GCSE Science – Schemes of Work

Biology

Unit 2: Biology 2

Spec Reference	Summary of the Specification Content	Learning Outcomes *What most candidates should be able to do*	Suggested timing (lessons)	*Opportunities to develop Scientific Communication skills*	Opportunities to develop and apply Practical and Enquiry skills	Self/Peer assessment Opportunities & resources *reference to past questions that indicate success*
B2.1.1 This unit builds on the understanding that all living things are made up of cells. The structures of different types of cells are related to their functions. Students should be able to use their skills, knowledge and understanding to relate the structure of different types of cells to their function B2.1.2 To get into or out of cells, dissolved substances have to cross the cell membranes. Students should be able to explain how materials can simply be transported into and out of cells by diffusion. Green plants and algae use light energy to make their own food. They obtain the raw materials they need to make this food from the air and the soil. The conditions in which plants are grown can be changed to promote growth. Candidates should use their skills, knowledge and understanding to interpret data showing how factors affect the rate of photosynthesis.						

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B2.1 Cells and simple cell transport						
B2.1.1 Cells and cell structure						
a b	Most human and animal cells have a nucleus, cytoplasm, membrane, mitochondria and ribosomes. Plant and algal cells also have a cell wall and often have chloroplasts and a permanent vacuole.	Describe and label diagrams of animal and plant cells. Describe cell structure using a microscope. Explain how to prepare slides of plant and animal cells. Explain how cell organelles are related to their functions.	2	**Communication for audience and purpose** Are all cells the same? Students **describe and compare** the similarities and differences between plant and animal cells from prior knowledge and extend to include mitochondria and ribosomes. They produce a presentation of this using media of their choice. Label diagrams of plant and animal cells. **Developing explanations using models** Watch video clip on plant and animal structures.	**Assessing risk and working safely** Prepare slides of onion epidermis, rhubarb epidermis, cheek cells, spirogyra, moss etc. and observe under a microscope. **Describe** the structure of root hair cells in sprouting mung beans. **Explain** how these observations are matched to the function. **Evaluate and assess** risk in the investigation.	Join the Biology community for more resources at national Stem Centre by registering with http://www.nationalstemcentre.org.uk BBC class clips plant and animal cells video http://www.bbc.co.uk/learningzone/clips/plant-and-animal-cell-structures/4188.html

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				Use resources such as 'Learning Skills for Science' on National Stem Centre portal to structure student note taking **Models:** Students make a plant or animal cell model and create a display to explain cells for year 7 pupils Can cells survive without mitochondria and ribosomes? **Discuss:** Discuss which structures could be seen and compare with EM images **Explain how** organelles are structured to suit their functions.		**Cells:** Microscopes, slides, coverslips, tiles, forceps, mounted needles, iodine solution, methylene blue, onion, rhubarb, spirogyra and moss. Sprouting mung beans Puzzles, quizzes and images can be found at www.cellsalive.com Useful information on cell structure can be found at www.biology4kids.com

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						Assess using Powerpoint AQA B2.1 cells
c d	Bacterial cells have cytoplasm and a membrane surrounded by a cell wall; genes are not in a distinct nucleus. Yeast cells have a nucleus, cytoplasm and a membrane surrounded by a cell wall.	Describe and label diagrams of bacterial and yeast cells. Recognise diagrams of cells as being from an animal, plant, bacterium or yeast.	1	**Presenting and writing arguments** How are bacterial and yeast cells different from plant and animal cells? Observe under microscope. Culture of yeast cells to show budding. Students develop an argument for and against bacteria and yeast cells to be classified as plants or animals	**Using models** • Use computer simulations to model the relative size of different cells, organelles and molecules • Describe and label diagrams of bacterial and yeast cells • Display images of cells to classify as plant, animal, bacterial or yeast and compare sizes of cells and organelles.	Cells observation: microscopes, slides, coverslips, yeast culture, bacterial cultures and EM images. Diagrams of bacteria and yeast cells. Comparing cell size http://www.bbc.co.uk/learningzone/clips/understanding-the-size-of-bacteria/2279.html

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e	Cells may be specialised to carry out a particular function.	Make observations and describe different types of cells under a microscope. Relate their structure to their function. Explain how specialised cells are adapted for their function.	1	**Presenting and writing descriptions and explanations** Do all organisms start from the same ball of cells? Can all cells carry out any job? Students use a structured worksheet to gather evidence to describe specific cells and explain how structure relates to function eg Watch video clip of egg and sperm cells or generalise cell structure compared to function Produce a poster of labelled specialised cells to explain how they are adapted for their function. .	**Obtaining and presenting primary evidence** What would happen to plants if there were no root hair cells? Extend above practicals to obtain and record data to relate structure of cells to function eg root hair cells of mung bean	A useful video clip on cells and their functions can be found on the BBC website at www.bbc.co.uk/learningzone/clips by searching for '1832'. Look at National Learning Network materials on National Stem Centre website for interactive resources Assess using Powerpoint AQA B2.1 cells

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B2.1 Cells and simple cell transport						
B2.1.2 Dissolved substances						
a b c	Dissolved substances can move into and out of cells by diffusion. Definition of diffusion and factors affecting rate. Oxygen passes through cell membranes by diffusion.	Explain the term 'diffusion'. Explain that diffusion is faster if there is a bigger concentration difference. Describe examples of substances that diffuse into and out of cells.	1-2	**Developing argument** Can diffusion occur in space? Do large particles diffuse too? Students are presented with a series of scenarios and present balanced arguments to arrive at an explanation. eg • Time how long it is before candidates can smell a perfume placed in a corner of the room • Fresh beetroot placed in iced water and warm water – compare and explain the difference in the depth of colour of the water. Are there a number of viewpoints?	**Working critically with primary evidence** Through teacher demonstration or student Does diffusion stop at the North Pole? Investigation as appropriate. Students collect valid and reliable data to arrive at conclusions relating to factors affecting diffusion. They identify any errors and anomalies. eg • Diffusion of ammonium hydroxide and hydrogen chloride in a glass tube; nitrogen dioxide in gas jars	Demo: Concentrated NH4OH, concentrated HCl, gloves, mask, forceps, cotton wool, long glass tube with strips of damp litmus along length; two gas jars of NO2, two empty gas jars; beaker of water, pot perm crystals; agar in test tube; strong perfume; beetroot.

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				• **Video:** Watch a video or computer simulation of diffusion – see Mcgraw-Hill website. **Explain using Models;** Role play of diffusion in gases and liquids at different temperatures and concentrations. **HT only** **Search for 'interactive biochemistry' on the internet, then choose 'Wiley' to find the related animations.**	• potassium permanganate in beaker of water; potassium permanganate on agar • Investigate diffusion of different acids and alkalis through agar • Investigate rate of diffusion of glucose through cellulose tubing • Use digital microscope to describe diffusion of particles in milk or yogurt solution	Agar: Agar plates impregnated with UI solution, cork borers, solutions of acids and alkalis. Glucose: Beakers, cellulose tubing, glucose solution, timers, test tubes, Benedict's solution and water bath or glucose test strips. Further information can be found on BBC GCSE Bitesize at www.bbc.co.uk/schools/gcsebitesize be able to name the process by which oxygen passes into a lung cell.

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						A useful video on diffusion can be found on the McGraw-Hill website at http://highered.mcgraw-hill.com/sites/0072495855/student_view0 by selecting 'Chapter 2' and the 'How Diffusion Works' animation. Assess using Powerpoint AQA B2.1 cells

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B2.2 Tissues, organs and organ systems (could be taught before B2.1) The cells of multicellular organisms may differentiate and become adapted for specific functions. Tissues are aggregations of similar cells; organs are aggregations of tissues performing specific physiological functions. Organs are organised into organ systems, which work together to form organisms. The structure and function of plant and animal tissues, organs and systems is considered so that students can apply their understanding in various contexts.						
B2.2.1 Animal organs						
d	Systems are groups of organs that perform a particular function; structure and function of the digestive system.	Explain the term organ system. Describe the main systems in the human body and state their functions. Identify and label a diagram of the digestive system. Describe the functions of the digestive system to digest and absorb food molecules. Describe the functions of the organs in the system – salivary glands, stomach, small intestine, liver, pancreas and large intestine.	1	**Communication for audience and purpose** Students produce a flyer or leaflet for a doctor's surgery to **describe** the main organ systems and **explain** their functions (*can be linked to unit B1 Healthy Lifestyles*) **Developing argument** Plan for structured, small-group **discussion and research** on whether, and to what extent, digestion depends on diffusion.	**Obtaining and presenting primary evidence** Teacher demonstration of dissection of a rat. Students describe how the major organs are linked and observe structure of the digestive system. Key measurements of organs can be made to inform discussion. Offer an alternative and opt out for those students who prefer not to take part eg video of dissection or research topic.	Rat for dissection from reputable source, dissection board or waxed tray, dissection kit, tape measure. Torso/model of digestive system. The Digestive System builder can be found at http://science.waltermack.com/flashTeacherTools/biology/digestiveSystemBuilder2a.swf

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				Develop explanations using models **Explain** digestion using different **models** eg • Label a diagram of the digestive system and colour areas where digestion, digestion and absorption of food, and absorption of water occur • Add labels to diagram to state functions of organs in the system • Watch a video about the digestive system and collect evidence to support explanation of digestive process • Make a life size model of digestive system • Develop animation of digestion		Useful information on the human body can be found at http://kidshealth.org/kid by selecting 'How the body works' in the left navigation bar. You can download a digestive system to label from http://klbict.co.uk/interactive/science/digestion2.htm A useful video clip on digestion and absorption can be found on the BBC website at www.bbc.co.uk/learningzone/clips

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				• Role play – what happens to food as it moves along the digestive system (opportunity for investigations – see B2.5.2).		Search for clip '4180'.
c b a	Organs are made of tissues; tissues in stomach. A tissue is a group of cells with similar structure and function; muscular, glandular and epithelial tissues. Multicellular organisms develop systems for exchanging materials; during development cells differentiate to	Recognise the main organs in the human body and state their functions. Describe the tissues in the stomach and explain what they do. Explain the terms tissue and organ. Explain why large organisms need different systems to survive. Explain what cell differentiation is. Describe organisation in large organisms.	1	**Using models** Describe a model of the stomach showing different tissues. Label a diagram of the stomach with the names of the tissues and their functions. Explain how tissues match with their functions. **Extended writing (remember** **P – point** **E – evidence** **E – explanation** **which is used in English lessons)** **Describe** different types of cells in the stomach and **explain** differentiation– link with lesson on specialised cells.	Torso and posters of organ systems. Model of stomach.	Be able to appreciate the sizes of cells, tissues, organs and organ systems. Extended writing (use Quality of Written Communication guidance to assess)

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	perform different functions.			Use a **model** to summarise, produce a flow diagram showing organisation in large organisms and relate to size.		

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B2.2.2 Plant organs						
a b	Plant organs include stems, roots and leaves. Examples of plant tissues – epidermal, mesophyll, xylem and phloem.	Describe the main organs of a plant and describe their functions. Recognise different tissues in a leaf and describe their functions.	1-2	**Communication for audience and purpose** Do plant organs do the same job in all plants? **Describe** and label a diagram of a plant with names and functions of organs. **Explain** how shape of plant organs vary but tissue function is similar. **Analyse** a cross section of a leaf and explain function of tissue. **Evaluate** efficiency of transport of coloured dye in celery or a plant – could prepare slides and observe them (links with B2.3, B3.1.3 and B3.2.3).	**Assessing risk and working safely** Make sections of plant tissue eg using celery stems. Students identify hazards and **explain how risk is managed** safely. **Observe and describe** their prepared slides or bioviewers of leaves, stems and roots and identify different tissues; hypothesise what they are for.	Plant tissues: eg celery Microscopes, slides etc. prepared slides and bioviewers.

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B2.3 Photosynthesis Green plants and algae use light energy to make their own food. They obtain the raw materials they need to make this food from the air and the soil. The conditions in which plants are grown can be changed to promote growth. Students will be able to use their skills, knowledge and understanding to interpret data showing how factors affect the rate of photosynthesis and how we can apply this in horticulture						
B2.3.1 Photosynthesis						
a b e	Photosynthesis equation. Light energy is absorbed by chlorophyll in chloroplasts and used to convert carbon dioxide and water into glucose, oxygen is a by-product. Glucose may be converted into starch for storage.	Explain the word equation for photosynthesis. Investigate how light, carbon dioxide and chlorophyll are needed to make glucose. Explain why plants should be destarched before photosynthesis experiments and describe how this is done. Describe experiments to show that plants produce oxygen in the light. Explain the steps involved in testing a leaf for starch.	3	**Developing explanations using ideas and models** **Discuss:** Brainstorm what plants need to survive and how they are useful to other organisms in order to come up with the word equation for photosynthesis. **Demo:** Plants produce oxygen in the light.	**Planning an approach** Where are the stomata? Students research methods before planning eg Dip privet leaves into hot water and observe nail varnish imprints of leaves (links with B2.2.2 leaf structure, xylem and phloem, B3.1.3 exchange systems in plants and B3.2.3 transport in plants). **Obtaining and presenting primary evidence** How is the leaf adapted for photosynthesis?	Lots of ideas and info can be found at www-saps.plantsci.cam.ac.uk/pubphoto.htm and www.s-cool.co.uk Broad leaved plant and bioviewers. **Stomata:** Leaves from privet and spider plants, kettle, beakers, nail varnish, slides,

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		Explain why glucose is converted to starch for storage.		Using models • Write word equation for photosynthesis – produce cards for equation and put into correct order • Label diagram of a plant to show that water enters via the roots and travels in the xylem to the leaves; carbon dioxide enters leaves via stomata; light is absorbed by chlorophyll in leaves • Produce a 3D model of a leaf to explain photosynthesis	Set up experiments to show that light, carbon dioxide and chlorophyll are needed to make starch – follow up with testing a leaf for starch in later lesson.	coverslips and microscope. **Photosynthesis:** Geraniums, plants with variegated leaves, lamps, black paper and paper clips, bell jars, saturated KOH solution or soda lime, ethanol, boiling tubes, beakers, glass rods, tiles, iodine solution, heating apparatus and goggles. **Oxygen:** Elodea/Cabomba, glass funnel, large beaker, test tube and splints. **Glucose:** Plant in light, Benedict's

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						solution, boiling tube and Bunsen burner. **Starch:** Pieces of apple and potato, sharp knives, slides, coverslips, iodine solution and microscopes.
c d	Factors affecting the rate of photosynthesis – temperature, CO_2 concentration, light intensity. Limiting factors and the rate of photosynthesis.	Interpret data showing how factors affect the rate of photosynthesis. Describe factors that affect the rate of photosynthesis. Explain how conditions in greenhouses can be controlled to optimise the growth of plants. Evaluate the benefits of artificially manipulating the	2	**Developing ideas and using models** Computer simulation to investigate factors that affect the rate of photosynthesis. **Describe** factors that affect the rate of photosynthesis. Interpret graphs and **explain** limiting factors. **Applications and implications** **Can we feed a city of people on the moon?**	Investigate the effect of light intensity or temperature on the rate of photosynthesis and plot data. Use sensors to measure oxygen, light, temperature and carbon dioxide levels. **Selecting and managing variables**	**Rate:** Elodea/Cabomba, funnel, large beaker, gas syringe, lamp, thermometer, sodium hydrogen carbonate. Sensors for use with any of the experiments. Useful information can be found on the

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		environment in which plants are grown.		Design a greenhouse to maintain optimum growth of plants on the moon. Explain all its design features. Can anyone be 'green fingers' in the garden? Use horticultural/ gardening magazines or catalogues to design a garden which will grow plants in light, dark and semi shade. Use BBC and Channel 4 websites. Create opportunities for pupils to research and critically analyse data related to the interplay of limiting factors in photosynthetic productivity and the implications for world food production.	Investigate growth of tomatoes in greenhouse, lab and outside.	BBC GCSE Bitesize at www.bbc.co.uk/schools/gcsebitesize Further information can be found at www.s-cool.co.uk Tomato plants, pots, compost, fertiliser, sensors and balance. http://www.bbc.co.uk/gardening/design/ http://www.channel4.com/4homes/rooms/outdoors
e	Glucose can be stored as starch and used in respiration.	Recognise ways in which glucose is used by a plant.	1-2	**Communication for audience and purpose**	**Selecting and managing variables**	Exhibition of plant products – sugar, starchy food,

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f g	Glucose is also used to produce fats and oils for storage, cellulose to strengthen cell walls and proteins. To produce proteins, plants also use nitrate ions that are absorbed from the soil.	Describe functions of fats, oils, cellulose, starch and proteins in a plant. Explain how plants obtain nitrate ions and what they are needed for. Interpret data from the results of bicarbonate indicator experiment.		**Discuss** uses of glucose and produce a mind map or poster to demonstrate your ideas to the class. Produce diagrams to illustrate the flow of carbon dioxide and oxygen in and out of a plant in bright light, dim light and darkness. **Reaching agreement on scientific explanations** What is the link between photosynthesis and respiration? **Explain** the equations for photosynthesis and respiration – use cards previously made for photosynthesis and rearrange to show respiration. **Applications, implications and cultural understanding** Does it matter where you get your carbon from?	**Obtaining and presenting primary evidence** Do plants need to take in protein to survive? Investigate the effect of mineral salts on plant growth. **Planning and approach** Can plants photosynthesise under water? Do plants drown? Students carry out elodea investigation to **explain** photosynthesis in aquatic plants, vary carbon dioxide concentration using sodium hydrogen carbonate.	protein rich food, plant oils, paper, cocoa, coffee, cotton, rubber, flour, nuts, drugs etc. Video clips on photosynthesis and plant growth can be found on the BBC website at www.bbc.co.uk/learningzone/clips by searching for clips '212' and '213'. **Indicator:** Bicarbonate indicator solution, acid, alkali, straw, boiling tubes,

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				Explain the benefits and drawbacks, including ethical, moral, social and political aspects, of some applications and implications of science photosynthesis, eg use of pesticides, destruction of rainforests. Can you really grow plants without soil? Research hydroponics and produce a report or PowerPoint presentation.		bungs, black paper, Cabomba, small invertebrates, gauze and lamp. **Minerals:** Tomato plants, pots, compost. Grow cultures in solutions with and without minerals, eg magnesium and nitrates. Powerpoint B2.3 Photosynthesis questions

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B2.4 Organisms and their environment Living organisms form communities, and we need to understand the relationships within and between these communities. These relationships are affected by external influences. Students will be able to use their skills, knowledge and understanding to: • suggest reasons for the distribution of living organisms in a particular habitat • evaluate methods used to collect environmental data, and consider the validity of the method and the reproducibility of the data as evidence for environmental change. NB Students should understand the terms mean, median and mode and that sample size is related to both validity and reproducibility						
B2.4.1 Distribution of organisms						
a	Physical factors that may affect organisms – temperature, nutrients, light, water, oxygen and carbon dioxide.	Explain distribution of organisms in a habitat. Evaluate methods used to collect environmental data and consider the validity and	2-3	**Working critically with primary and secondary evidence** **Discuss** factors that may affect the distribution of organisms. Use **interactive modelling** to change environment	**Obtaining and presenting primary evidence** Know that sample size is important in terms of reliability and validity eg	Using a quadrat can be found at www.skoool.co.uk

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b	Quantitative data can be obtained by sampling with quadrats and along a transect.	reliability as evidence of environmental change. Name and explain how different factors can affect the distribution of organisms in a habitat. Investigate methods of measuring abiotic factors. Describe how to carry out random sampling of organisms using a quadrat. Evaluate data gathered by using a transect line Calculate mean, median, mode and range.		**Explain** how these factors could affect the distribution of organisms • select an environment such as seashore/ school fields/ woodland • use a range of examples to explore the impact of external and internal factors on the interdependence of organisms, e.g. poisons, disease, food shortages **Evaluate** how environmental data can be collected efficiently –use prior knowledge. **Developing argument** Explore with pupils how diagrams in different textbooks show the same concept but could lead to misconceptions, e.g. scales used in diagrams such as pyramids of numbers and biomass or directional arrows on food webs.	• look at distribution of alga Pleurococcus on walls, fences, trees • Estimate cover using diagrams/ photographs and cover slips as 'mini quadrats' Use transect lines and quadrats to collect data. **Analyse** ecological data Interpret various types of diagrams that illustrate the distribution of organisms in a habitat (Links with B1.4.1, B1.4.2 and B3.4.1).	Appropriately sized quadrats, clipboards, sensors **Transect:** String, identification charts. **Environmental data:** Sensors, dataloggers, thermometers and calculators. Questions on Ppt B2.4

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B2.5 Proteins – their functions and uses Proteins have many functions, both inside and outside the cells of living organisms. Proteins, as enzymes, are now used widely in the home and in industry. Students will be able to use their skills, knowledge and understanding to evaluate the advantages and disadvantages of using enzymes in the home and in industry.						
B2.5.1 Proteins						
a b	Proteins are long chains of amino acids folded to produce a specific shape that accommodates other molecules. Proteins act as structural components, hormones, antibodies and catalysts. Catalysts increase the rate of chemical reactions. Biological catalysts are called	Describe the structure of protein molecules. Explain the function of some protein molecules are found inside living organisms. Define the terms 'catalyst' and 'enzyme'.	1	**Developing explanations using ideas and models** Watch a computer simulation of protein structure eg using APP on mobile phone. **Reaching agreement on scientific explanations** Students **describe** how bias or lack of evidence can cause/ give incorrect theories. Students can **explain and justify** why a scientific claim can be justified by use of validated evidence eg structure of insulin.	**Working with primary and secondary evidence** Make 3D models of proteins using • Plasticine • Different coloured and shaped beads or card for amino acids Compare to research into protein structure (secondary evidence).	

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	enzymes; these are proteins.			**Research** project to include the structure of proteins and names and functions of some proteins in the body. Produce a poster, PowerPoint presentation or mind map. Revise chemical bonding so that students can **explain** 3D structure of protein and binding sites.	**Demonstration** Students describe action of an inorganic catalyst and catalase on the breakdown of hydrogen peroxide.	

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B2.5.2 Enzymes						
a	The shape of an enzyme is vital for the enzyme's function. High temperatures change the shape	Explain why enzymes are specific in their action. Explain why enzymes are denatured by high temperatures.	1	**Using models** Watch video to help to describe how enzymes work Make models or cut-outs to demonstrate the shape of the active site of an enzyme and the shape of the substrate(s). Computer simulation to show shape of enzymes and substrates and effect of temperature on the shape of an enzyme molecule.	**Demo:** Manganese dioxide, liver, boiled liver, celery, apple or potato, hydrogen peroxide, test tubes and goggles. Further information can be found at www.skoool.co.uk	Enzyme action video http://www.bbc.co.uk/learningzone/clips/enzymes/13505.html Enzyme simulations can be found at http://mhhe.com/biosci/genbio/virtual_labs/BL_11/BL_11.html An enzyme animation can be found at www.youtube.com by searching for 'CZD5xs 0Kres'.

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b	Different enzymes work best at different pH values .	Describe and explain the effect of different pH values on the activity of different enzymes.	1	**Model** Computer simulation to show shape of enzymes and substrates and effect of pH on the shape of an enzyme molecule.	**Selecting and managing variables** Investigate the optimum pH values for pepsin and trypsin enzymes.	**pH:** Pepsin solution, trypsin solution, buffer solutions at different pH values, UI strips, egg white suspension, test tubes, timers and goggles.
C d	Some enzymes work outside body cells, eg digestive enzymes catalyse the breakdown of large molecules into smaller ones in the gut. Amylase is produced in the salivary glands, pancreas and small intestine. It catalyses	Explain why food molecules need to be digested. Recognise the names of digestive enzymes, and identify the organs which produce them, substrates they act on and products of digestion. Plot a line graph and interpret results of effect of temperature on amylase activity.	2	Recap work done in B2.2.1 on the digestive system. **Describe** digestive system and include labels to diagram of digestive system giving names of enzymes produced. **Present evidence** Produce table giving names of enzymes, substrates and products. **Research:** Research Alexis St Martin story. **Modelling:** Use computer simulations to model effect of temperature, pH and	**Planning, selecting variables, assessing risk, obtaining evidence** Investigate the effect of temperature on amylase activity – measure time taken for starch to disappear.	**Amylase:** Saliva or amylase solution, starch solution, test tubes, water baths at different temperatures, glass rods, spotting tiles, iodine solution and timers. The digestive system in www.science.jrank.org

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e f g	the breakdown of starch into sugars. Protease enzymes are produced by the stomach, pancreas and small intestine. They catalyse the breakdown of proteins into amino acids. Lipase enzymes are produced by the pancreas and small intestine. They catalyse the breakdown of lipids (fats and oils) into fatty acids and glycerol.			concentration on enzyme activity (Links with B3.1.1). **Applications and implications of science and developing argument** Design an investigation to find the optimum temperature for biological and non-biological washing powders to remove stains and other materials. Produce a report for large supermarket chain to promote both.	Different groups do different temperatures and share results. Could be done using a computer simulation instead. Plot results and find optimum temperature for amylase. Use small pieces of cooked sausage, use 2% pepsin and 0.01M HCl in water baths at different temperatures to estimate the rate of digestion. This can also be carried out with 2% trypsin and 0.1M NaOH. The concentration of both enzymes can be varied. **Developing argument** Demonstrate: Effect of bile salts on rate of digestion of milk. Students **discuss** outcomes.	Two tubes, milk, sodium carbonate solution, phenolphthalein solution, lipase solution, +/- washing up liquid and timer.

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h	The stomach produces hydrochloric acid to provide the right conditions for stomach enzymes to work effectively. The liver produces bile, which is stored in the gall bladder. Bile neutralises the acid added to food in the stomach and provides alkaline conditions in the small intestine for the enzymes there to work effectively.				Further information can be found at www.skoool.co.uk	
i	Microorganisms produce enzymes that pass out of cells.	Explain that microorganisms produce enzymes that we use in the home and in industry.	2	**Presenting and writing descriptions and explanations**	Information and test questions for enzymes in industry can be	**Exhibition:** Biological and non-biological

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j	These have many uses in the home and industry. Enzymes in industry bring about reactions at normal temperature and pressure that would otherwise need expensive, energy expending equipment. Most enzymes are denatured at high temperatures and are costly to produce.	For example, biological detergents, baby foods, sugar syrup and fructose syrup. Describe examples of enzymes used in industry – proteases, carbohydrases and isomerase. Explain why biological detergents work better than non-biological detergents at removing protein and fat stains. Explain the advantages and disadvantages of biological and non-biological detergents. Explain the advantages and disadvantages of enzymes in industry. Use a line graph to describe the effect of increasing temperature on the time taken by a detergent to remove a stain.		Students review an exhibition to illustrate uses of enzymes in the home and industry. **Activity:** Could taste glucose and fructose solutions. Make a table to show names of enzymes used in home and industry and what they are used for. **Evaluate** the advantages and disadvantages of using enzymes in the home and industry. **Presenting and writing arguments** Watch a video about uses of enzymes in industry. Produce a table to show the advantages and disadvantages of using enzymes in industry.	found at www.absorblearning.com **Selecting and managing variables** Investigate the effect of temperature on stain removal using biological and non-biological detergents. **Or** Simplify to investigate which type of detergent removes fat and protein stains best at 40 °C. Candidates can stain the cotton for homework or in a previous lesson or test on different types of stains.	detergents, baby food, sugar syrup and slimming foods containing fructose. **Detergents:** Liquid detergents, white cotton stained with fat and protein, kettle, beakers, cylinders, stirring rods, thermometers and white tiles. Powerpoint B2.5 Proteins – their functions and uses

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B2.6 Aerobic and anaerobic respiration Respiration in cells can take place aerobically or anaerobically. The energy released is used in a variety of ways. The human body needs to react to the increased demand for energy during exercise. Students will be able to use their skills, knowledge and understanding to interpret the data relating to the effects of exercise on the human body.						
B2.6.1 Aerobic respiration						
a b e f	Chemical reactions in the body are controlled by enzymes. During aerobic respiration glucose and oxygen react to release energy. Word equation for aerobic respiration. Energy released during respiration is used to build molecules, enable muscle contraction,	Describe the word equation for aerobic respiration. Define the term 'aerobic'. Describe some uses of energy in animals and in plants.	1-2	**Developing argument** Do all living things respire? Ask what substance the body uses to release energy from and build up the word equation for aerobic respiration; **Explain** what does aerobic mean? Show energy drink and glucose tablets and ask students to **explai**n what they are used for. Lead in to discussion on the uses of energy in animals and plants; explain all the reactions involved are controlled by enzymes.	**Obtaining and presenting primary evidence** **Assessing risk and working safely** Investigate respiration in living organisms –series of boiling tubes containing 1.sodium hydroxide 2. Limewater 3. Organism 4. Limewater and connected by tubes	Be able to complete a word equation for aerobic respiration Bottle of Lucozade, glucose tablets and a plant. **Peas:** Soaked peas, boiled and cooled peas and thermos flasks with

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c d	maintain a steady body temperature and build up proteins. Aerobic respiration occurs continuously in plants and animals. Most of the reactions in aerobic respiration take place inside mitochondria.	Explain why respiration has to occur continually in plant and animal cells. State the site of aerobic respiration and be able to give examples of cells that contain a lot of mitochondria. Describe the test for carbon dioxide.		**Describe** uses of energy in plants and animals. Show heat production from germinating peas. **Explain** need for energy even when asleep or the need for a glucose drip if in a coma. Where does aerobic respiration occur? Show EM images of mitochondria in cell. **Compare** number of mitochondria in muscle and skin cells. Why are there so many in muscle cells? What other cells will have a lot of mitochondria? Show EM images and include mitochondria in plant cells (links with B2.1.1). **Communication for audience and purpose** Research composition of inhaled and exhaled air and display as pie charts or bar charts.	**Working with primary evidence** Investigate, describe and explain the composition of	temperature probes. Information and images on mitochondria can be found at www.Biology4kids.com **Exhaled air:** carbon dioxide in inhaled and exhaled air apparatus, limewater, mirrors, cobalt chloride paper and thermometers.

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					exhaled air.	
e	Word equation for aerobic respiration.	State that all animals and plants produce carbon dioxide all the time as a by-product of aerobic respiration. Describe the test for carbon dioxide.	1	**Developing argument** Why don't you explode when you eat a bar of chocolate? Do plants breathe? Gather evidence to discuss these questions. Structured groups with prompts to support argument **P E E** Point; Evidence; Explanation	**Working with primary evidence** Interpret results from germinating pea demo. **Demo:** Animal in a bell jar experiment to show it produces carbon dioxide. **Demo:** Plant in a bell jar (no light) – results following lesson. Investigate the rate of respiration in yeast using carbon dioxide sensors and data loggers **Discuss:** Discuss the set up of the apparatus – soda lime, limewater in both containers	**Demo:** Two bell jars connected to two containers of limewater that air is passing through via tubes, first container fitted with thistle funnel containing soda lime, pump to draw air through system, small animal, plant and black paper.

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g h i	During exercise the heart rate, breathing rate and depth of breathing increase. These changes increase blood flow to muscles and so increase the supply of sugar and oxygen and removal of carbon dioxide. Muscles store glucose as glycogen, which can be converted back to glucose for use during exercise.	Design an investigation to find out the effect of exercise on heart and breathing rates. Plot the results in a graph. Explain why heart rate and breathing rate increase during exercise. Interpret data relating to the effects of exercise on the body, eg spirometer tracings. Write equations and explain the conversion between glucose and glycogen in liver and muscle cells.	1-2	**Communication for audience and purpose/ Modelling** **Video:** Effect of exercise on the body. **Explain** the advantages to the body of the breathing rate being much higher when running than walking. **Video:** Use of spirometer in 'Respiration in Humans' . **Discuss:** Discuss the sources of glucose during exercise and link to storage and conversion of glycogen in liver and muscles back into glucose (links with B3.1.2 and B3.3.3).	**Planning an approach** **Investigate** the effect of exercise on heart rate, breathing rate and depth of breathing. **Interpret** line graphs and spirometer tracings to compare rate of breathing before, during and after exercise. Use spirometer tracing to **calculate** breathing rate and depth of breathing.	Timer, pulse sensor and spirometer if available. Website for practical sheets http://www.biology-resources.com/biology-experiments2.html#germination **Useful videos** • Screaming jellybaby http://www.bbc.co.uk/learningzone/clips/aerobic-respiration/13518.html • Respiration in humans http://www.bbc.co.uk/learningzone/clips/

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						respiration-in-humans/113.html
B2.6.2 Anaerobic respiration						
a b c	During exercise, if insufficient oxygen is reaching the muscles they use anaerobic respiration to obtain energy. Anaerobic respiration is the incomplete breakdown of glucose and produces lactic acid. **HT only** **Anaerobic respiration releases less energy than aerobic**	Write the equation for anaerobic respiration in animal cells. Explain the effect of lactic acid build up on muscle activity.	1-2	**Do mammals breathe under water?** **Describe** equation for anaerobic respiration **Explain** why muscles become fatigued during exercise. **Communication for audience and purpose** Investigate effect of muscle fatigue on muscle strength and produce an article for a fitness magazine. **Discuss:** Discuss causes and effects of muscle fatigue; relate to lactic acid build up.	**Planning an approach** Do we need oxygen to give us energy? Investigate how long it takes muscles to fatigue – repetitive actions, eg step ups or holding masses at arm's length.	Timers, masses Force meters Be able to understand that the build up of lactic acid leads to oxygen debt. Powerpoint B2.6 Aerobic and anaerobic respiration

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d	**respiration; it results in an oxygen debt that is repaid in order to oxidise lactic acid to carbon dioxide and water.** Muscles can become fatigued and stop contracting efficiently; lactic acid can build up which is removed by the blood.	**HT only** **Explain why anaerobic respiration is less efficient than aerobic respiration.** **Define the term oxygen debt.** **Write the equation for the Breakdown of lactic acid into carbon dioxide and water.**		Write the word equation for anaerobic respiration in animal cells. **Video:** Watch a video showing sprinters and discuss how the body reacts at the end of the race – paying back the oxygen debt. **HT only** **Describe and explain equation for the breakdown of lactic acid.**		

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B2.7 Cell division and inheritance

Characteristics are passed on from one generation to the next in both plants and animals. Simple genetic diagrams can be used to show this. There are ethical considerations in treating genetic disorders.

All students will be able to use their skills, knowledge and understanding to:

- explain why Mendel proposed the idea of separately inherited factors and why the importance of this discovery was not recognised until after his death
- interpret genetic diagrams, including family trees
- predict and/or explain the outcome of crosses between individuals for each possible combination of dominant and recessive alleles of the same gene
- make informed judgements about the social and ethical issues concerning the use of stem cells from embryos in medical research and treatments
- make informed judgements about the economic, social and ethical issues concerning embryo screening.

NB Data may be given in unfamiliar contexts

In addition to the above, Higher Tier students only will

- **construct genetic diagrams of monohybrid crosses and predict the outcomes of monohybrid crosses and be able to use the terms homozygous, heterozygous, phenotype and genotype**

B2.7.1 Cell division

Throughout section 2.7 students will develop an understanding of the relationship from the molecular level upwards between genes, chromosomes, nuclei

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and cells and to relate these to tissues, organs and systems (2.2 and 2.3).						
a b c d n	Chromosomes are found in pairs in body cells; body cells divide by mitosis. Chromosomes contain the genetic information. During mitosis copies of the genetic material are made then the cell divides once to form two genetically identical body cells. Mitosis occurs during growth or to produce replacement cells. Cells of the offspring produced by asexual reproduction are produced by mitosis	*NB Knowledge and understanding of the stages in mitosis and meiosis is not required* Recognise from photos of karyotypes that chromosomes are found in pairs in body cells. Explain that the genetic information is carried as genes on chromosomes. Describe simply how the body cells divide by mitosis.(detail not required) Draw simple diagrams to describe mitosis. Explain that offspring produced by asexual reproduction are produced by mitosis so contain	1	**Presenting and writing descriptions and explanations** **Is cell division the same in all living things?** **Can the human race survive without cell division?** **Activity:** Recap work covered in B1.7.1 – genes, chromosomes, nuclei, cells; look at photos of male and female karyotypes. Produce a revision guide or mind map to **describe and summarise** **Discuss:** Discuss how organisms grow and relate this to cell division. **Modelling** Use plasticine, pipe cleaners, beads etc to make a simple model of mitosis. **Describe** using simple diagrams and **explain** mitosis in terms of copies of genetic information being made and cell	**Using primary and secondary evidence** Use bioviewers, root tip squashes or a video clip to show chromosomes and mitosis. Produce a simple summary Or make a simple animation of root tip cells dividing. .	Bioviewers, microscopes, slides, coverslips and germinating pea seeds. Useful information can be found at www.science3-18.org by searching 'Investigating cell division' A useful animation on mitosis can be found at www.cellsalive.com by searching 'mitosis'. A video clip on cell division by mitosis can be found on the BBC website at

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	from the parental cells. They contain the same alleles as the parents.	all the same alleles as the parent cell.		division to produce two identical daughter cells.		www.bbc.co.uk/learningzone/clips by searching for clip '4189'. Use Science and Plants for Schools (SAPS) and Scottish Schools Equipment Research Centre (SSERC) sites for images, activities etc.
e f g	Sex cells (gametes) have only one set of chromosomes. Cells in testes and ovaries divide to form gametes.	Explain that sex cells are called gametes and are produced when cells in the sex organs divide by meiosis; sex cells have only one set of chromosomes. *For **Foundation Tier,** knowledge of meiosis is restricted to where the process occurs and that*	1	**Developing explanations using ideas and models** • Consider fusion of sex cells at fertilisation and **explain** why gametes have only one set of	Use bioviewers, video clips or images to show chromosomes and meiosis.	Lots of class clips can be found on the BBC website at www.bbc.co.uk/learningzone/clips A video clip on cell division by mitosis and meiosis can be

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h i	Cell division to form gametes is called meiosis. **HT only** **During meiosis copies of the genetic information are made, then the cell divides twice to form four gametes, each with a single set of chromosomes.** When gametes join at fertilisation, a single body cell with new pairs of chromosomes	*gametes are produced by meiosis.* Explain why gametes only have one set of chromosomes. Explain why sexual reproduction results in variety. **HT only** **Draw diagrams to explain how gametes are formed in meiosis.** Compare mitosis and meiosis.		chromosomes – use models or diagrams • Make models to show what happens during fertilisation • Make models or draw diagrams to show how gametes are formed during meiosis • Produce a poster to compare mitosis and meiosis • Use genetic diagrams (biological models) to predict the outcome of crosses **Developing argument** Involve pupils in identifying and presenting scientific arguments for a		found on the BBC website at www.bbc.co.uk/learningzone/clips by searching for clip '6022'. **Note:** Knowledge and understanding of the stages in meiosis are **not** required.

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	is formed. A new individual then develops by this cell repeatedly dividing by mitosis.			specific audience around a controversial issue, eg 'Should conjoined twins be separated?', 'Should there be an age limit for *in vitro* fertilisation (IVF) treatment?', 'Should all people have the right to be a parent?' **Presenting and writing descriptions, explanations and arguments** What determines gender? Do we need males? Students work in groups **to research** and prepare for debate Involve pupils in discussing the role of science in solving problems and the range of issues that can arise as a result, eg increasing crop production through GM crops or cloning.		
J	Most animal cells differentiate at an early stage whereas many plant cells	Identify the sources of stem cells in humans.	2	**Applications, implications and cultural understanding** Why are stem cells so valuable?		Information on stem cells can be found at www.eurostemcell.o

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k l m	retain the ability to differentiate throughout life. In mature animals, cell division is mainly restricted to repair and replacement. Stem cells from human embryos and adult bone marrow can be made to differentiate into many types of cells. Human stem cells can develop into any type of human cell. Treatment with stem cells may be able to help conditions such as paralysis.	Describe cell differentiation in plants and animals. Explain the function of stem cells. Explain how stem cells could be used to help treat some medical conditions. Make informed judgements about the social and ethical issues concerning the use of stem cells from embryos in medical research and treatments.		Do we need males? Should embryonic stem cells be used for research into cures for human disease? **Video:** Watch a video clip showing cell differentiation in plants and animals. **Video:** Watch the stem cell story at Euro Stem Cell site. Create opportunities for pupils to devise criteria to **evaluate** claims made in newspapers or scientific articles, eg about stem-cell research. Provide students with a help sheet to direct them in researching stem cells – where they are produced in humans; their uses; how they could be used to treat some medical conditions; pros and cons of stem cell research. Use research to produce a poster, carry out role play or a debate about stem cell research (links with B3.3).	**Note:** Stem cell techniques are **not** required	rg and www.stemcells.nih.gov Video clips on embryo stem cells and stem cell research can be found on the BBC website at www.bbc.co.uk/learningzone/clips by searching for clips '6581' and '6013'. Useful information can be found at www.christopherreeve.org and www.ukscf.org

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B2.7.2 Genetic variation ***Additional guidance for this section*** Students should be familiar with principles used by Mendel in investigating monohybrid inheritance in peas. They should understand that Mendel's work preceded the work by other scientists which linked Mendel's 'inherited factors' with chromosomes.						
f g h	Chromosomes are made up of large molecules of DNA which has a double helix structure. A gene is a small section of DNA. **HT only** **Each gene codes for a particular**	Describe the structure of chromosomes and DNA. Explain that a gene is a small section of DNA. **HT only** **State that each gene codes for**	1	**Using models** **Video:** Watch a video about Watson and Crick – discovery of the structure of DNA. **Describe** DNA using a model eg using sweets	**Assessing risk and working safely** Extract DNA from fruits such as kiwi fruit or strawberry	**Note:** The names of the four bases are **not** required. Further information on Watson and Crick can be found at www.bbc.co.uk by searching 'historic figures Watson and Crick'.

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	combination of amino acids which makes a specific protein.	a particular sequence of amino acids to make a specific protein.				How to extract DNA from fruits can be found at www.funsci.com/fun3_en/dna/dna.htm A video clip on DNA and the Human Genome Project can be found on the BBC website at www.bbc.co.uk/learningzone/clip by searching for clip '6015'. Useful information on the DNA timeline can be found at www.timelineindex.com by searching 'DNA'.

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a b	Sexual reproduction gives rise to variation because one of each pair of alleles comes from each parent. In human body cells one of the 23 pairs of chromosomes carries the genes that determine sex; the sex chromosomes in females are XX and in males are XY.	Explain using a Punnett square and genetic diagram how sex is determined in humans.	1	**Writing for audience and purpose** How do we express our genes? Produce a presentation using media of student choice to **describe** the journey of a gene carried in a sperm or egg. **Explain** how characteristics are expressed. **Developing argument** Create opportunities for pupils to devise criteria and evaluate claims made in the media and scientific articles, eg about allowing pregnancies of 'designer siblings' to provide organs or tissues for transplantation. Involve pupils in discussing the role of science in solving problems and the range of issues that can arise as a result, eg human embryology and fertilisation issues.	Use a computer simulation or make a model to show the separation and mixing of chromosomes in gamete formation and fertilisation. Link to variation caused by sexual reproduction (links with B1.7.1).	Be able to use a punnette square to show the inheritance of sex. A video clip on dominant and recessive characteristics can be found on the BBC website at www.bbc.co.uk/learningzone/clip by searching for clip '4197'. Animations produced by Wellcome Trust can be found on National Stem Centre website

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				Modelling • Look at male and female karyotypes and **identify** the number of pairs of chromosomes and each pair of sex chromosomes • Use a Punnett square and a genetic cross diagram to illustrate the inheritance of sex; **evaluate** the chance of producing a male or female		
c d	Some characteristics are controlled by a single gene; each gene may have different forms called alleles. A dominant allele controls the development of a characteristic when	Describe some of the experiments carried out by Mendel using pea plants. Explain why Mendel proposed the idea of separately inherited factors and why the importance of this discovery was not recognised until after his death.	2	**Modelling** **Video:** Watch a video/computer simulation of Mendel's experiments.		A video clip on dominant and recessive characteristics can be found on the BBC website at www.bbc.co.uk/learningzone/clip by searching for clip '4197'.

Spec Reference	Summary of the Specification Content	Learning Outcomes	Suggested timing (lessons)	Opportunities to develop Scientific Communication skills	Opportunities to develop Practical and Enquiry skills	Self/Peer Assessment Opportunities & resources
e	present on only one of the chromosomes. A recessive allele controls the development of a characteristic only if the dominant allele is not present.	Predict and explain the outcome of crosses using genetic diagrams based on Mendel's experiments and using unfamiliar information. **HT only** **Define the terms homozygous, heterozygous, phenotype and genotype.**		**Activity: HT only** **Draw and label genetic diagrams to explain Mendel's experiments.** **Interpret** genetic diagrams of Mendel's experiments.		Variety of pea seed, plants and pods or diagrams of them. .
i	Each person, apart from identical twins, has unique DNA. This can be used to identify individuals using DNA fingerprinting.	Define the term 'DNA fingerprinting'.(techniques not required) Identify individuals from their DNA fingerprints.	1	**Video:** Watch a video clip using DNA fingerprinting to help solve a crime. **Activity:** Use DNA fingerprints to find the person who committed the crime; match DNA fingerprints to people; identify the twins.	A video clip on DNA finger printing can be found at www.engineering.com by searching 'DNA fingerprinting'. Crime scene, DNA fingerprints and DNA profile from crime scene.	**Note:** Knowledge and understanding of genetic fingerprint techniques is **not** needed.

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B2.7.3 Genetic disorders						
a b c	Some disorders are inherited. Polydactyly, having extra fingers or toes, is caused by a dominant allele. Cystic fibrosis, a disorder of cell membranes, is caused by a recessive allele.	Explain what polydactyly is (extra fingers or toes). Draw/interpret genetic diagrams to show how polydactyly is inherited. Explain what cystic fibrosis is and why it can be inherited from two healthy parents. Draw/interpret genetic diagrams to show how cystic fibrosis is inherited.	1	**Using models** Show images or video clips to show polydactyly. Interpret family trees to determine chance of inheriting disorders. **Video:** Watch a video to explain what cystic fibrosis is, how it is inherited and to illustrate the severity of the disorder. **Activity:** Produce notes and draw genetic diagrams to explain how polydactyly and cystic fibrosis are inherited. **Interpret** genetic diagrams relating to these disorders.	Past BLY2 exam questions.	A video clip on gene therapy and cystic fibrosis can be found on the BBC website at www.bbc.co.uk/learningzone/clips by searching for clip '6014'.
d	Embryos can be screened for the alleles that cause genetic disorders.	Make informed judgements about the economic, social and ethical issues concerning embryo screening.	1	Role play – choices for parents of a cystic fibrosis sufferer who would like another child. To involve experts explaining cystic fibrosis and the screening procedure; the child with the		Be able to suggest one reason why people support and one reason why people are against the screening of

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				disorder; parents to discuss what they would do if the foetus had the disorder. **Or** Watch a video of the process and **describe** issues to be considered re embryo screening. **Reaching agreement on scientific explanations** **Plan structured whole-class discussion** on some of the sex-linked diseases, eg haemophilia, and suggest why scientists have not been able to eliminate these.		embryos for the cystic fibrosis allele.

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B2.8 Speciation Changes in the environment of plants and animals may cause them to die out. The fossil record shows that new organisms arise, flourish, and after a time become extinct. The record also shows changes that lead to the formation of new species. Students will be able to use their skills, knowledge and understanding to: suggest reasons why scientists cannot be certain about how life began on Earth. NB *The uncertainty arises from the lack of enough valid and reliable evidence.*						
B2.8.1 Old and new species						
a b c	Evidence for early forms of life comes from fossils. Fossils are the 'remains' of organisms from many years ago, which are found in rocks. They can be formed in various ways. Many early forms of life were soft bodied so left few traces behind; these traces have been mainly destroyed by	Explain what a fossil is. Describe ways in which fossils are formed – from hard parts that do not decay easily; when conditions for decay are absent; when parts are replaced by other materials as they decay; as preserved imprints. Explain why fossils are useful to us today – to provide evidence of how life has developed; to help us understand evolutionary relationships.	1-2	**Presenting and writing descriptions and explanations** **Research:** Research different ways in which fossils are formed and produce a report with illustrations – complete for homework. Explain formation of fossils using evidence from videos- use scaffold sheet to collect evidence eg Learning Skills for Science. **Developing argument** Are mummies fossils? Why can scientists not be totally certain about how life began on Earth?	**Working critically with primary evidence** Observe an exhibition of fossils or fossil pictures and guess how they were formed and what they are fossils of. **Modelling** Make imprints of leaves, shells, bones etc. as models of fossils **UPD8 activity:** Candidates look at fossil evidence to explain how living things once lived.	Objects to make imprints in sand, plasticine, plaster of Paris. A video clip on DNA and prehistoric animals can be found on the BBC website at www.bbc.co.uk/learningzone/clips by searching for clip '5890'. Interesting information on a huge fossilized skull

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d	geological activity. We can learn from fossils how much or how little organisms have changed as life developed on Earth.	Suggest reasons why scientists cannot be certain how life began on Earth.		Explain how the fossil record is incomplete because many fossils have been destroyed by geological activity. **Discuss** how life on earth might have begun and discuss why we cannot be certain how life began (links with B1.8.1).		found in Argentina can be found at www.UPD8.org.uk by searching 'Godzilla is real'
e	Causes of extinction – changes to the environment over geological time, new predators, new diseases, new competitors, a catastrophic event, through the cyclical nature of speciation.	Define the term 'extinction'. Explain how extinction may be caused. Explain that organisms become extinct because something changes and the species cannot adapt quickly enough to the new circumstances.	1	**Working with secondary evidence** Give a list of extinct organisms and ask students to print off images; suggest reasons to **explain** why they died out. Produce a poster of pictures of extinct organisms; discuss the evidence we have that they looked like this. **Explai**n why some organisms are endangered. Give examples. Give reasons why it is important to prevent species from becoming extinct. **Research:** Research causes of extinction eg climate change, disease, predators		Be able to give two reasons why some organisms are in danger of extinction.

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				and write a report/PowerPoint presentation to present to the class.		
f	New species arise as a result of isolation **(HT only – genetic variation, natural selection and speciation).**	Define the term 'species'. Explain how new species arise using the terms • 'isolation' • Genetic variation • Natural selection • speciation **HT only** **Include, explain and use the terms 'genetic variation', 'natural selection' and 'speciation'**	1	**Presenting and writing descriptions and explanations** Describe what a species is and write a definition. Explain how new species arise **Using models** Use a model to explain one of the following and present to class isolation – two populations of a species become separated, eg geographically genetic variation – each population has a wide range of alleles that control their characteristics natural selection – in each population, the alleles that control the characteristics which help the organism to survive are selected		Understand that it takes millions of years for a new species to form Catalyst magazine on National Stem Centre website has an article on The Socotra archipelago – regarded as modern day Galapagos.

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				speciation – the populations become so different that successful interbreeding is no longer possible. **Discuss** organisms that are only found in or are endemic to eg Australia, Madagascar and ask why this is; support with projected images or video clips. Produce a flow diagram or cut-out to illustrate how new species arise (links with B1.8.1).		