



GCSE Science – Schemes of Work

Biology

Unit 1: Biology 1

Spec Reference	Summary of the Specification Content	Learning Outcomes <i>What most candidates should be able to do</i>	Suggested timing (lessons)	<i>Opportunities to develop Scientific Communication skills</i>	Opportunities to develop and apply Practical and Enquiry skills	Self/Peer assessment Opportunities & resources <i>reference to past questions that indicate success</i>
B1.1 Keeping healthy						
B1.1.1 Diet and exercise						
a	Healthy diet Know the right balance of the different foods you need and the right amount of energy.	Evaluate information about the effect of food on health. Explain how carbohydrates, fats and proteins are used by the body to release energy and to build cells. Explain that mineral ions and vitamins are needed in small amounts for healthy functioning of the body.	2	Developing explanations using ideas and models Devise a model to explain the link between energy transfer and different foods. Evaluate the strengths and weaknesses of own and models of others Developing argument Should companies advertise unhealthy foods? Explain labelling on a range of food products and discuss how informative these are in making healthy choices.	Working critically with primary evidence How far would you have to run to equal the energy transferred from one chocolate bar? Research suggests that Some pizzas are saltier than the sea. How could you test this statement? There is a link between kidney cancer and obesity. How could you test this statement?	NHS choice website 'Behind the headlines' hot discussion topics PPT B1.1.Diet and Exercise
c	Metabolic rate – The rate at which all the chemical reactions in the cells of the body	Describe factors that affect the metabolic rate, eg the rate varies with the amount of activity you do and the	1-2	Presenting and writing arguments What's the ideal proportion of muscle to body fat? Prepare a presentation to	Working with primary and secondary evidence How can we use height-weight	

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d	<p>are carried out.</p> <p>Inherited factors affect health, eg metabolic rate and cholesterol level.</p>	<p>proportion of muscle to fat in your body.</p> <p>Explain how inherited factors can also affect our health; these include metabolic rate and cholesterol levels.</p>		<p>compare the ideal proportion of muscle to fat in the bodies of 3 different athletes eg cyclist, rugby player, long distance swimmer</p> <p>Discuss: Use food labels to discuss saturated and unsaturated fats and their effect on cholesterol levels and heart disease.</p> <p>Developing argument: Accurately assess the validity of a scientific claim, eg 'Healthy Chocolate'.</p>	<p>charts to classify people? Calculate BMIs using primary and secondary evidence.</p> <p>Developing explanations using models Develop a model of blockage in artery. Now evaluate the strengths and weaknesses of your and other's models</p>	<p>BMI calculator can be found in the Health section of the BBC website at www.bbc.co.uk or at www.eatwell.gov.uk by searching 'BMI calculator'.]</p>

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b	Mass A person loses mass when the energy content of the food taken in is less than the amount of energy expended by the body.	Analyse and evaluate claims made by slimming programmes and products. Be able to explain the benefits of exercise on the body.	1	Reaching agreement on scientific explanations <ul style="list-style-type: none"> Research different types of diets, eg Atkins, Slimfast, G.I., Weight watchers and produce a table to compare evidence and accept or reject evidence. Match diets to different types of employment. Write an article or a blog to advise lifestyle changes for any of the above 	Working critically with secondary evidence <ul style="list-style-type: none"> Research obesity problems in children in the UK or from another country. Extend by comparing data from different countries to conclude or evaluate Calculate dietary values from nutritional information on food packets. 	Use BBC - Super Slim Me PART 1/6 video on Youtube to stimulate discussion More information on exercise can be found in the Health section of the BBC website at www.bbc.co.uk by searching for ' Importance of exercise '.
e	Regular exercise improves your health. Note: Effect of exercise on breathing and heart rate is not required.	Evaluate information about the effect of lifestyle on development of diseases.				

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B1.1.2 How our bodies defend themselves against infectious diseases						
a	Pathogens cause disease. Note: Structure of bacteria and viruses is not required.	Explain how pathogens cause disease. Be able to describe the processes involved in aseptic techniques.	2	Communication for audience and purpose Do all pathogens have the same effect on the body? <ul style="list-style-type: none"> Complete report for a scientific journal illustrating examples of diseases caused by viruses and bacteria. 	Working critically with primary evidence Are some pathogens more dangerous than others? <ul style="list-style-type: none"> Use data to compare the numbers of deaths from different pathogens. 	A useful website is www.curriculumbits.com – Microbes and disease. Information on health conditions can be found in the Health section of the BBC website at www.bbc.co.uk by searching 'Medical Conditions'. Video clips can be found at www.bbc.co.uk/learningzone/clips

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f	Semmelweiss recognised the importance of hand-washing to reduce the spread of infection.	Describe the work of Semmelweiss and link to results of class investigations.	1	Societal aspects and applications of scientific evidence <ul style="list-style-type: none"> Research the work of Semmelweiss and write his blog or produce mock TV interview. Relate work of Semmelweiss to problems with spread of infection in hospitals today in a ppt presentation with video clips/animations 	Developing practical skills through planning and risk assessment Why are we always told to wash our hands before meals and after the toilet? <ul style="list-style-type: none"> Plan an investigation using agar plates to compare the growth of micro-organisms from unwashed and washed hands. Check CLEAPPS advice to help with assessing risk 	
b	Microbes can reproduce rapidly inside the body and produce toxins that make us feel ill.	Describe ways in which the body defends itself against disease. Explain how microbes make us feel ill and how viruses damage cells.	1	Developing explanations using models Are all bacteria and viruses dangerous? <ul style="list-style-type: none"> Conduct research into different diseases. Devise a model to illustrate how bacteria and viruses invade 	Assessing risk and working safely Why do research scientists working microbes that cause diseases such as influenza, AIDS and Ebola, rarely catch the	A video clip on white blood cells can be found on the BBC website at www.bbc.co.uk/learningzone/clips by searching for clip

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c	The body has different ways of protecting itself against pathogens.			<p>the body .</p> <p>Communication for audience and purpose</p> <ul style="list-style-type: none"> Produce an article for a teenage magazine to explain how the body defends itself against disease. Use Point, Evidence, Explanation to help to structure writing <p>Developing ideas using models</p> <ul style="list-style-type: none"> Produce a cartoon strip or animation to show actions of white blood cells. 	<p>disease?</p> <ul style="list-style-type: none"> Produce a risk assessment for their work 	<p>'1838'.</p> <p>Video: BBC clip or video on defence against disease.</p>
d	White blood cells ingest pathogens and produce antibodies and antitoxins.	Describe the actions of white blood cells using terms 'ingest', 'antibodies' and 'antitoxins'.				

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e l	Immunity and action of antibodies. Vaccines – what they are and how they work.	Explain the processes of natural and acquired immunity. Evaluate the advantages and disadvantages of being vaccinated against a disease, eg the measles, mumps and rubella (MMR) vaccine.	1	Developing argument Look up and interpret child immunisation programmes. Role play on whether to give your child vaccinations. Reaching agreement on scientific explanations Consider the actions of Dr Wakefield and the MMR vaccine.	Working critically with secondary evidence the relationship between the per cent vaccinated and frequency of the disease. Use data from a line graph to describe	Information on vaccinations can be found on the NHS website at www.nhs.uk by searching 'When are vaccinations given?'. Information on the MMR vaccine can be found on the BBC website at www.bbc.co.uk by searching 'MMR debate'. Information about the history of medicine can be found on the GCSE Bitesize section of the BBC website at www.bbc.co.uk by searching 'Medicine through time'.

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g m n o	Use of medicines to relieve symptoms. Investigating the action of disinfectants and antibiotics; aseptic techniques; incubation temperatures.	Describe the use of aseptic techniques and explain the precautions taken when handling microorganisms. Explain how antibiotics work to combat pathogens.	1	Application to society and cultural understanding Discuss: Brainstorm medicines used to relieve symptoms and treat disease; names of some antibiotics. Research work of Fleming and/or Florey and Chain and discuss the impact of their work on society.	Selecting and managing variables Are antibiotics universal in their action against pathogens? Antibiotics or antiseptics etc and growth of microbes (area of clearance to be measured in later lesson). Investigate type of agent or concentration.	Be able to explain why schools do not incubate above 25 °C. A video clip on penicillin can be found on the BBC website at www.bbc.co.uk/learningzone/clips by searching for '2884'.
h i j	Use of antibiotics – how they work and problems of overuse. Antibiotic resistance, eg MRSA. Mutations lead to resistant strains of pathogens which can spread rapidly.	Explain how the treatment of disease has changed due to understanding the action of antibiotics and immunity. Explain the difficulty in developing drugs that kill viruses without damaging body tissues. Evaluate the consequences of mutations of bacteria and viruses in relation to epidemics and pandemics.	1	Developing argument Describe the impact of antibiotic resistance and explain how this has impacted on cleaning practices in Britain's hospitals. Research MRSA and C. difficile infections and treatment. Applications and implications Evaluate the consequences of flu pandemics and identify categories of individuals most at risk and the strategies used to reduce the risks.	Working critically with secondary evidence Use secondary evidence from text books, the internet and other sources to draw a timeline to show how treatment of disease has changed over the years.	Useful information can be found on the BBC website at www.bbc.co.uk B1.1.2 How our bodies defend against disease

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k	Development of new antibiotics to combat resistant bacteria.	HT only Explain what we should do to slow down the rate of development of resistant strains of bacteria.		Developing explanations using ideas and models Devise a model to explain how a new, named antibiotic has been used to slow down spread of resistant bacteria.		

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B1.2 Nerves and hormones						
B1.2.1 The nervous system						
a	The nervous system enables humans to react to their surroundings and coordinate behaviour.	Describe the functions of the main structures in the nervous system.	1-2	Communication for audience and purpose Describe stimulus response reactions eg loud bang, light, touch, movement, smell and taste. Explain how detection of stimuli protects the body from danger	Selecting and managing variables Plan and manage a variety of variables to illustrate body responses eg <ul style="list-style-type: none"> • Response to temperature: three bowls of water – hot, warm and ice-cold. • Taste receptors: Salt, sugar, coffee and lemon solutions to taste. • Skin sensitivity: Hairpin set with 1 cm gap, blindfolds. 	PPT B1.2 The nervous system
b	Receptors detect stimuli.	Be able to sequence a reflex action from stimulus to response Explain how receptors in the eye, ear, tongue and skin are linked to the stimuli they detect.		Demo: response to different temperatures. How Science Works: Detecting different tastes on the tongue – draw results on diagram of tongue.		
c	Basic structure of a light receptor cell.	Describe how a light receptor cell has a nucleus, cytoplasm and cell membrane. Explain the importance of being able to respond to environmental changes.		Discuss: How Science Works: Investigate sensitivity of different areas of the body.		

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					Obtaining and presenting primary evidence Discuss the senses and complete a table to show name of sense, main organ and stimulus it responds to primary evidence	
d e	Pathway of nerve Impulses and reflex actions.	Explain the importance of reflex actions and be able to give examples. Describe the pathway of a nerve impulse in a reflex response and explain the roles of the structures involved. stimulus→receptor→sensory neurone→relay neurone→motor neurone→effector→response Explain the role of chemicals at synapses. Describe different ways of	1	Developing argument Use knee-jerk and pupil reflexes as a stimulus for discussion. Students discuss their importance and gather other examples leading into explanation of why they are faster than a voluntary action. Developing explanations using models Students use a model eg Sheep Dash Activity to explain reaction times	Obtaining and presenting primary evidence Use and apply systematic observations to gather data. Justify chosen presentation of data eg table, praph, pie chart etc <ul style="list-style-type: none"> Investigate reaction time using different combinations of receptors. Past BLY1 exam questions. Use cards to sequence the pathway of a nerve 	The Sheep Dash activity can be found on the BBC website at www.bbc.co.uk/science/humanbody/sleep/sleep Reaction time: Metre-rulers and blindfolds or sensors and dataloggers.

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		measuring reaction time.			<p>impulse. Arrange candidates holding cards in this sequence and discuss role of each and how impulse passes from one to another.</p> <ul style="list-style-type: none"> Match structures in nerve pathway to different reflex actions, eg production of saliva when smelling food; pupil response to light. 	

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B1.2.2 Control in the human body						
a	The need to control water and ion content of the body, temperature and blood sugar levels.	Describe some conditions that need to be controlled in the body. Explain why body temperature has to be controlled.	1-2	Communication for audience and purpose Describe the body's inputs and outputs on a diagram of the body – water, ions, CO ₂ , sugar and heat. Be able to link the organ to the condition it helps control in the body. Communication for audience and purpose Devise an advertising campaign for a holiday resort targeted at families to show the dangers to the body of remaining in the sun for long periods.	Planning and approach <ul style="list-style-type: none"> Investigate what is normal body temperature. Investigate the effect of exercise on body temperature and/or sweating. Investigate the effect of temperature on enzyme activity, eg digestion of starch. 	. Body temperature: Digital and forehead thermometers. Exercise: Thermometers, cotton wool and balance. Temperature and enzymes: Starch and amylase solutions, tubes, water baths, ice, iodine solution or Benedict's solution and goggles. Check CLEAPPS
b	Hormones are chemical substances produced by glands	Explain the source function of hormones Describe some changes that	1	Developing explanations using ideas and models Discuss: Recap the control of blood	.	PPT B1.2.2 Control in the human body

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c d	and transported to target organs in the blood. Hormonal control of the menstrual cycle – FSH, LH and oestrogen.	occur at puberty and link with secretion of hormones. Describe the hormones that control the menstrual cycle and the glands that produce them.		sugar levels as a lead into names of other hormones, where they are produced and how they are transported around the body. Describe collectively changes that occur in boys and girls at puberty – what causes them? Use a model eg diagram, chart, animation etc to show the names, sites of production and effects of FSH, LH and oestrogen in the menstrual cycle.		
e	Uses of hormones in the control of fertility – oral contraception and fertility drugs.	Evaluate the benefits and problems of using hormones to control fertility. Describe the hormones that may be present in oral contraceptives. Explain the link the hormones used in oral contraceptives to their effects on the body. Use a model eg a flow diagram to explain the process of In Vitro Fertilisation (IVF).	1	Working with primary evidence Identify the hormones used in contraceptives Communication for audience and purpose <ul style="list-style-type: none"> • Research why each hormone is used and produce a report for a teen magazine on the advantages and disadvantages of different oral contraceptives. • Be able to state how oral 		Useful information can be found at www.nhsdirect.nhs.uk/en A good activity can be found at www.UPD8.org.uk by searching for 'New womb?'. Useful information on IVF can be found at

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				<p>contraceptives have been improved over the years.</p> <p>Applications implications and cultural understanding</p> <ul style="list-style-type: none"> • Research the process of IVF and produce a leaflet for a doctor's surgery to describe the main stages involved in IVF treatment. • Apply different ethical approaches to making a decision about non-vital transplants. • Discuss possible causes of infertility in men and women and treatment available. • Invite an outside speaker to discuss contraception, eg women's health nurse. 		<p>www.babycentre.co.uk by searching 'In Vitro Fertilisation'.</p> <p>PPT 1.2.2 Control in the Human Body</p>

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B1.2.3 Control in plants						
a b c	Plant shoots and roots respond to light, moisture and gravity. Hormones control and coordinate growth in plants. Responses to light, gravity and moisture are controlled by the unequal distribution of auxin which causes unequal growth rates in shoots and roots.	Describe how plant shoots and roots respond to light, gravity and moisture. Explain the role of auxin in plant responses in terms of unequal distribution in shoots and roots.	2	Developing explanations and arguments using models <ul style="list-style-type: none"> Compare and contrast the ability of different plants to reach light – obstacle course. Explain positive and negative phototropism. Use diagrams to explain plant responses in terms of distribution of auxin. Interpret Charles Darwin's investigations into tropisms 	Working critically with primary evidence Obtaining and presenting primary evidence Are all plants sensitive? <ul style="list-style-type: none"> Students use evidence from demo of a plant's sense of touch – Venus fly trap, Mimosa, Honeysuckle or from video clips to suggest degrees of plant sensitivity Effect of light on growth of shoots – dark, even light, light box and clinostat in light box. Investigate which part of a shoot is sensitive to light. 	Useful information on plant growth can be found at www.s-cool.co.uk by searching for 'plant growth' Obstacle course: Three identical shoe boxes with simple obstacle course inside and hole at one end, dish of mustard seedlings, germinating broad bean and sprouting potato. Positive and negative phototropism: Broad bean seedling held by pin in jar with light entering through a slit.

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					<ul style="list-style-type: none"> • Effect of gravity on growth of plants • Demo response to water. • Interpret experiments using agar blocks and seedlings with shoot tips removed. 	<p>Light sensitivity: Three pots of oat seedlings in three light boxes – tips removed, tips covered and untreated.</p> <p>Gravity: Grow broad beans in dark jar in different positions, blotting paper. Broad bean seedling in clinostat in dark – rotating and still.</p> <p>B1.2.3 Control in plants</p>
d	Use of plant hormones in agriculture and horticulture.	Explain how plant hormones are used as weed killers and rooting hormones.	1		<p>Planning an approach Are all plant hormones useful?</p> <ul style="list-style-type: none"> • Investigate the effect of rooting hormones on growth of cuttings. • Investigate effect of weed killer on an area of lawn. 	<p>Rooting hormone: Rooting powder, jars of water and plant cuttings.</p> <p>Weed killer: Selective weed killer solution.</p>

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B1.3 The use and abuse of drugs						
B1.3.1 Drugs						
a b d	Testing of new drugs and clinical trials. Thalidomide	Explain the term 'drug' and give examples of medical drugs. Explain why drugs need to be tested before they can be prescribed. Describe the uses and problems associated with thalidomide. Explain how the drug testing procedure for thalidomide was inappropriate. Describe the main steps in testing a new drug. Be able to give reasons for the different stages in drug testing. Explain the terms placebo and double-blind trial.	1	Presenting and writing descriptions and explanations Discuss: Brainstorm – what is a drug? Names of medicines. Use pictures to relate uses and problems associated with thalidomide. Research: Research and produce a newspaper report on thalidomide to include <ul style="list-style-type: none"> • original use, • use in pregnant women, • current uses. Discuss: Discuss drug safety and how drugs are tested today. Using models Cards/cut-outs to sequence stages in drug testing and trialling and purpose of each stage.		PPT B1.3 Use and abuse of drugs Useful information on thalidomide can be found at www.thalidomideuk.com

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c e	Statins lower the amount of cholesterol in the blood. Recreational drugs	Describe and evaluate the effect of statins in cardiovascular disease. Describe some recreational drugs. Describe some effects of caffeine on the body. Explain why a person might become addicted to a recreational drug	1	Developing argument Discuss: Brainstorm on recreational drugs, sort into legal and illegal and discuss why people use them.	Working critically with secondary evidence Interpret data on statins (links with inherited factors B1.1.1d). Obtaining and presenting evidence Investigate the effect of caffeine on heart rate or reaction time (see B1.2.1 reaction time experiment').	Caffeine: coffee/energy drink/coke vs. decaf version or water, timer/pulse rate sensor and a ruler (alternative measure effect of caffeine concentration on heart rate of daphnia)
9	Overall impact of legal drugs	Evaluate the impact of smoking on health.	1	Presenting and writing arguments 'My granddad is 85 and has smoked all his life so why shouldn't I?' <ul style="list-style-type: none"> • Students work in groups to produce arguments for and against the statement then debate in class • Poster to show effects of chemicals in smoke on the body. 	Obtaining and presenting primary evidence Demo: Smoking machine to show carbon dioxide and tar content of smoke. Students gather and present data	Be able to use data from a line graph to describe the relationship between birth mass of a baby and the number of cigarettes smoked by the mother. Useful information on drugs can be found at www.talktofrank.com A useful tool about

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		<p>Evaluate why some people use illegal drugs for recreation.</p> <p>Evaluate claims made about the effect of prescribed and non-prescribed drugs on health.</p>		<ul style="list-style-type: none"> Calculate the cost of smoking cigarettes. <p>Show health warning on packets of cigarettes; video clips of smoking adverts. Why do people smoke?</p> <p>Reaching an agreement on scientific explanations</p> <p>Use evidence from research to arrive at an opinion about claims made about the effect of prescribed and non-prescribed drugs on health. Students write a blog about how they came to this view</p>		<p>smoking can be found on the NHS website at www.nhs.uk by searching 'smoking calculator'.</p> <p>Further information on smoking can be found at www.ash.org.uk</p>

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e g	Recreational drugs Impact of legal drugs on health is greater than illegal drugs as more people use them.	Evaluate the impact of alcohol on health. Evaluate why some people use illegal drugs for recreation. Evaluate claims made about the effect of prescribed and non-prescribed drugs on health.	1	Applications, implications and cultural understanding Discuss: Discuss effects of alcohol on the body, recommended units for men and women. Survey friends and family and calculate number of units of alcohol consumed in a week. What advise would you give about drinking?	Working critically with primary evidence Evaluate whether individuals who smoke and drink alcohol to excess should receive the same NHS treatment as those who do not eg heart by-pass operations, lung transplant	Exhibition of alcoholic drinks with units per measure. A tool about drinking can be found on the NHS website at www.nhs.uk by searching 'alcohol tracker'.
e f h	Recreational drugs Cannabis Drug addiction and withdrawal symptoms – heroin and cocaine.	Describe the effects of cannabis on the body. Consider the possible progression from recreational to hard drugs. Describe the effects of heroin/cocaine addiction on the body and withdrawal symptoms.	1	Applications implications and cultural understanding How fine is the line between recreational and hard drugs? Can using 'hard drugs' ever be justified? Students gather evidence for a class debate from <ul style="list-style-type: none"> • Invite an outside speaker, eg drugs and alcohol adviser. • Research effects of cannabis on the body. 	Working critically with primary and secondary evidence Interpret data on drug use Interpret data on cannabis use and progression to hard drugs	Information on cannabis can be found on the NHS website at www.nhs.uk by searching 'the dangers of cannabis'. Further information on drugs can be found on the following websites www.dare.uk.com www.nida.nih.gov and on the NHS website

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				<ul style="list-style-type: none"> Watch NHS video clip on the dangers of smoking cannabis. 		at www.nhs.uk by searching for 'drugs'. Video: Watch video clips from NHS site on cocaine use.
i	Steroids and performance enhancing drugs.	Evaluate the use of drugs to enhance performance in sport. Consider the ethical issues of performance enhancing drugs. Describe some effects and risks of these drugs.	1	Reaching agreement about scientific explanations <i>Is taking a dietary supplement to boost fitness and stamina in athletes any different to taking steroids to increase muscle bulk?</i> Students research and debate Research: Research types of drugs used in sport and their effects on the body and produce a table. Presenting and writing arguments Role play, write a story or debate about using drugs in sport; random drug testing; getting caught cheating.		Information about drugs in sport can be found on BBC GCSE Bitesize at www.bbc.co.uk/school/gcsebitesize by searching 'doping' or 'performance enhancing drugs'.

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B1.4 Interdependence and adaptation						
B1.4.1 Adaptations						
d e f g	Adaptations for survival. Extremophiles Adaptations for survival in deserts and the Arctic. Adaptations to cope with specific features of the environment.	Explain the reason for adaptations in a range of organisms. Explain how organisms are adapted to survive in their habitat. Describe and explain adaptations for survival in the Arctic. Describe and explain adaptations for survival in a desert. Define the term extremophile and be able to give general examples. Be able to relate features seen in a diagram to the organism's survival.	2	Communication for audience and purpose Are all living things on the planet adapted in one way or another? Use evidence to <ul style="list-style-type: none"> produce a display of plants, animals and microorganisms with labels to explain how their adaptations help them to survive in their habitat. Include examples of extremophiles and desert and arctic organisms.Or Prepare a presentation in any media to answer the question. 	Use full range of practical and enquiry skills ie planning; variable; assessing risk; obtaining and presenting evidence; evaluating Investigate the rate of cooling – either SURFACE AREA (SA)/Volume ratio, colour of body, body covering or huddling. Link results to different organisms.	Useful information can be found on the BBC website at www.bbc.co.uk by searching 'adaptations and behaviours'. Further information can be found at www.yourdiscovery.com Useful video clips can be found on the BBC website at www.bbc.co.uk/learningzone/clips by searching for extremophile bacteria (clip 10469), plant adaptations – extreme cold (clip

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						5506), and plant adaptations – extreme heat (clip 5514).
a b c	Organisms require materials from their surroundings and from other organisms to survive. Plants compete for light, space, water and nutrients. Animals compete for food, mates and territory.	Describe factors that affect the survival of organisms in their habitat. Describe resources that plants and animals compete for in a given habitat. Describe adaptations that some organisms have to avoid being eaten. Interpret population curves.	2-3	Presenting and writing arguments Discuss: Brainstorm factors that affect the survival of organisms in a habitat. Discuss resources that organisms may compete for and the effect on populations.	Working critically with secondary evidence Interpret population curves, eg hare and lynx, red and grey squirrels, and native and American crayfish.. Working critically with primary evidence Investigating the distribution of plants on the school field or relationship between light intensity and types of plants. Competition in radish seedlings – spacing trials and height (links with B2.4.1 and B3.4.1).	Video clip on courtship displays. Exhibition of camouflaged organisms. PPT B1.4 Interdependence and adaptation

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B1.4.2 Environmental change						
a b c d	Environmental change and the distribution of organisms. Environmental changes due to living and non-living factors. Indicators of pollution – lichens and invertebrates. Measuring environmental changes.	Evaluate data on environmental change and the distribution and behaviour of living organisms. Describe with examples how an environment can change. Interpret data on lichen distribution and sulfur dioxide levels. Interpret data on invertebrates and water pollution.	2-3	Presenting and writing descriptions and explanations Prepare a concept map to show how an environment can change and how these changes could affect organisms within it. Show the impact eg on distribution of bird species, disappearance of bees, global warming, agricultural pollution, sulfur dioxide and oxygen levels in water. Reaching agreement on scientific explanations Research why the bee population is falling and the effects this will have (overlap with B2.4 and B3.4) and come to an informed opinion. Share with group	Planning an approach Demonstrate use of rain gauges and maximum -and minimum thermometers ,the use of equipment to measure oxygen, temperature and rainfall.. Assessing risk and working safely Investigate the effect of phosphate levels on algal growth and oxygen levels Pond/stream dipping and measurement of environmental factors, eg temperature changes over a day, oxygen content of water and pH.. What are indicator species? Carry out a lichen survey on local trees/walls. Interpret data on lichens and invertebrates.	Be able to give two ways in which humans damage the environment. Be able to Pond dipping: Kick nets, sample trays and pots, identification charts, oxygen, pH and temperature sensors Lichen identification charts, clip boards. Phosphate levels: Jars of water and algae, phosphate solution and pipettes and oxygen sensor. A useful clip on the honey bee can be found on the BBC website at

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					Choice chambers: choice chambers, with areas of different conditions, woodlice or maggots.	www.bbc.co.uk/learningzone/clips by searching for clip '7187'.

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B1.5 Energy and biomass in food chains						
B1.5.1 Energy in biomass						
a b	The Sun is the source of energy for most communities; photosynthesis. Pyramids of biomass.	Be able to construct and interpret pyramids of biomass.	1		Obtaining and presenting primary evidence Investigate leaf litter – separate into plant material and different types of animals; construct pyramids of number and biomass.	Useful information can be found at www.gould.edu.au/foodwebs Leaf litter, identification charts, balance and containers.
b c	Pyramids of biomass Energy losses in food chains.	Describe how energy and mass is transferred along a food chain. Explain why energy and biomass is reduced at successive stages in a food chain.	1	Developing explanations using models Are pyramids of number, biomass and energy always pyramid shaped? Review and research to compare information shown in pyramids of number and biomass and discuss why biomass decreases at each level.	Working critically with secondary data Interpret data on energy transfer in food chains and list energy losses at each level.	Note: Candidates do not need to be able to interpret pyramids of number. B1.5 Energy and biomass in food chains

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B1.6 Waste materials from plants and animals						
B1.6.1 Decay processes						
a b c d	<p>Living things remove materials from the environment for growth and other processes; these are returned to the environment in wastes and when organisms die and decay.</p> <p>Conditions for decay</p> <p>Decay releases nutrients for plant growth.</p> <p>Material is constantly cycled and can lead to stable communities.</p>	<p>Describe how plants and animals return materials to the environment.</p> <p>Describe the role of microorganisms in decay.</p> <p>Be able to name the type of living organism which causes leaves to decay?</p> <p>Describe factors affecting the rate of decay.</p> <p>Explain how decay is useful to plants.</p> <p>Evaluate the necessity and</p>	2	<p>Presenting and writing arguments Should non-biodegradable packaging be banned?</p> <ul style="list-style-type: none"> Classify items as biodegradable and non-biodegradable and agree criteria for classification. Discuss: Show some examples of rotting foods; discuss what has caused the food to rot. What would happen if things didn't rot when they died? <p>Developing explanations using ideas and models</p> <ul style="list-style-type: none"> Discuss why plants in a wood continue to grow without the use of fertilisers and relate to recycling of materials. 	<p>Selecting and managing variables Why do leaves decay faster in summer than winter?</p> <ul style="list-style-type: none"> Investigating the factors that affect decay, eg temperature, moisture, pH, oxygen and decay of bread or fruit. Investigate the rate of decay of grass clippings Competition – whose potato will decay the fastest? Plan the best 	<p>Grass clippings: Thermos flasks with thermometers/temperature probe, disinfectant, wet and dry grass and composting agent. PPT B1.6 Waste materials from plants and animals</p> <p>Useful information on earthworms can be</p>

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		effectiveness of recycling organic kitchen or garden wastes.		<ul style="list-style-type: none"> Research how kitchen and garden wastes can be recycled. 	<p>conditions for decay</p> <p>Demo: Set up a wormery and observe how they improve the soil and breakdown dead leaves.</p> <p>Online activity: Earthworm investigation.</p>	<p>found at www.curriculumbits.com by searching for 'Earthworm investigation'.</p>

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B1.6.2 The carbon cycle						
a	The main processes involved in the carbon cycle.	<p>Explain the carbon cycle in terms of photosynthesis, respiration, feeding, death and decay, combustion of wood and fossil fuels.</p> <p>Explain the role of microorganisms and detritus feeders in decay.</p> <p>Explain why deforestation increases the amount of carbon dioxide in the atmosphere.</p>	1	<p>Applications implications and cultural understandings</p> <p>Can any action to use natural resources be justified if it is part of a recycling programme?</p> <p>Gather evidence to debate this topic from the following</p> <ul style="list-style-type: none"> • Revise how carbon dioxide is used by plants in photosynthesis and why this is of use to animals. What happens to the carbon? • how the carbon passes from plants to animals; how it is returned to the air; • what happens when things die; describe how the carbon in dead bodies may be recycled. 	<p>Assessing risk and working safely</p> <p>Demos: Show examples of fossil fuels; burn a fossil fuel and bubble the fumes through limewater.</p> <p>Use sensors to measure carbon dioxide levels in the air; show a piece of coal and discuss what it is and how it was formed.</p> <p>Demo: fuels, inverted glass funnel to direct fumes through tube of limewater and pump.</p>	Carbon dioxide sensor, coal and oil

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				<ul style="list-style-type: none"> formation and combustion of fossil fuels. <p>Developing ideas through models Cut-out different coloured cards for processes and organisms and arrange them as in the carbon cycle.</p>		

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B1.7 Genetic variation and its control						
B1.7.1 Why organisms are different						
d	Genetic and environmental causes of variation.	Classify characteristics as being due to genetic or environmental causes. Decide the best way to present information about variation in tables and charts.	1-2	Developing argument Why do organisms of the same species show variation? <ul style="list-style-type: none"> • Discuss genetic and environmental variation. • Discuss continuous and discontinuous variation. Would you want to know if you had a genetic predisposition to illness that could be linked to environment? Eg high cholesterol levels in family Examine the benefits of knowing how genes can be linked to diseases	Obtaining and presenting primary evidence Class survey of characteristics – collate results in a table and produce a display of the results in appropriate format. Include in the table whether each characteristic is due to genetic or environmental causes, or both. Measure variation in a plant species growing in different areas of school grounds, eg leaf length in areas of sun/shade	B1.7 Genetic variation and its control Useful information can be found at www.UPD8.org.uk by searching 'the future in your genes'.
c a	Different genes control different characteristics. Genes carry	Describe the order of size of cell, nucleus, chromosome and gene.	1	Developing explanations using models Students produce models eg animations, artefact, diagram to explain the relationship between cell, nucleus,	Working critically with primary and secondary evidence Ask Rich questions such as <ul style="list-style-type: none"> • What determines 	Name cards to sort. Microscopes, prepared slides, and bioviewers.

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b	<p>information about characteristics and are passed from parents to offspring in gametes.</p> <p>Nucleus contains chromosomes that carry genes.</p>			<p>chromosome. gene</p> <p>gather evidence, for example, from</p> <ul style="list-style-type: none"> • Look at chromosomes on slides or bioviewers. • Look at photographs of chromosomes from a male and a female or cut and pair chromosomes from photos of male and female karyotypes. 	<p>gender?</p> <ul style="list-style-type: none"> • Why are stem cells so valuable? • Should genetic screening be compulsory <p>Students use secondary evidence to suggest answers to the questions</p>	<p>Photos of karyotypes – partially paired chromosomes.</p> <p>www.sciencemuseum.org.uk/WhoAmI/FindOutMore/Yourgenes</p> <p>this is also available for download in PDF.</p>

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B1.7.2 Reproduction						
a b	There are two forms of reproduction – sexual results in variation in the offspring due to mixing of genes; asexual produces genetically identical clones. New plants can be produced by taking cuttings. They are genetically identical to the parent plant.	Explain why sexual reproduction results in variation, but asexual reproduction does not produce variation. Describe sexual reproduction as the joining of male and female gametes. Define the term ‘clone’. Explain how plant cuttings can be grown into new plants.	1	Developing argument Rich questions to support recap of reproduction Students work in small groups or pairs to research and share answers <ul style="list-style-type: none"> • Do we really need males? • Is sex necessary? • Can scientists solve the world food shortage? • Do hermaphrodites lead a solitary existence? 	Application of science Should the EU subsidise horticultural farmer at the expense of traditional growing methods? Take stem cuttings of geraniums or leaf cuttings of African violets; produce potato plants from sprouting potatoes.	Be able to sequence the stages involved in adult cell cloning. Show video clips of fertilisation of an egg by a sperm and of insects pollinating flowers Show strawberry runners, carrot top growing on damp blotting paper, potato sprouting, spider plant producing runners, bulb, amoeba and yeast. Cuttings: Healthy geranium plants and African violets, sprouting potatoes, knives or scissors, pots, compost, warm

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						water, labels and marker pens, rooting compound if wanted.
c	Modern cloning techniques – tissue culture, embryo transplants and adult cell cloning.	Interpret information about cloning techniques. Make informed judgements about the economic, social and ethical issues concerning cloning. Describe the process of tissue culture in plants. Explain the importance of cloning to plant growers. Describe the process of embryo transplants in animals.	1	Applications, implications and cultural understanding/ Developing explanations using ideas and models Discuss: Discuss how identical twins are formed and lead on to embryo transplants. Students produce models to explain the method of embryo transplants or adult cell cloning. Students evaluate strengths and weaknesses of their own and other models	Working critically with primary evidence Students produce cauliflower clones –follow guidance from SAPS and draw reliable conclusions from the evidence gathered	Worksheet for Cauliflower activity can be found at http://www.saps.org.uk/students/projects/149
c	Modern cloning techniques – tissue culture, embryo transplants and adult cell cloning.	Describe the process of adult cell cloning in animals. Explain advantages and disadvantages of cloning techniques. Be able to present arguments	1	Developing explanations using ideas and models Video: Watch a video clip of adult cell cloning/Dolly the sheep. Produce a flow diagram to describe the process of adult cell cloning or carry out card sorting activity. Developing argument	Applications, implications and cultural understanding Interpret information/ data about cloning techniques.	Video clips on cloning can be found on the BBC website at www.bbc.co.uk/learningzone/clips by searching for clips '4140' and '4139'.

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		for and against human cloning.		Should human cloning be allowed? Research and debate the advantages and disadvantages of cloning plants and animals. Research latest legislation on human cloning and discuss social and ethical issues related to human cloning.		Useful websites are www.bbc.co.uk and www.hfea.gov.uk

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d e f	Genetic engineering techniques. Examples of genetic engineering. Concerns about genetically modified (GM) crops	Define the term 'genetic engineering'. Describe the process of genetic engineering to produce bacteria that can produce insulin and crops that have desired characteristics. Interpret information about genetic engineering techniques. Make informed judgements about the economic, social and ethical issues concerning genetic engineering. Explain advantages and disadvantages of genetic engineering.	1-2	Reaching agreement on scientific explanations Discuss: Brainstorm what the terms genetic engineering, genetic modification and gene therapy mean. List examples of genetic engineering. Communication for audience and purpose Produce a leaflet for a doctors surgery to explain how human insulin is produced by bacteria and discuss the advantages of this over porcine insulin (links with B3.3.3). Research: Research advantages and disadvantages of GM crops; what characteristics may be modified; produce a web page or a table of benefits versus concerns for homework.	Working critically with secondary evidence Interpret information about genetic engineering techniques. Weigh up the pros and cons of growing genetically modified food and produce up to fifty word headline paragraphs to represent the views of <ul style="list-style-type: none"> • Organic farmers • Food-Aid organisers • GM Research scientists • Students themselves Information on genetic engineering can be found at www.UPD8.org.uk by searching for 'mosquitoes vs malaria'.	Be able to give two reasons why farmers are in favour of growing GM crops. Be able to give two reasons why people are against growing GM crops. Information on genetically modified food can be found at www.curriculumbits.com PPT B1.7 Genetic variation and its control
Choose option						38 of 41

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B1.8 Evolution						
B1.8.1 Evolution						
a c	Darwin's theory of evolution by natural selection. Other theories, eg Lamarck, are based mainly on the idea that changes that occur in an organism during its lifetime can be inherited.	Describe Darwin's theory of evolution. Describe different theories of evolution.	1 plus HWK	Working critically with primary and secondary evidence Discuss: Look at exhibition to show the wide variety of organisms that live, or have lived, on Earth. Where did they come from? Describe Video: Watch video on Darwin's theory of evolution and other theories Research: Research and produce report on evolutionary theories, eg Darwin, Lamarck, Creationism, Buffon, and Cuvier. Be able to give two reasons why people were against Darwin's ideas at that time.		Video clips on evolution and natural selection can be found on the BBC website at www.bbc.co.uk/learningzone/clips by searching for clips '5523' and '5516'.
e f	Evolution occurs by natural selection. Mutations may lead	Identify differences between Darwin's theory of evolution and conflicting theories. Suggest reasons for the	1	Presenting and writing descriptions and explanations Does evolution always produce better organisms?	Planning an approach/Working with secondary evidence) Describe how to gather evidence for an evolutionary	

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	to more rapid evolution.	different theories. Explain the terms 'inherited' and 'acquired' characteristics. Describe the stages in natural selection. Define the term 'mutation'. Explain why mutation may lead to more rapid change in a species.		Discuss natural selection and create a presentation in media of choice to answer the rich question Developing explanations using ideas and models <ul style="list-style-type: none"> • Natural selection role play activities. • Peppered moth game; explain in terms of natural selection. • Produce flow diagram to explain evolution by natural selection. • Look at pictures of Darwin's finches and match up with the Galapagos Island they lived on based on food available there. 	tree to describe relationships between organisms (HT include the time scales involved in evolution).	
b d	The theory of evolution was only gradually accepted. Studying similarities and differences between organisms allows us to classify	Explain why Darwin's theory was only gradually accepted. Interpret evidence relating to evolutionary theory. Classify organisms based on their similarities.	1	Reaching an agreement on scientific explanations <ul style="list-style-type: none"> • Explain why Darwin did not publish his theory straight away and why it was only gradually accepted. 	Working critically with primary and secondary evidence Evaluate conclusions drawn by Darwin and his followers. Why do some people today not accept Darwin's theories	PPT 1.8 Evolution

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	them as animals, plants or microorganisms.			<ul style="list-style-type: none"> Interpret evidence relating to evolutionary theory – fossils, pictures of horses, humans, tree of life etc. <p>How Science Works:</p>	<p>Exhibition of organisms to classify into groups (this could be the first lesson on evolution).</p> <p>Sort pictures of organisms into an evolutionary timeline.</p>	