different concentrations of solute in visking tubing, time distance of liquid rising and calculate rate of osmosis and compare. http://www.bbc.co.uk/schools/gcsebitesize/teachers/biology/activities.shtml good animation of osmosis

11.3/12.3 How do plants obtain the food they need to live and grow?			
Topic outline		**Teaching approach including possible experiments/investigation opportunities**	**Additional notes**
Introduce photosynthesis		• Diffusion of carbon dioxide and oxygen in and out of plants leaves • Word equation for photosynthesis and brief explanation • Use of glucose by plant for respiration or storage when converted to starch	
	?	• Brainstorm how glucose produced by photosynthesis is converted into many other different products we use and/or enjoy – sucrose, cocoa, paper, cotton, rubber, plant oils (link to Unit 1 Chemistry 12.5), flour, nuts, drugs (link to 11.3) etc	

Topic outline		Teaching approach including possible experiments/investigation opportunities	Additional notes
Factors affecting rate of photosynthesis		• Low temperature • Shortage of carbon dioxide • Shortage of light • Interpret data showing how factors affect the rate of photosynthesis. How was data obtained?	http://www-saps.plantsci.cam.ac.uk
ISA		• Find out how the rate of photosynthesis depends upon light intensity	
Mineral requirements of plants	 	• Plant roots absorb mineral salts needed for healthy growth • Importance of nitrate and magnesium • Symptoms of deficiency • Demo of plants grown in range of nutrient solutions N.B. observe root growth as well • Evaluate the benefits of artificially manipulating the environment in which plants are grown	

11.4/12.4 What happens to energy and biomass at each stage in a food chain?			
Topic outline		**Teaching approach including possible experiments/investigation opportunities**	**Additional notes**
Importance of photosynthesis in food chains		• Radiation from the Sun = solar energy. Sun is source of energy for most communities of organisms. Role of photosynthesis.	
Food chains		• Key words/phrases: biomass, pyramid of biomass, stages/trophic levels, biomass and energy loss. • Reasons for these losses to include: - waste produced by organisms - respiration - high constant body temperatures of birds and mammals • Interpret pyramids of biomass and construct them from appropriate information	In school gym or playing field: Divide class into groups of 3, and each person represents either “Plants” “Herbivores” or “Carnivores.” Plants stay still and have largest container of a substance (water or shredded paper or sweets). Herbivores are ~20m from plants and have to collect substance using a smaller container and bring it back to original position. Carnivores are further away still and have a tiny container to collect substance from herbivores. Measure amount of substance at each stage of food chain after 3 minutes. Calculate % energy lost at each stage.
Food animals		• Explore farming techniques that increase efficiency of food production from food animals: pigs/cows/sheep/poultry/fish • Focus on limiting movement and controlling the temperatures of their surroundings	

Topic outline		Teaching approach including possible experiments/investigation opportunities	Additional notes
Cornflakes → you	 	• Food chains involving humans are unique because of the use of machinery, fossil fuels and other resources • Evaluate the positive and negative effects of a food chain involving any processed food: - managing food production (pesticides, fertilizers, habitat destruction, harvesting equipment, processing – milling, cooking etc - distribution (packaging, additives, preservatives, storage, transport) - recognise that practical solutions to human needs may require compromise between competing priorities	"Putting Food on the Table" Display Project Create graphic displays of every stage involved in getting a chosen processed food into the home starting with the raw materials.

11.5/12.5 What happens to the waste material produced by plants and animals?			
Topic outline		**Teaching approach including possible experiments/investigation opportunities**	**Additional notes**
Waste products, death and decay		• Brainstorm ideas to do with what happens to leaves shed by trees, animal droppings, and with all plants and animals when they die. Link to Fossils 11.7. • Demo of Pasteur's original experiment. Role of microorganisms. • Circus of foods in various stages of decay by various organisms • Iodine test for starch on bread at various stages of decay	http://www.school.science.co.uk click on Microbes and Food
Conditions for decay		• Prepare and examine slides of bread mould • What do these living organisms need to survive? • Iodine test for starch on bread left to decay under various conditions	
ISA		• Investigate the best conditions for a compost heap	

Topic outline		Teaching approach including possible experiments/investigation opportunities	Additional notes
Cycling		• Importance of decay in returning materials to the environment as substances that plants need to grow	
The Carbon Cycle		• Importance of photosynthesis, respiration, food chains, waste, death and decay by respiring microorganisms	
11.6/12.6 What are enzymes and what are some of their functions?			
Topic outline		**Teaching approach including possible experiments/investigation opportunities**	**Additional notes**
Enzymes		• Key words/phrases: biological catalysts, proteins, amino acids, special shapes, fit of other molecules, effect of high temperatures, pH • Build Styrofoam models of enzymes to show function	HAZARD: In fume cupboard demo effect of temperature on Styrofoam models of enzymes.

Topic outline		Teaching approach including possible experiments/investigation opportunities	Additional notes
Enzymes inside living cells		• Enzymes catalyse respiration, protein synthesis, photosynthesis • Focus on aerobic respiration: mitochondria, word equation • Use of energy from respiration: - to build big molecules from small ones - muscle contraction - maintain constant body temperature - in plants, to build up sugars, nitrates and other nutrients into amino acids and proteins	http://www.bbc.co.uk/schools/gcsebitesize
Enzymes outside of living cells		• Digestive enzymes, their production, action in gut, amylase, protease, lipase • Effect of HC1 and bile on enzyme action in gut	
Digestive enzymes		• Model torso • Investigate action of enzymes on food	

Topic outline		Teaching approach including possible experiments/investigation opportunities	Additional notes
Commercial enzymes in the home		• Source: microorganisms produce enzymes that pass out of the cells • Examples: - home biological detergents containing lipases and proteases - demo comparing bio and non-bio detergents on stained cotton	
Industrial enzymes		• In industry: - proteases to 'pre-digest' protein in some baby foods: meat tenderisers - carbohydrases to convert starch to sugar syrup (corn syrup) - isomerase to convert glucose into fructose. Fructose is much sweeter and therefore smaller quantities can be used in slimming foods. • Websearch into use of isomerase by manufacturers of confectionary or check labels on certain chocolate bars	http://www.crocodile-clips.com/absorb/AC4/sample/LR1507.html

Topic outline		Teaching approach including possible experiments/investigation opportunities	Additional notes
ISA		• The effect of temperature upon enzyme activity	
11.7/12.7 How do our bodies keep internal conditions constant?			
Topic outline		**Teaching approach including possible experiments/investigation opportunities**	**Additional notes**
Internal conditions which are controlled		• Review 11.1 – water and ion content, temperature and blood sugar levels • Removal of waste products: - carbon dioxide produced by - urea • Control of water and ion content prevents damage to cells by osmosis • Study effects of a range of solutions on onion cells	http://www.s-cool.co.uk

Topic outline		Teaching approach including possible experiments/investigation opportunities	Additional notes
Temperature control		• Role of sweating in temperature control and effect on water content • Key words/phrases: thermoregulatory centre, temperature receptors in brain and skin, impulses, core body temperature • Role of vasodilation, sweating, vasoconstriction, shivering	http://www.s-cool.co.uk
		• Investigate skin sensations/reactions when water, ethanol, and petroleum jelly are put on back of hand	
		• Investigate rates of temperature change of test tubes of water wrapped in wet and dry cloths	

Topic outline		Teaching approach including possible experiments/investigation opportunities	Additional notes
Control of blood glucose levels		• Brief description of role of pancreas, function of insulin • Brief description of diabetes and ways of treating it	http://www.schoolscience.co.uk/content/4/biology/abpi/abpilink.htm
		• Evaluate the data from the experiments by Banting and Best which led to the discovery of insulin	http://www.abpi.org.uk
		• Evaluate modern methods of treating diabetes	

11.8/12.8 Which human characteristics show a simple pattern of inheritance?			
Topic outline		**Teaching approach including possible experiments/investigation opportunities**	**Additional notes**
Chromosomes and cell division		• Draw a diagram of very simple life cycle of a multicellular organism • Label using following key words/phrases: chromosomes, pairs, mitosis, growth and repair, body cells, sex cells (gametes), testes, ovaries, meiosis, single sets of chromosomes, fertilisation, fertilised egg = first body cell (ultimate stem cell), new pairs of chromosomes	

Topic outline		Teaching approach including possible experiments/investigation opportunities	Additional notes
Stem cells	?	• Briefly compare timing of cell differentiation in plants and animals after fertilisation • Where does mitosis occur in an adult animal? A plant? Brief definition of stem cells, sources and uses e.g. stem cells differentiate into nerve cells, can treat paralysis • Make informed judgements about the social and ethical issues concerning the use of stem cells from embryos in medical research and treatments	

Topic outline		Teaching approach including possible experiments/investigation opportunities	Additional notes
Reproduction and variation		• Simple definitions of asexual, sexual reproduction, gene, characteristic, alleles, variation	
Inheritance of chromosomes - gender		• 23 pairs of chromosomes in human body cell. One pair determines gender (sex) XX for female, XY for male • Interpret genetic diagrams regarding the inheritance of gender	

Topic outline		Teaching approach including possible experiments/investigation opportunities	Additional notes
Inheritance of alleles		• Explain why Mendel proposed the idea of separately inherited factors and why the importance of this discovery was not recognised until after his death • Define dominant and recessive alleles • Study genetic corn cobs and why no intermediates of F_1 HT – predict and/or explain the outcome of crosses between individuals for each possible combination of dominant and recessive alleles of the same gene of F_2, test crosses, dihybrid inheritance HT – construct genetic diagrams	

Topic outline		Teaching approach including possible experiments/investigation opportunities	Additional notes
Inheritance of disease alleles	 	• Inheritance of Huntington's disease and Cystic Fibrosis • Make informed judgements about the economic, social and ethical issues concerning embryo screening of these and other diseases • Interpret genetic diagrams HT as above	
DNA		• Brief definition of DNA • Extract DNA from onions	