OCR Gateway GCSE Science 2011

GCSE Science: Biology

Module B1: Understanding Ourselves	Boardworks presentation
B1a: Fitness and health	
Explain why blood in arteries is under pressure: *- due to contraction of heart muscles* *- so that it reaches all parts of the body.*	**Blood Pressure**
Recall that blood pressure measurements consist of diastolic and systolic information in mmHg.	**Blood Pressure**
Describe the factors that increase blood pressure: - being overweight - stress - high alcohol intake - smoking.	**Blood Pressure**
Describe the factors that decrease blood pressure: - regular exercise - balanced diet.	**Blood Pressure**
Explain the possible consequences of having high blood pressure: **- burst blood vessels, which can cause** **- damage to brain** **- stroke** **- kidney damage.**	**Blood Pressure**
Explain the possible consequences of having low blood pressure: **- dizziness** **- fainting** **- poor circulation.**	**Blood Pressure**
Explain the difference between fitness (ability to do physical activity) and health (free from disease).	**Diet, Exercise and Health**
Analyse the results of different ways of measuring fitness (strength, stamina, flexibility, agility, speed, as well as cardiovascular efficiency).	**Diet, Exercise and Health**
Evaluate different ways of measuring fitness.	**Diet, Exercise and Health**
Recognise that the risk of developing heart disease can be increased by a number of factors, to include: *- high blood pressure* *- smoking* *- eating high levels of salt* *- eating high levels of saturated fat.*	**Heart Disease**
Describe how cholesterol can restrict or block blood flow in arteries by forming plaques.	**Heart Disease**
Analyse data that show the changing incidence of heart disease in the UK.	**Heart Disease**
Explain how smoking increases blood pressure: - carbon monoxide reduces the oxygen-carrying capacity of the blood so heart rate increases to compensate - nicotine increases heart rate.	**Blood Pressure**
Explain how diet can increase the risk of heart disease because of: - saturated fats which can lead to a build up of cholesterol (a plaque) in arteries - high levels of salt which can elevate blood pressure.	**Heart Disease**
Interpret data showing possible links between the amount of saturated fat eaten, the build up of cholesterol plaques and the incidence of heart disease	**Heart Disease** **Blood Pressure**
Explain why carbon monoxide reduces the carrying capacity of red blood cells, using the idea that it combines with the haemoglobin preventing the oxygen transport.	**Blood Pressure** **Alcohol and Tobacco**
Explain how narrowed coronary arteries, together with a thrombosis, increase the risk of a heart attack.	**Heart Disease / Blood Pressure**

B1b: Human health and diet	
Explain why a balanced diet should include: *- protein (for growth and repair)* *- carbohydrates and fats (as high energy sources)* *- minerals (limited to iron to make haemoglobin)* *- vitamins (limited to vitamin C to prevent scurvy)* *- fibre (to prevent constipation)* *- water (to prevent dehydration).*	**Nutrients** **Diet, Exercise and Health**
Recall that: - carbohydrates are made up of simple sugars such as glucose - fats are made up of fatty acids and glycerol - proteins are made up of amino acids.	**Nutrients**
Explain how a balanced diet will vary depending on the age, gender, activity, religion, personal choice (to include vegetarians, vegans) and medical issues (to include food allergies).	**Diet, Exercise and Health**
Describe the storage of biological molecules, to include: **- carbohydrates are stored in the liver as glycogen or converted to fats** **- fats are stored under the skin and around organs as adipose tissue** **- proteins are not stored.**	**Nutrients**
Interpret simple data on diet.	**Diet, Exercise and Health**
Explain why: *- a high protein diet is necessary for growing teenagers* *- in many parts of the world diets are deficient in protein*	**Nutrients**
Recall that proteins are only used as an energy source in a shortage.	**Nutrients**
Recall that being very overweight (obese) is linked to increased health risks to include arthritis, heart disease, diabetes, breast cancer.	**Diet, Exercise and Health**
Explain why protein deficiency (kwashiorkor) is common in developing countries, limited to: - overpopulation - limited investment in agricultural techniques.	**Nutrients**
Calculate the estimated average daily requirement (EAR) for protein using the formula EAR in g = 0.6 × body mass in kg	**Nutrients**
Calculate the Body Mass Index given the formula: BMI = mass in kg/(height in m)^2 and use it as a guide to understand the terms underweight, normal, overweight, obese. Explain how low self-esteem, poor self-image and desire for perfection can lead to a poor diet and the increased risks involved.	**Diet, Exercise and Health**
Describe the differences between first and second class proteins: **- proteins of animal origin are called 'first class proteins' because they contain all essential amino acids (these cannot be made by the body)** **- plant proteins are called 'second class proteins'.**	**Nutrients**
Understand that the EAR is an estimated daily figure for an average person of a certain body mass.	**Nutrients**
Explain why the EAR for protein may vary depending on age, pregnancy and lactation.	**Nutrients**

B1c: Staying healthy	
Recall that infectious diseases are caused by pathogens (disease-causing microorganisms): *- fungi* *- bacteria* *- viruses* *- protozoa.*	**Causes of disease**
Recall one example of a disease caused by each type of pathogen limited to athlete's foot (fungus), flu (virus), cholera (bacteria) and malaria (protozoa).	**Causes of disease**
Recall the meaning of the terms parasite and host with reference to malaria.	**Causes of disease**
Describe how vectors spread disease: - limited to mosquito.	**Causes of disease**
Explain how knowledge of the way in which vectors spread disease can help control infections: **- limited to mosquito.**	**Causes of disease**
Describe how the human body is defended against pathogens: *- skin provides a barrier* *- blood clotting prevents entry of pathogens* *- pathogens are trapped by mucus in airways* *- hydrochloric acid in the stomach kills pathogens.*	**The Body's Defenses**
Describe the difference between infectious and noninfectious diseases.	**Causes of disease**
Understand that some disorders have other causes, to include genetic causes.	**Causes of disease**
Describe changes in lifestyle and diet which may reduce the risk of some cancers.	**Causes of disease**
Describe the difference between benign and malignant tumours.	**Causes of disease**
Interpret data on types of cancer and survival/mortality rates.	**Causes of disease**
Recall that Immunization (vaccination) gives protection from certain pathogens.	**Immunization**
Describe how pathogens that enter the body are destroyed by the immune system (white blood cells): *- engulfed by white blood cells* *- destroyed by antibodies.*	**The Body's Defenses**
Interpret data on the incidence of disease around the world to show links with climate and socio-economic factors.	**Causes of disease**
Explain how pathogens cause the symptoms of an infectious disease by cell damage or by production of toxins.	**The Body's Defenses**
Recall that antibodies lock on to antigens leading to the death of the pathogens.	**The Body's Defenses**
Explain the difference between passive (receive antibodies) and active immunity (make own antibodies).	**The Body's Defenses**
Recall the difference between antibiotics and antiviral drugs.	**Combatting Infection**
Explain how each pathogen has its own antigens so specific antibodies are needed.	**The Body's Defenses**
Explain the process of Immunization (vaccination): **- harmless pathogen given which carries antigens** **- antigens trigger immune response by white blood cells which produce antibodies** **- immunity remains (memory cells produced).**	**Immunization**
Describe the benefits and risks (possible side effects) associated with Immunization.	**Immunization**
Explain the need for careful use of antibiotics to prevent the increase of strains such as MRSA.	**Combatting Infection**
Explain why new medical treatments/drugs are tested before use: *- to see if they are safe* *- to see if they work.*	**Drug Development**
Describe how new treatments are tested using animals, human tissue, computer models and understand objections to some forms of testing.	**Drug Development**
Explain why blind and double blind trials are used in testing new drugs against placebos or the best existing treatment.	**Drug Development**

B1d: The nervous system	
Describe the body's sense organs (receptors) and the information they gather, limited to: *- skin – pressure, temperature and pain (touch)* *- tongue – chemicals in food (taste)* *- nose – chemicals in air (smell)* *- eyes – light (sight)* *- ears – sound (hearing) and balance.*	**The Nervous System**
Name and locate the main parts of the eye: cornea, iris, pupil, lens, retina, optic nerve, blind spot.	**The Eye and Seeing**
Describe the functions of the main parts of the eye: - cornea - refracts light - iris - controls how much light enters pupil - lens - focuses light on to retina - retina - contains light receptors - optic nerve - carries impulses to the brain.	**The Eye and Seeing**
Describe the pathway of light through the eyeball, being refracted by the cornea and lens.	**The Eye and Seeing**
Explain how the eye focuses light (accommodation) from distant objects: **- ciliary muscle relaxes** **- suspensory ligaments tighten** **- lens pulled into a less rounded shape.**	**The Eye and Seeing**
Explain how the eye focuses light (accommodation) from close objects: **- ciliary muscle contracts** **- suspensory ligaments slacken** **- the lens' elasticity makes it a more rounded shape.**	**The Eye and Seeing**
Describe the difference between monocular (seeing objects with one eye) and binocular vision (seeing objects with both eyes).	**The Eye and Seeing**
Explain the advantages and disadvantages of: - monocular vision: wider field of view but poorer judgement of distance - binocular vision: narrower field of view but better judgement of distance.	**The Eye and Seeing**
Explain how binocular vision helps to judge distances by comparing the images from each eye – the more similar the images, the further away the object.	**The Eye and Seeing**
Describe the main problems in vision limited to longsight, short-sight and red-green colour blindness.	**The Eye and Seeing**
Explain how long and short-sight is caused by the eyeball or the lens being the wrong shape.	**The Eye and Seeing**
Recall that red-green colour blindness is the result of a lack of specialised cells in the retina.	**The Eye and Seeing**
Explain how long and short-sight can be corrected by corneal surgery or by different lenses in glasses or contact lenses: convex lenses for long sight and concave lenses for short sight.	**The Eye and Seeing**
Name and locate the main parts of the nervous system, to include: *- the central nervous system (CNS) (brain and spinal cord)* *- the peripheral nervous system.*	**The Nervous System**
Describe the nerve impulse as an electrical signal that is carried by nerve cells called neurones.	**The Nervous System**
Describe reflex actions as fast, automatic and protective responses.	**Reflex Reactions**
Recognise that voluntary responses are under the conscious control of the brain.	**The Nervous System**
Name and locate the parts of a motor neurone: cell body, axon, sheath.	**The Nervous System**
Recall that the nerve impulse passes along the axon of a neurone.	**The Nervous System**
Describe a reflex arc: stimulus → receptor →sensory neurone → central nervous system → motor neurone → effector → response.	**Reflex Reactions**
Describe the path taken by a spinal reflex involving a receptor, sensory neurone, relay neurone, motor neurone and effector.	**Reflex Reactions**
Explain how neurones are adapted to their function by their length, insulating sheath and branched endings (dendrites).	**The Nervous System**
Recall that the gap between neurones is called a synapse.	**The Nervous System**
Describe how an impulse triggers the release of a transmitter substance in a synapse and how it diffuses across to bind with receptor molecules in the membrane of the next neurone causing the impulse to continue.	**The Nervous System**

B1e: Drugs and you	
Recognise that drugs can be beneficial or harmful.	**Drug Development**
Explain why some drugs are only available on prescription: misuse could cause harm.	**Drug Development**
Explain the terms: addiction, withdrawal symptoms, tolerance and rehabilitation.	**Drug Misuse and Addiction**
Explain the basis of the legal classification of drugs: - class A being the most dangerous with the heaviest penalties - class C being the least dangerous with the lightest penalties.	**Drug Misuse and Addiction**
Describe the general effects of each drug category: *- depressants: slow down brain's activity* *- pain killers: block nerve impulses* *- stimulants: increase brain's activity* *- performance enhancers: muscle development* *- hallucinogens: distort what is seen and heard.*	**Drug Misuse and Addiction**
Recall examples of drugs: - depressants limited to alcohol, solvents and temazepam - pain killers limited to aspirin and paracetamol - stimulants limited to nicotine, ecstasy and caffeine - performance enhancers limited to anabolic steroids - hallucinogens limited to LSD.	**Drug Misuse and Addiction**
Explain the action of depressants and stimulants on the synapses of the nervous system: **- depressants bind with receptor molecules in the membrane of the next neurone blocking the transmission of the impulses** **- stimulants cause more neurotransmitter to cross the synapse.**	**Drug Misuse and Addiction**
Recall that tobacco smoking can cause emphysema, bronchitis, cancer (mouth, throat, oesophagus, lung and throat) and heart disease.	**Tobacco and Alcohol**
Describe the effects of: *- carbon monoxide (lack of oxygen, heart disease)* *- nicotine (addictive)* *- tars (irritant, carcinogenic)* *- particulates (accumulation in lung tissue).*	**Tobacco and Alcohol**
Describe how cigarette smoke affects ciliated epithelial cells lining the trachea, bronchi and bronchioles.	**Tobacco and Alcohol**
Explain why damage to ciliated epithelial cells can lead to a 'smokers cough'.	**Tobacco and Alcohol**
Interpret data on the effects of smoking (to include cancer, heart disease, emphysema and birth weights of bbies born to mothers who smoke).	**Tobacco and Alcohol**
Recognise the short term and long term effects of alcohol on the body: *- short term (impaired judgment, balance and muscle control, blurred vision, slurred speech, drowsiness, increased blood flow to skin)* *- long term effects (liver and brain damage).*	**Tobacco and Alcohol**
Explain why there is a legal limit for the level of alcohol in the blood/breath for drivers and pilots.	**Tobacco and Alcohol**
Describe how the liver can become damaged as it removes toxic alcohol (cirrhosis).	**Tobacco and Alcohol**
Interpret data on the alcohol content (measured in units of alcohol) of different alcoholic drinks.	**Tobacco and Alcohol**
Interpret information on reaction times, accident statistics and alcohol levels.	**Tobacco and Alcohol**

B1f: Staying in balance	
Recognise that the body works to maintain steady levels of temperature, water, and carbon dioxide and that this is essential to life.	**Homeostasis**
Understand that maintaining a constant internal environment involves balancing bodily inputs and outputs and is called homeostasis.	**Homeostasis**
Explain why factors are kept at steady levels by automatic control systems (limited to temperature, water content and carbon dioxide).	**Homeostasis**
Explain how negative feedback mechanisms are used to maintain a constant internal environment.	**Controlling Water Content**
Recall that the core temperature of the human body is normally maintained at approximately 37°C.	**Homeostasis**
Describe appropriate procedures to measure body temperature: *- where (ear, finger, mouth, anus)* *- how (clinical thermometer, sensitive strips, digital recording probes, thermal imaging).*	**Homeostasis**
Describe how heat can be gained or retained (respiration, shivering, exercise, less sweating, less blood flow near skin surface, clothing).	**Homeostasis**
Describe how heat can be lost (by sweating, more blood flow near skin).	**Homeostasis**
Explain how sweating increases heat transfer to the environment by evaporation of sweat which requires heat and removing heat from the skin.	**Homeostasis**
Describe how high temperatures can cause heat stroke and dehydration and if untreated, death.	**Homeostasis**
Describe how very low temperatures can cause hypothermia and if untreated, death.	**Homeostasis**
Explain how vasodilation and vasoconstriction increase or reduce heat transfer to the environment.	**Homeostasis**
Understand that the body temperature of 37°C is linked to enzyme action.	**Homeostasis**
Explain that blood temperature is monitored by the brain which will bring about temperature control mechanisms.	**Homeostasis**
Name and locate the pancreas.	**Controlling Blood Sugar**
Recall that the pancreas produces the hormone insulin.	**Controlling Blood Sugar**
Recall that Type 1 diabetes is caused by the failure of the pancreas to produce insulin.	**Controlling Blood Sugar**
Describe how insulin travels around the body.	**Controlling Blood Sugar**
Recall that insulin controls blood sugar levels.	**Controlling Blood Sugar**
Explain how Type 2 diabetes can often be controlled by diet but that Type 1 diabetes also needs to be treated by insulin dosage.	**Controlling Blood Sugar**
Explain why responses controlled by hormones are usually slower than responses controlled by the nervous system.	**Controlling Water Content** / **Hormones and Fertility**
Explain how insulin helps to regulate blood sugar levels by converting excess blood glucose to glycogen in the liver.	**Controlling Blood Sugar**
Explain how the dosage of insulin needed to be taken by a person with Type 1 diabetes depends upon diet and activity.	**Controlling Blood Sugar**

B1g: Controlling plant growth	
Recognise that plants as well as animals respond to changes in their environment.	**Plant Hormones**
Understand that plant growth (limited to growth of shoots and roots, flowering, fruit ripening) is controlled by chemicals called plant hormones.	**Plant Hormones**
Describe an experiment to show that shoots grow towards light.	**Plant Hormones**
Understand how growth towards light increases the plant's chance of survival.	**Plant Hormones**
Understand that roots grow downwards in response to gravity.	**Plant Hormones**
Describe shoots as positively phototropic but negatively geotropic.	**Plant Hormones**
Describe roots as negatively phototropic but positively geotropic.	**Plant Hormones**
Recall that the group of plant hormones called auxins: - move through the plant in solution - are involved in the response to light (phototropism) - are involved in the response to gravity (geotropism).	**Plant Hormones**
Interpret data from phototropism experiments in terms of auxin action: **- auxin made in tip** **- unequally distributed in response to light.**	**Plant Hormones**

Explain how auxin brings about shoot curvature in terms of cell elongation.	**Plant Hormones**
Recognise that plant hormones can be used in agriculture to speed up or slow down plant growth.	**Plant Hormones**
Relate the action of plant hormones to their commercial uses: - selective weedkillers - rooting powder - fruit ripening (delay or acceleration) - control of dormancy.	**Plant Hormones**

B1h: Variation and inheritance

Analyse human characteristics to determine those that are a result of both environmental and inherited factors, to include: *- intelligence* *- body mass* *- height.*	**Similarity and Variation**
Recall that chromosomes are held in the nucleus and they carry information in the form of genes which control inherited characteristics.	**Similarity and Variation**
Recognise that most body cells contain chromosomes in matching pairs.	**Inheritance**
Recall that gametes have half the number of chromosomes of body cells.	**Inheritance**
Identify inherited characteristics as dominant or recessive when given the results of a breeding experiment.	**Inheritance**
Describe how sex (in mammals) is determined by sex chromosomes: XX (female) and XY (male).	**Inheritance**
Explain the causes of genetic variation, to include: - mutations (changes to the genes) - gamete formation - fertilisation.	**Similarity and Variation / Evolution**
Recall that most body cells have the same number of chromosomes but this number varies between species (humans have 23 pairs).	**Inheritance**
Recall that alleles are different versions of the same gene.	**Inheritance**
Recognise that there is a debate over the relative importance of genetic and environmental factors in determining some human attributes: intelligence, sporting ability, health.	**Similarity and Variation**
Explain how dominant and recessive characteristics depend on dominant and recessive alleles: **- dominant alleles are those expressed if present** **- recessive alleles are those only expressed if the dominant allele is absent.**	**Inheritance**
Explain a monohybrid cross involving dominant and recessive alleles: genetic diagrams using letters to represent alleles.	**Inheritance**
Use and explain genetic terms: **- homozygous – two identical alleles** **- heterozygous- two different alleles** **- genotype – the genetic makeup** **- phenotype – the characteristics expressed.**	**Inheritance**
Explain sex inheritance using genetic diagrams: production of equal numbers of male and female offspring.	**Inheritance**
Recognise that some disorders are inherited: redgreen colour blindness, sickle cell anaemia, cystic fibrosis.	**Inherited Diseases**
Understand that inherited disorders are caused by faulty genes.	**Inherited Diseases**
Recall that inherited disorders are caused by faulty alleles, most of which are recessive.	**Inherited Diseases**
Use genetic diagrams to predict the probabilities of inherited disorders passing to the next generation.	**Inherited Diseases**
Understand the issues raised by knowledge of inherited disorders in a family.	**Inherited Diseases**

Module B2: Understanding Our Environment

B2a: Classification

Understand that organisms can be classified into groups according to shared characteristics.	**Classifying Organisms**
Describe the characteristics used to place organisms into the five Kingdoms *- plants –cellulose cell wall, use light energy to produce food* *- animals – multicellular, feed on other organisms* *- fungi – cell wall of chitin, produce spores* *- protoctista – mostly singled celled organisms* *- prokaryotes – no nucleus*	**Classifying Organisms**
Understand that the variety of life is a continuous spectrum which makes it difficult to place organisms into distinct groups.	**Classifying Organisms**
Describe the classification of organisms into kingdom, phylum, class, order, family, genus and species.	**Classifying Organisms**
Explain the problems of classifying newly discovered organisms..	**Classifying Organisms**
Understand that classification systems can be natural (based on evolutionary relationships) or artificial (for purposes of identification).	
Explain how use of genetic information has led to changes in understanding of classification.	**Classifying Organisms**
Appreciate that systems of classification change over time.	**Classifying Organisms**
Use characteristics to place organisms into the different classes of arthropods, limited to: *- insects* *- arachnids* *- crustaceans* *- myriapods*	
Explain the problems of classification in organisms such as Archaeopteryx (bird and reptile characteristics).	**Classifying Organisms**
Recognise that organisms of the same species: *- may show great variation* *- have more features in common than they do with organisms of a different species.*	**Classifying Organisms** **Evolution**
Define the term 'species' as a group of organisms which are capable of interbreeding to produce fertile offspring.	**Classifying Organisms**
Use the binomial system as a basis for naming species.	**Classifying Organisms**
Explain some of the problems of classifying organisms into species, to include: **- hybrids such as mules** **- organisms such as bacteria that only reproduce asexually** **- evolution as a continuing process.**	**Classifying Organisms**
Understand why similar species tend to live in similar types of habitats.	**Classifying Organisms**
Recall that closely related species: - share a relatively recent ancestor. - may have different features if they live in different types of habitats.	**Classifying Organisms**
Explain how similarities and differences between species can be explained in terms of both evolutionary relationships and ecological relationships.	**Classifying Organisms**
Explain why dolphins and whales are classified as mammals but appear similar to fishes such as sharks.	**Classifying Organisms**

B2b: Energy flow	
Explain the term trophic level.	
Understand that there are organisms other than green plants that are producers.	**Energy Transfers in Food Chains**
Explain why some organisms are both primary and secondary consumers.	**Energy Transfers in Food Chains**
Explain how changes in the population of one organism may affect the other organisms in a food web.	**Environmental Change and its Effects**
Understand how pyramids of numbers show the dry mass of living material at each stage of a food chain.	**Energy Transfers in Food Chains**
Construct pyramids of biomass from given information.	**Energy Transfers in Food Chains**
Explain why pyramids of numbers and pyramids of biomass for the same food chains can be different shapes.	**Energy Transfers in Food Chains**
Explain the difficulties in constructing pyramids limited to: **- organisms may belong to more than one different trophic level** **- the problems with measuring dry biomass.**	**Energy Transfers in Food Chains**
Explain how energy from the Sun flows through food webs.	**Energy Transfers in Food Chains**
Interpret data on energy flow in food webs.	**Energy Transfers in Food Chains**
Explain how some energy is transferred to less useful forms at each stage (trophic level) in the food chain, to include: - heat from respiration - excretion - egestion.	**Energy Transfers in Food Chains**
Explain how the efficiency of energy transfer explains the shape of pyramids of biomass.	**Energy Transfers in Food Chains**
Explain how the efficiency of energy transfer explains the limited length of food chains.	**Energy Transfers in Food Chains**
Calculate the efficiency of energy transfer.	**Energy Transfers in Food Chains**
Describe how excretory products, faeces and uneaten parts can be used as the starting point for other food chains.	**Energy Transfers in Food Chains / Decay**

B2c: Recycling	
Recall that when animals and plants die and decay the elements in their bodies are recycled.	**Decay**
Recognise that many soil bacteria and fungi are decomposers, decaying dead organisms.	**Decay**
Describe the importance of this decay process in making elements available again to living organisms.	**Decay**
Recognise that as animals and plants grow they take in chemicals and incorporate elements from these into their bodies.	**Decay**
Recall that two of the most important elements that are required are: *- carbon* *- nitrogen.*	**Decay**
Recall that carbon is taken up by plants as carbon dioxide.	**Decay**
Explain why recycling of nutrients takes longer in waterlogged or acidic soils than it does in well drained neutral soils.	
Explain how carbon is recycled in nature, limited to: - plants removing carbon dioxide from the air by photosynthesis - feeding passes carbon compounds along a food chain or web - plants and animals releasing carbon dioxide into the air, as a product of respiration - burning of fossil fuels (combustion) releasing carbon dioxide - soil bacteria and fungi, acting as decomposers, releasing carbon dioxide into the air.	**The Carbon Cycle**
Explain how carbon is recycled in nature, limited to: **- marine organism making shells made of carbonates** **- shells becoming limestone** **- carbon returning to the air as carbon dioxide during volcanic eruption or weathering** **- oceans absorbing carbon dioxide, acting ascarbon sinks.**	**The Carbon Cycle**

Recall that nitrogen is taken up by plants as nitrates.	**The Nitrogen Cycle**
Recall the abundance of nitrogen in the air (78%).	**The Nitrogen Cycle**
Explain why nitrogen gas can't be used directly by animals or plants, in terms of its reactivity.	**The Nitrogen Cycle**
Explain how nitrogen is recycled in nature, limited to: - plants taking in nitrates from the soil to make protein for growth - feeding passes nitrogen compounds along a food chain or web - nitrogen compounds in dead plants and animals being broken down by decomposers and returning to the soil.	**The Nitrogen Cycle**
Explain how nitrogen is recycled in nature, limited to: **- soil bacteria and fungi, acting as decomposers, converting proteins and urea into ammonia** **- the conversion of this ammonia to nitrates by nitrifying bacteria** **- the conversion of nitrates to nitrogen gas by denitrifying bacteria** **- the fixing of nitrogen gas by nitrogen-fixing bacteria living in root nodules or in the soil or by the action of lightning.**	**The Nitrogen Cycle**

B2d: Interdependence

Explain how competition may influence the distribution and population size of animals or plants, related to the availability of food, water, shelter, light and minerals.	**Competition** **Interdependence**
Interpret data which shows that animals and plants can be affected by competition for resources, including population sizes and distribution data.	**Competition** **Interdependence**
Explain how similar animals in the same habitat will be in close competition.	**Competition**
Describe how organisms within a species compete in order to survive and breed.	**Competition**
Use the terms interspecific and intraspecifc to describe given examples of competition and explain why intraspecific competition is often more significant.	**Competition**
Explain what is meant by the term ecological niche.	**Competition**
Explain that similar organisms will occupy similar ecological niches.	**Competition**
Explain how the size of a predator population will affect the numbers of prey and vice versa.	**Interdependence**
Explain how the populations of some predators and their prey show cyclical fluctuations in numbers.	**Interdependence**
Explain why the cycles populations for predator and prey are out of phase with each other.	**Interdependence**
Recall that some organisms benefit from the presence of organisms of a different species.	**Interdependence**
Describe one example of such a relationship limited to cleaner species, to include oxpecker and buffalo.	**Interdependence**
Describe other types of interdependence between organisms to include: - parasitism, where the parasite benefits to the living host's detriment, including fleas and tapeworms - mutualism, where both species benefit including cleaner species and pollination by insects.	**Interdependence**
Explain how the interdependence of organisms determines their distribution and abundance.	**Competition / Interdependence**
Explain why nitrogen-fixing bacteria in the root nodules of leguminous plants are an example of mutualism, due to: **- bacteria gaining sugars** **- plants gaining compounds containing nitrogen.**	**Interdependence**

B2e: Adaptations	
Explain how some animals are adapted to be successful predators, to include: *- binocular vision to judge size and distance* *- camouflage to avoid being seen by prey* *- sharp teeth and claws to catch hold of prey* *- built for speed to chase prey* *- stings or venoms to paralyse or poison prey.*	**Adaptation**
Explain how some animals are adapted to avoid being caught as prey, to include: *- eyes on side of head for wide field of view* *- camouflage to avoid being seen by predators* *- live in groups to reduce the chance of being caught* *- built for speed to outrun predators* *- defences such as stings or poison to deter predators eating them.*	**Adaptation**
Explain how adaptations to cold environments help organisms survive, to include: - methods of insulation - adaptations for coping with moving on snow - adaptations for coping with hunting in cold water	**Adaptation**
Explain how adaptations to hot environments help organisms survive to include: - methods of increasing heat loss - adaptations for coping with moving on sand	**Adaptation**
Explain how adaptations to dry environments help organisms survive to include: - adaptations for coping with lack of water	**Adaptation**
Explain how adaptations help organisms cope with environmental stresses such as changes in temperature and water availability, to include **- how surface area / volume ratios are linked to heat and water loss** **- behavioural responses to include migration, hibernation, 'sun basking' in reptiles** **- life cycles, to include synchronous breeding and giving birth to live young.**	**Adaptation**
Recall that animals and plants that are adapted to their habitats are better able to compete for limited resources.	**Adaptation**
Explain how animals and plants that are adapted to an environment are better able to compete for limited resources.	**Adaptation**
Describe how some organisms are: **- specialists, which are well suited to only certain habitats** **- generalists, which can live in a range of habitats but can easily be out-competed.**	**Adaptation**

B2f: Natural selection	
Identify variations within a population of organisms of the same species.	**Evolution**
Recognise that over long periods of time, groups of organisms can change and that this is called evolution.	**Evolution**
Understand how when environments change, some animal and plant species survive or evolve but many become extinct.	**Environmental Change and its Effects**
When provided with information, explain why a species is likely to survive or become extinct.	**Environmental Change and its Effects**
Explain why animals and plants that are better adapted to their environment are more likely to survive.	**Adaptation / Evolution**
Recognise that this is part of Charles Darwin's theory of natural selection.	**Evolution**
Explain that adaptations are controlled by genes and that these genes can be passed on to the next generation.	**Evolution**
Explain examples of change by natural selection occurring today, to include: - the frequency of dark or pale forms of the peppered moth in areas with different levels of pollution - bacteria becoming resistant to antibiotics - rats that are resistant to the rat poison warfarin.	**Evolution**

Use Darwin's theory of natural selection to explain how a species evolved or why a species became extinct. **To include ideas about:** **- presence of natural variation** **- competition for limited resources** **- 'survival of the fittest'** **- inheritance of 'successful' adaptations** **- extinction of species unable to compete.**	**Evolution**
Explain how over long periods of time the changes brought about by natural selection may result in the formation of new species.	**Evolution**
Recall that: *- many theories have been put forward to explain how evolution may occur* *- most scientists accept the theory of natural selection first put forward by Charles Darwin.*	**Evolution**
Explain the reasons why the theory of evolution by natural selection met with an initially hostile response (social and historical context).	**Evolution**
Recognise that natural selection as a theory is now widely accepted: - because it explains a wide range of observations - has been discussed and tested by a wide range of scientists.	**Evolution**
Explain how Lamarck's idea of evolution by the inheritance of acquired characteristics was different from Darwin's theory.	**Evolution**
Explain why Lamarck's theory was discredited as acquired characteristics do not have a genetic basis.	**Evolution**
Recognise that the theory of natural selection has developed as new discoveries have been made, to include the understanding of inheritance.	**Evolution**

B2g: Population and pollution	
Recognise that the human population is increasing.	**Human Impact on the Environment**
Recognise that the human population uses resources, some of which are finite, to include: *- fossil fuels* *- minerals.*	**Human Impact on the Environment**
Explain that an increasing population will increase the use of resources.	**Human Impact on the Environment**
Explain how as the human population increases, there is a related increase in use of resources and therefore more pollution is created; pollutants, limited to: *- household waste* *- sewage* *- sulfur dioxide from burning fossil fuels* *- carbon dioxide from burning fossil fuels.*	**Human Impact on the Environment**
Understand that the human population is increasing exponentially.	**Human Impact on the Environment**
Understand that population growth is the result of increasing birth rate and decreasing death rate.	
Explain the causes and consequences of: - global warming from increasing levels of carbon dioxide - ozone depletion from CFCs in upper atmosphere - acid rain from sulfur dioxide.	**Human Impact on the Environment**
Explain how the developed countries of the world, with a small proportion of the world's population, have the greatest impact on the use of resources and the creation of pollution.	**Human Impact on the Environment**
Explain the term 'carbon footprint' in terms of the amount of greenhouse gases given off in a certain period of time.	**Human Impact on the Environment**
Discuss the possible consequences of exponential growth.	**Human Impact on the Environment**
Understand that pollution can affect the number and type of organisms that can survive in a particular place.	**Environmental Change and its Effects**
Explain how the presence/absence of indicator species helps to indicate the level of pollution, to include: - water pollution - waterlouse sludgeworm, rattailed maggot, mayfly larva - air pollution – lichen.	**Measuring Environmental Change**
Describe how pollution can be measured: - by direct measurement of pollutant levels - by measuring the occurrence of indicator species.	**Measuring Environmental Change**
Interpret data on indicator species.	**Measuring Environmental Change**
Describe the advantages and disadvantages of using living and non-living methods of measuring levels of pollution.	**Measuring Environmental Change**

B2h: Sustainability	
Explain why organisms become extinct or endangered, to include: *- climate change* *- habitat destruction* *- hunting* *- pollution* *- competition.*	**Environmental Change and its Effects**
Describe how endangered species can be helped, to include: *- protecting habitats* *- legal protection* *- education programmes* *- captive breeding programmes* *- seed banks* *- creating artificial ecosystems.*	**Environmental Change and its Effects**
Explain reasons for conservation programmes, to include: - protecting human food supply - ensuring minimal damage to food chains - future identification of plants for medical purposes - cultural aspects.	**Environmental Change and its Effects** / **Sustainability**
Explain why species are at risk of extinction if: **- the numbers of individuals fall below critical levels** **- there is not enough genetic variation in the population** **- populations are found in only one or two areas.**	
Evaluate a given example of a conservation programme in terms of: **- genetic variation of key species** **- viability of populations** **- available habitats** **- interaction between species**	**Sustainability**
Interpret data on different whale species which shows different distributions according to their feeding habitat.	**Whales**
Discuss the reasons why certain whale species are close to extinction.	**Whales**
Recognise that both living and dead whales have commercial value: tourism when alive; food, oil and cosmetics when dead.	**Whales**
Describe issues arising from keeping whales in captivity: entertainment, research, captive breeding programmes and lack of freedom.	**Whales**
Recognise that some aspects of whale biology are still not fully understood: communication, migration patterns and survival at extreme depths.	**Whales**
Describe issues concerning whaling, to include: getting international agreement, policing and enforcing such agreements and culling for research.	**Whales**
Recognise that a sustainable resource can be removed from the environment without it running out.	**Sustainability**
Recall that some resources can be maintained, limited to: *- fish stocks* *- woodland.*	**Sustainability**
Explain the term sustainable development as providing for the needs of an increasing population without harming the environment.	**Sustainability**
Explain how fish stocks and woodland can be sustained and developed using: - education - quotas on fishing - re-planting of woodland.	**Sustainability**
Explain the importance of population size, waste products, food and energy demands in the achievement of sustainable development.	**Sustainability**
Understand that sustainability requires planning and co-operation at local, national, and international levels.	**Sustainability**
Describe how sustainable development may protect endangered species.	**Sustainability**

OCR Gateway GCSE Science 2011

GCSE Science: Chemistry

C1: Carbon Chemistry	Boardworks presentation
C1: Fundamental Chemical Concepts	
Understand that in a chemical reaction reactants are changed into products.	Chemical Reactions
Recognise the reactants and products in a word equation.	Chemical Reactions
Construct word equations given the reactants and products.	Chemical Reactions
Construct word equations (not all reactants and products given).	Chemical Reactions
Recognise the reactants and the products in a symbol equation.	Chemical Reactions
Construct balanced symbol equations given the formulae (no brackets) of the reactants and products.	Chemical Reactions
Explain why a symbol equation is balanced.	Chemical Reactions
Construct balanced symbol equations given the formulae (some or all with brackets) of the reactants and products.	Chemical Reactions
Construct balanced symbol equations given the names of the reactants and products (limited to the learning outcomes in C1).	Chemical Reactions
Deduce the number of elements in a compound given its formula.	Chemical Reactions
Deduce the number of atoms in a formula with no brackets.	Chemical Reactions
Deduce the number of each different type of atom in a formula with no brackets.	Chemical Reactions
Deduce the number of atoms in a formula with brackets.	Chemical Reactions
Deduce the number of each type of different atom in a formula with brackets.	Chemical Reactions
Recall the formula of the following substances: - carbon dioxide and carbon monoxide - oxygen and water.	Chemical Reactions
Recall the formula of the following substances: **- sulfuric acid** **- sulfur dioxide** **- sodium hydrogencarbonate and sodium carbonate.**	Chemical Reactions
Recognise whether a substance is an element or a compound from its formula.	Chemical Reactions
Deduce the names of the different elements in a compound given its formula.	Chemical Reactions
Understand that a molecule is made up of more than one atom joined together.	Chemical Reactions
Understand that a molecular formula shows the numbers and types of atom in a molecule.	Chemical Reactions
Deduce the number of atoms in a displayed formula.	Chemical Reactions
Deduce the names of the different elements in a compound given its displayed formula.	Chemical Reactions
Deduce the number of each different type of atom in a displayed formula.	Chemical Reactions
Understand that a displayed formula shows both the atoms and the bonds in a molecule.	Chemical Reactions
Write the molecular formula of a compound given its displayed formula.	Chemical Reactions
Construct balanced equations using displayed formulae.	Chemical Reactions
Recognise whether a particle is an atom, molecule or ion given its formula.	Chemical Reactions
Understand that atoms contain smaller particles one of which is a negative electron.	Chemical Reactions / Introducing Atoms
Understand that positive ions are formed when electrons are lost from atoms.	Introducing Atoms
Understand that negative ions are formed when electrons are gained by atoms.	Introducing Atoms
Recall that two types of chemical holding atoms are: *- ionic bonds* *- covalent bonds.*	Introducing Atoms
Understand that an ionic bond is the attraction between a positive ion and a negative ion.	
Understand that a covalent bond is a shared pair of electrons.	
Explain how an ionic bond is formed.	
Explain how a covalent bond is formed.	
C1a: Making crude oil useful	
Recall that crude oil, coal and gas are fossil fuels.	Combustion
Describe non-renewable fuels as ones which take a very long time to make and are used up faster than they are formed.	Hydrocarbon Fuels
Explain why fossil fuels are finite resources and are non-renewable: - finite resources are no longer being made or being made extremely slowly - non-renewable resources are used up faster than they are formed.	Hydrocarbon Fuels
Describe crude oil as a mixture of many hydrocarbons.	Crude Oil

Discuss the problems associated with the finite nature of crude oil: **- all the readily extractable resources will be used up in the future** **- finding replacements** **- conflict between making petrochemicals and fuels.**	**Crude Oil**
Recognise that fractional distillation separates crude oil into useful products called fractions.	**Fractional Distillation**
Understand that fractional distillation works because of differences in boiling points.	**Fractional Distillation**
Recognise that LPG, petrol, diesel, paraffin, heating oil, fuel oils and bitumen are fractions obtained from crude oil.	**Fractional Distillation**
Recall that LPG contains propane and butane gases.	**Fractional Distillation**
Label a diagram of a crude oil fractional distillation column to show the main fractions and the temperature gradient.	**Fractional Distillation**
Describe how fractional distillation separates crude oil into fractions: - crude oil is heated - use of a fractionating column which has a temperature gradient (cold at the top and hot at the bottom) - fractions containing mixtures of hydrocarbons are obtained - fractions contain many substances with similar boiling points - fractions with low boiling points 'exit' from the top of the fractionating column - fractions with high boiling points 'exit' at the bottom of the fractionating column.	**Fractional Distillation**
Explain in terms of molecular size, intermolecular forces and boiling point why crude oil can be separated by fractional distillation.	**Fractional Distillation**
Understand that during boiling the intermolecular forces between molecules break but covalent bonds within the molecule do not.	**Fractional Distillation**
Describe some of the environmental problems involved in the exploitation of crude oil: *- oil slicks as a result of accidents* *- damage to wildlife and beaches.*	**Crude Oil**
Explain some of the potential environmental problems involved in the transportation of crude oil: - damage to birds' feathers causing death - use of detergents to clean up oil slicks and consequent damage to wildlife.	**Crude Oil**
Explain in simple terms the political problems associated with the exploitation of crude oil: **- UK dependent on oil and gas from politically unstable countries** **- future supply issues.**	**Crude Oil**
Label the laboratory apparatus used for cracking liquid paraffin.	**Cracking Hydrocarbons**
Describe cracking as a process that: *- needs a catalyst and a high temperature* *- converts large hydrocarbon molecules into smaller ones that are more useful* *- makes more petrol.*	**Cracking Hydrocarbons**
Describe cracking as a process that: - converts large alkane molecules into smaller alkane and alkene molecules - makes useful alkene molecules because they can be used to make polymers - interpret data about the supply and demand of crude oil fractions (no recall expected).	**Cracking Hydrocarbons**
Explain how cracking helps an oil refinery match its supply of useful products such as petrol with the demand for them.	**Cracking Hydrocarbons**
C1b: Using carbon fuels	
Interpret simple data about fuels in order to choose the best fuel for a particular purpose (no recall expected).	**Hydrocarbon Fuels**
List the factors about fuels in order to choose the best fuel for a particular purpose: *- energy value* *- availability* *- storage* *- cost* *- toxicity* *- pollution eg acid rain, greenhouse effect* *- ease of use.*	**Hydrocarbon Fuels**
Interpret data about fuels in order to choose the best fuel for a particular purpose (no recall expected).	**Hydrocarbon Fuels**
Suggest the key factors that need to be considered when choosing a fuel for a particular purpose.	**Hydrocarbon Fuels**
Evaluate the use (no recall expected) of different fuels.	**Hydrocarbon Fuels**

Explain why the amount of fossil fuels being burnt is increasing: **- increasing world population** **- growth of use in developing countries eg India and China.**	**Fossil Fuels and the Environment**
Recall that the combustion of a fuel releases useful heat energy.	**Combustion**
Understand that complete combustion needs a plentiful supply of oxygen (air).	**Combustion**
Understand that complete combustion of a hydrocarbon fuel makes only carbon dioxide and water.	**Combustion**
Construct word equations to show the complete combustion of a hydrocarbon fuel given the reactants and products.	**Combustion**
Describe an experiment to show that combustion of a hydrocarbon in a plentiful supply of air produces carbon dioxide and water.	**Combustion**
Construct word equations to show the complete combustion of a hydrocarbon fuel (not all reactants and products given).	**Combustion**
Construct the balanced symbol equation for the complete combustion of a simple hydrocarbon fuel given its molecular formula.	**Combustion**
Understand that incomplete combustion takes place when there is a shortage of oxygen (air).	**Incomplete Combustion**
Explain why a blue Bunsen flame releases more energy than a yellow flame.	**Incomplete Combustion**
Identify that a yellow flame produces lots of soot.	**Incomplete Combustion**
Understand that incomplete combustion of a hydrocarbon fuel makes carbon monoxide, carbon (soot) and water.	**Incomplete Combustion**
Recall that carbon monoxide is a poisonous gas.	**Incomplete Combustion**
Construct word equations to show the incomplete combustion of a hydrocarbon fuel given the reactants and products.	**Incomplete Combustion**
Explain the advantages of complete combustion over incomplete combustion of hydrocarbon fuels.	**Incomplete Combustion**
Construct word equations to show the incomplete combustion of a hydrocarbon fuel (not all reactants and products given).	**Incomplete Combustion**
Construct the balanced symbol equation for the incomplete combustion of a simple hydrocarbon fuel given its molecular formula and the product (carbon or carbon monoxide).	**Incomplete Combustion**
C1c: Clean air	
Recall that air contains oxygen, nitrogen, water vapour and carbon dioxide.	**Earth's Atmosphere**
Understand that oxygen, nitrogen and carbon dioxide levels in the present day atmosphere are approximately constant.	**Earth's Atmosphere**
Understand that photosynthesis decreases the level of carbon dioxide and increases the level of oxygen in the air.	**Evolution of the Atmosphere**
Understand that respiration and combustion increase the level of carbon dioxide and decrease the level of oxygen in the air.	**Evolution of the Atmosphere**
Recall the percentage composition by volume of clean air: - 21% oxygen - 78% nitrogen - 0.035% carbon dioxide.	**Earth's Atmosphere**
Describe a simple carbon cycle involving photosynthesis, respiration and combustion.	**Evolution of the Atmosphere**
Describe how the present day atmosphere evolved: - original atmosphere came from gases escaping from the interior of the Earth - photosynthesis by plants increased the percentage of oxygen until it reached today's level.	**Evolution of the Atmosphere**
Evaluate the effects of human influences on the composition of air, for example: **- deforestation** **- population.**	**Changing the Atmosphere**
Describe one possible theory for how the present day atmosphere evolved over millions of years (based on the composition of gases vented by present day volcanic activity): **- degassing of early volcanoes producing an atmosphere rich in water and carbon dioxide** **- condensing of water vapour to form oceans** **- dissolving of carbon dioxide in ocean waters** **- relative increase of nitrogen due to its lack of reactivity** **- development of photosynthetic organisms** **- increase in oxygen levels due to photosynthesis.**	**Evolution of the Atmosphere**
Relate the common pollutants found in air to the environmental problem the pollutant causes and/or to the source of the pollutant: *- carbon monoxide – a poisonous gas formed by the incomplete combustion of petrol or diesel in car engines* *- oxides of nitrogen – causes photochemical smog and acid rain and formed in the internal combustion engine* *- sulfur dioxide – causes acid rain that will kill plants, kill aquatic life, erode stonework and corrode metals and formed when sulfur impurities in fossil fuels burn..*	**Fossil Fuels and the Environment**
Interpret data about the effects of atmospheric pollutants.	**Changing the Atmosphere**
Explain why the high temperature inside an internal combustion engine allows nitrogen from the air to react with oxygen to make oxides of nitrogen.	**Fossil Fuels and the Environment**
Understand that a catalytic converter removes carbon monoxide from the exhaust gases of a car.	**Reducing Pollution**

Explain why it is important that atmospheric pollution is controlled.	**Fossil Fuels and the Environment**
Understand that a catalytic converter changes carbon monoxide into carbon dioxide.	**Reducing Pollution**
Describe the use of a catalytic converter in removing carbon monoxide from exhaust fumes by converting it to carbon dioxide: $2CO + 2NO \rightarrow N_2 + 2CO_2$	**Reducing Pollution**

C1d: Making polymers

Recall the two elements chemically combined in a hydrocarbon: *- carbon* *- hydrogen.*	**Crude Oil / Hydrocarbon Fuels**
Recognise a hydrocarbon from its molecular or displayed formula.	**Crude Oil**
Recall that a hydrocarbon is a compound formed between carbon atoms and hydrogen atoms only.	**Crude Oil / Hydrocarbon Fuels**
Explain why a compound is a hydrocarbon given its molecular or displayed formula.	**Crude Oil**
Describe a saturated compound as one which contains only single covalent bonds between carbon atoms.	**Crude Oil**
Describe an unsaturated compound as one which contains at least one double covalent bond between carbon atoms.	**Cracking Hydrocarbons**
Recognise that alkanes are hydrocarbons.	**Crude Oil**
Understand that alkanes are hydrocarbons which contain single covalent bonds only.	**Crude Oil**
Interpret information on displayed formulae of alkanes.	**Crude Oil**
Interpret information from the displayed formula of a saturated hydrocarbon.	**Crude Oil**
Recognise that alkenes are hydrocarbons.	**Cracking Hydrocarbons**
Understand that alkenes are hydrocarbons which contain a double covalent bond(s) between carbon atoms.	**Cracking Hydrocarbons**
Interpret information on displayed formulae of alkenes.	**Cracking Hydrocarbons**
Describe how the reaction with bromine can be used to test for an alkene: - bromine water is orange - bromine water is decolourised.	**Cracking Hydrocarbons**

Interpret information from the displayed formula of an unsaturated hydrocarbon.	**Cracking Hydrocarbons**
Explain the reaction between bromine and alkenes: **- addition reaction** **- formation of a colourless dibromo compound.**	**Cracking Hydrocarbons**
Deduce the name of an addition polymer given the name of the monomer and vice versa.	**Making Polymers**
Recognise the displayed formula for a polymer.	**Making Polymers**
Draw the displayed formula of an addition polymer given the displayed formula of its monomer.	**Making Polymers**
Draw the displayed formula of a monomer given the displayed formula of its addition polymer.	**Making Polymers**
Recall that large molecules, called polymers are made when many small molecules called monomers join together in a polymerisation reaction.	**Making Polymers**
Describe addition polymerisation as a process in which many alkene monomer molecules react together to give a polymer which requires high pressure and a catalyst.	**Making Polymers**
Explain that addition polymerisation involves the reaction of many unsaturated monomer molecules (alkenes) to form a saturated polymer.	**Making Polymers**

C1e: Designer polymers

Interpret simple information about properties of polymers (plastics) and their uses given appropriate information (no recall expected).	**Properties and Uses of Polymers**
Suggest the properties a polymer (plastic) should have in order to be used for a particular purpose.	**Properties and Uses of Polymers**
Explain why a polymer (plastic) is suitable for a particular use given the properties of the polymer.	**Properties and Uses of Polymers**
Understand that the atoms in plastics are held together by strong covalent bonds.	**Properties and Uses of Polymers**
Relate the properties of plastics to simple models of their structure: **- plastics that have weak intermolecular forces between polymer molecules have low melting points and can be stretched easily as the polymer molecules can slide over one another** **- plastics that have strong forces between the polymer molecules (covalent bonds or crosslinking bridges) have high melting points, cannot be stretched and are rigid.**	**Properties and Uses of Polymers**
Recall that nylon is used in clothing.	**Properties and Uses of Polymers**
Compare the properties of nylon and Gore-Tex®: - nylon is tough, lightweight, keeps water out, keeps UV light out but does not let water vapour through it which means that sweat condenses - Gore-Tex® has all of the properties of nylon but is also breathable.	**Properties and Uses of Polymers**
Explain why the discovery of Gore-Tex® type materials has been of great help to active outdoor people to cope with perspiration wetness.	**Properties and Uses of Polymers**
Explain why Gore-Tex® type materials are waterproof and yet breathable: **- nylon laminated with PTFE / polyurethane membrane** **- holes in PTFE are too small for water to pass through but are big enough for water vapour to pass through** **- PTFE laminate is too fragile on its own and so is combined with nylon.**	**Properties and Uses of Polymers**
Understand that many polymers are nonbiodegradable, so they will not decay or decompose by bacterial action.	**Polymers and the Environment**
Explain some of the problems of disposing of nonbiodegradable polymers: *- litter and difficult to dispose of.*	**Polymers and the Environment**
Recall some of the ways that waste polymers can be disposed of: *- use of land-fill sites* *- burning of waste polymers* *- recycling.*	**Polymers and the Environment**
Explain why chemists are developing new types of polymers: - polymers that dissolve - biodegradable polymers.	**Polymers and the Environment**
Explain some of the environmental and economic issues related to the use of polymers: - land-fill sites get filled quickly wasting valuable land - burning waste plastics makes toxic gases - disposal by burning or land-fill sites wastes a valuable resource - difficult to sort out different polymers so recycling is difficult.	**Polymers and the Environment**

C1f: Cooking and food additives

Recognise that a chemical change takes place if:
- there is a new substance made
- the process is irreversible
- an energy change takes place.

Cooking

Explain why cooking food is a chemical change:
- a new substance is formed
- the process cannot be reversed.

Cooking

Recall that protein molecules in eggs and meat change shape when eggs and meat are cooked and this is called denaturing.

Cooking

Explain why the texture of egg or meat changes when it is cooked:
- the shape of protein molecules permanently change.

Cooking

Explain why potato is easier to digest if it is cooked:
- cell walls rupture resulting in loss of rigid structure and a softer texture
- starch grains swell up and spread out.

Cooking

Relate types of food additive to their function:
- antioxidants stop foods from reacting with oxygen
- food colours give food an improved colour
- flavour enhancers improve the flavour of a food.
- emulsifiers help oil and water to mix and not separate.

Emulsions

Describe emulsifiers as molecules that have a water loving (hydrophilic) part and an oil or fat loving (hydrophobic) part.

Emulsions

Explain why an emulsifier helps to keep oil and water from separating:
- hydrophilic end bonds to water molecules
- hydrophobic end bonds with oil or fat molecules.

Emulsions

Explain how baking powder helps make cakes rise.

Cooking

Recall that the chemical test for carbon dioxide is that it turns lime water cloudy.

Cooking / Calcium Carbonate

Recall the word equation for the decomposition of sodium hydrogencarbonate (not all products given).
sodium hydrogencarbonate → sodium carbonate + carbon dioxide + water

Cooking

Construct the balanced symbol equation for the decomposition of sodium hydrogencarbonate (some or all formulae given)
2NaHCO3 → Na2CO3 + CO2 + H2O

Cooking

Construct the balanced symbol equation for the decomposition of sodium hydrogencarbonate (formulae not given)
2NaHCO3 → Na2CO3 + CO2 + H2O

Cooking

C1g: Smells

Understand that some cosmetics are synthetic and others are made from natural sources.
Recall that esters are perfumes that can be made synthetically.
Recall that alcohols react with acids to make an ester and water.
Describe how to carry out a simple experiment to make an ester.

Recall the necessary physical properties of perfumes:
- evaporates easily
- non-toxic
- does not react with water
- does not irritate the skin
- insoluble in water.

Explain why a perfume needs certain properties:
- easily evaporates so that the perfume particles can easily reach the nose
- non-toxic so it does not poison you
- does not react with water because otherwise the perfume would react with perspiration
- does not irritate the skin otherwise the perfume could not be put directly on the skin
- insoluble in water so it cannot be washed off easily.

Explain the volatility (ease of evaporation) of perfumes in terms of kinetic theory:
- in order to evaporate particles need sufficient energy to overcome the attraction to other molecules in the liquid
- only weak attraction exists between particles in the liquid perfume so easy to overcome this attraction.

Understand that nail-varnish remover dissolves nail varnish colours.
Understand the terms solvent, solute, solution, soluble and insoluble.

Recall that esters can be used as solvents.

Describe a solution as a mixture of solvent and solute that does not separate out.

Interpret information on the effectiveness of solvents (no recall expected).

Explain why water will not dissolve nail varnish colours:
- attraction between water molecules is stronger than attraction between water molecules and particles in nail varnish
- attraction between particles in nail varnish is stronger than attraction between water molecules and particles in nail varnish.

Recall that testing of cosmetics on animals is banned in the EU.

Explain why new cosmetic products need to be thoroughly tested before they are permitted to be used.

Explain why testing of cosmetics on animals has been banned in the EU.

Explain why people have different opinions about whether the testing of cosmetics on animals is ever justified.

C1h: Paints and pigments

Relate the ingredients of a paint to their function:
- solvent thins the paint and makes it easier to spread
- binding medium sticks the pigment in the paint to the surface
- pigment is the substance that gives the paint its colour.

Recall that oil paints:
- have the pigment dispersed in an oil
- and often a solvent that dissolves oil.

Describe paint as a colloid where the particles are mixed and dispersed with particles of a liquid but are not dissolved.

Explain why the components of a colloid will not separate.

Recall that paints are used to decorate or protect surfaces.

Describe how many paints dry
- paints are applied as a thin layer
- the solvent evaporates.

Describe emulsion paints as water based paints that dry when the solvent evaporates.

Explain how oil paints dry:
- the solvent evaporates
- the oil is oxidised by atmospheric oxygen.

Recall that thermochromic pigments change colour when heated or cooled.

Recall uses of thermochromic pigments.

Explain why thermochromic pigments are suited to a given use.

Explain how acrylic paints can be added to thermochromic pigments to make even more colour changes.

Recall that phosphorescent pigments can glow in the dark.

Explain why phosphorescent pigments glow in the dark
- they absorb and store energy
- then release it as light over a period of time.

Recall that phosphorescent pigments are much safer than the alternative radioactive substances eg in use of ‘glow in the dark’ watches.

C2: Chemical Resources

C2: Fundamental Chemical Concepts	
Understand that in a chemical reaction reactants are changed into products.	Chemical Reactions
Recognise the reactants and products in a word equation.	Chemical Reactions
Construct word equations given the reactants and products.	Chemical Reactions
Construct word equations (not all reactants and products given)	Chemical Reactions
Recognise the reactants and the products in a symbol equation.	Chemical Reactions
Construct balanced symbol equations given the formulae (no brackets) of the reactants and products.	Chemical Reactions
Explain why a symbol equation is balanced.	Chemical Reactions
Construct balanced symbol equations given the formulae (some or all with brackets) of the reactants and products.	Chemical Reactions
Construct balanced symbol equations given the names of the reactants and products (limited to the learning outcomes in C2).	Chemical Reactions
Deduce the number of elements in a compound given its formula.	Chemical Reactions
Deduce the number of atoms in a formula with no brackets.	Chemical Reactions
Deduce the number of each different type of atom in a formula with no brackets.	Chemical Reactions
Deduce the number of atoms in a formula with brackets.	Chemical Reactions
Deduce the number of each type of different atom in a formula with brackets.	Chemical Reactions
Recall the formula of the following substances: - calcium carbonate and calcium oxide - carbon dioxide, hydrogen and water - sodium chloride and potassium chloride - ammonia and nitrogen - hydrochloric acid.	Chemical Reactions
Recall the formula of the following substances: **- nitric acid and sulfuric acid** **- copper oxide, sodium hydroxide, potassium hydroxide and sodium carbonate** **- potassium sulfate, sodium sulfate and ammonium sulfate** **- calcium chloride, magnesium chloride magnesium sulfate and copper(II) sulfate.**	Chemical Reactions
Recognise whether a substance is an element or a compound from its formula.	Chemical Reactions
Deduce the names of the different elements in a compound given its formula.	Chemical Reactions
Understand that a displayed formula shows both the atoms and the bonds in a molecule.	Chemical Reactions
Write the molecular formula of a compound given its displayed formula.	Chemical Reactions
Construct balanced equations using displayed formulae.	Chemical Reactions
Recognise whether a particle is an atom, molecule or ion given its formula.	Chemical Reactions
Understand that atoms contain smaller particles one of which is a negative electron.	Chemical Reactions / Introducing Atoms
Understand that positive ions are formed when electrons are lost from atoms.	Introducing Atoms
Understand that negative ions are formed when electrons are gained by atoms.	Introducing Atoms
Recall that two types of chemical bond holding atoms are: *- ionic bonds* *- covalent bonds.*	Introducing Atoms
Understand that an ionic bond is the attraction between a positive ion and a negative ion.	
Understand that a covalent bond is a shared pair of electrons.	
Explain how an ionic bond is formed.	
Explain how a covalent bond is formed.	

C2a: The structure of the Earth	
Describe the structure of the Earth as a sphere with a thin rocky crust, mantle and and an core.	Plate Tectonics
Understand that the movement of tectonic plates: *- results in volcanic activity and earthquakes* *- is very slow (about 2.5cm per year) took millions of years to result in the movement of continents to their present arrangement.*	Volcanoes and Earthquakes
Recognise that: *- many theories have been put forward to explain the nature of the Earth's surface* *- Earth scientists accept the theory of plate tectonics.*	Volcanoes and Earthquakes
Describe the lithosphere as the (relatively) cold rigid outer part of the Earth that includes the crust and part of the mantle.	Plate Tectonics
Describe the lithosphere as made of tectonic plates that are less dense than the mantle below.	Plate Tectonics
Explain the problems associated with studying the structure of the Earth: - crust is too thick to drill through - the need to use seismic waves produced by earthquakes or man-made explosions.	Volcanoes and Earthquakes
Explain why the theory of plate tectonics is now widely accepted: - it explains a wide range of evidence - it has been discussed and tested by a wide range of scientists.	Plate Tectonics
Describe the mantle as the zone between the crust and the core which is: **- cold and rigid just below the crust** **- hot and non-rigid at greater depths and therefore able to move.**	Volcanoes and Earthquakes
Describe the theory of plate tectonics: **- energy transfer involving convection currents inthe semi-rigid mantle causing the plates to move slowly** **- oceanic crust more dense than continental crust** **- collision between oceanic plate and continental plate leads to subduction and partial melting** **- plates cooler at ocean margins so sink and pull plates down.**	Plate Tectonics
Describe in simple terms the development of the theory of plate tectonics: **- Wegener's continental drift theory (1914)** **- continental drift theory not accepted by scientists at the time** **- new evidence in 1960s – sea floor spreading** **- theory of plate tectonics slowly accepted by the scientific community as subsequent research has supported the theory.**	Plate Tectonics
Explain how the size of crystals in an igneous rock is related to the rate of cooling of molten rock.	Igneous Rock Formation
Describe magma as molten rock beneath the surface of the Earth and lava as molten rock at the Earth's surface:	Volcanoes and Earthquakes
Understand that some volcanoes erupt runny lava, while some erupt thick lava violently and catastrophically.	Volcanoes and Earthquakes
Understand that the type of volcanic eruption depends on the composition of the magma.	Volcanoes and Earthquakes
Describe different types of igneous rocks that are formed from lava: **- iron-rich basalt is formed from runny lava from a fairly safe volcanic eruption** **- silica-rich rhyolite is formed from thick lava from an explosive eruption.**	Igneous Rock Formation
Explain why some people choose to live near volcanoes.	Volcanoes and Earthquakes
Explain why geologists study volcanoes: - to be able to forecast future eruptions - to reveal information about the structure of the Earth.	Volcanoes and Earthquakes
Explain why geologists are now able to better forecast volcanic eruptions but not with 100% certainty.	Volcanoes and Earthquakes

C2b: Construction materials	
Recall that some rocks are used in construction of buildings and roads: *- granite, limestone, marble and aggregates.*	Rocks as Resources
Relate some construction materials to the substances found in the Earth's crust from which they are manufactured: - aluminium and iron from ores - brick from clay - glass from sand.	Rocks as Resources
Explain why there are environmental problems when rocks are quarried or mined from the ground: *- landscape destroyed and has to be reconstructed when the mining or quarrying has finished* *- increased noise, traffic and dust.*	Calcium Carbonate
Campare the hardness of limestone, marble and granite.	Rocks as Resources
Explain why granite, marble and limestone have different hardness: **- limestone is a sedimentary rock** **- marble is a metamorphic rock made by the action of high pressures and temperatures on limestone** **- granite is an igneous rock.**	Rocks as Resources
Recall that limestone and marble are both forms of calcium carbonate.	Calcium Carbonate
Recall that limestone thermally decomposes to make calcium oxide and carbon dioxide.	Calcium Carbonate
Construct the word equation for the decomposition of limestone (products not given) calcium carbonate → calcium oxide + carbon dioxide	Calcium Carbonate
Construct the balanced symbol equation for the decomposition of limestone (given some formulae) $CaCO_3 \rightarrow CaO + CO_2$	Calcium Carbonate
Describe thermal decomposition as a reaction in which, when heated, one substance is chemically changed into at least two new substances.	Calcium Carbonate
Construct the balanced symbol equation for the decomposition of limestone (formulae not given) **$CaCO_3 \rightarrow CaO + CO_2$**	Calcium Carbonate
Describe how concrete is made: *- cement, sand, aggregate and water are mixed together* *- mixture then allowed to set.*	Calcium Carbonate
Recall that cement is made when limestone and clay are heated together.	Calcium Carbonate
Describe how concrete can be reinforced, using a steel support.	Calcium Carbonate
Recall that reinforced concrete is a composite material.	Calcium Carbonate
Explain why reinforced concrete is a better construction material than non-reinforced concrete in terms of: **- hardness of the concrete** **- flexibility and strength of the steel.**	Calcium Carbonate

C2c: Metals and alloys	
Understand how copper can be extracted by heating its ore with carbon.	Extracting Metals by Reduction
Recall that copper can be purified by electrolysis.	Extracting Metals by Electrolysis
Explain why recycling copper is cheaper than extracting copper from its ore: *- saves resources* *- uses less energy.*	Metals and the Environment
Recall that reduction is the removal of oxygen.	Extracting Metals by Reduction
Label the apparatus needed to purify copper by electrolysis.	Extracting Metals by Electrolysis
Explain some of the advantages and disadvantages of recycling copper.	Metals and the Environment
Describe the use of electrolysis in the purification of copper: **- impure copper as anode** **- pure copper as cathode** **- copper(II) sulfate solution as electrolyte** **- cathode gains mass because copper is deposited** **- anode loses mass as copper dissolves.**	Extracting Metals by Electrolysis
Explain why the electrolytic purification of copper involves both oxidation and reduction. **- $Cu^{2+} + 2e^- \rightarrow Cu$ as an example of reduction because electrons are gained** **- $Cu - 2e^- \rightarrow Cu^{2+}$ as an example of oxidation because electrons are lost.**	Extracting Metals by Electrolysis
Recall that alloys are mixtures containing one or more metal elements.	Alloys
Recognise that brass, bronze, solder, steel, and amalgam are alloys.	Alloys

Recall one important large scale use for each of the following alloys: *- amalgam used in tooth fillings* *- brass used in musical instruments, coins and door decorations eg door knockers* *- solder used to join electrical wires.*	**Alloys**
Recall the main metals in each of the following alloys: - amalgam – mercury - brass – copper and zinc - solder – lead and tin.	**Alloys**
Recognise that the properties of an alloy are different from the properties of the metals from which it is made.	**Alloys**
Interpret data about the properties of metals, including alloys eg hardness, density, boiling point and strength.	**Properties of Metals**
Suggest properties needed by a metal or alloy for a particular given use.	**Alloys**
Explain why metals, including alloys are suited to a given use given appropriate data (no recall expected).	**Alloys**
Evaluate the suitability of metals for a given use given appropriate data.	**Alloys**
Explain how the use of 'smart alloys' such as those with a shape memory property have increased the number of applications of alloys: **- nitinol (nickel and titanium) used to make spectacle frames as the frames will return to their original shape after bending.**	**Alloys**

C2d: Making cars	
Understand that rusting needs iron, water and oxygen.	**Properties of Metals**
Recall that aluminium does not corrode in moist conditions.	**Properties of Metals**
Interpret simple data about the rate of corrosion of different metals in different conditions (no recall is expected).	**Properties of Metals**
Understand that salt water and acid rain accelerate rusting.	**Properties of Metals**
Explain that rusting involves oxidation because iron reacts with oxygen and forms an oxide.	**Properties of Metals**
Construct the word equation for rusting: iron + oxygen + water → hydrated iron(III) oxide.	**Properties of Metals**
Explain why aluminium does not corrode in moist conditions.	**Properties of Metals**
Interpret data about the rate of corrosion of different metals in different conditions (no recall is expected).	**Properties of Metals**
Compare the properties of iron and aluminium: *- iron is more dense than aluminium* *- iron is magnetic and aluminium is not* *- iron corrodes (rusts) easily and aluminium does not* *- iron and aluminium are both malleable* *- iron and aluminium are both good electrical conductors.*	**Properties of Metals**
Understand that alloys often have properties that are different from the metals they are made from and that these properties may make the alloy more useful than the pure metal to include: - steel is harder and stronger than iron - steel is less likely to corrode than iron.	**Alloys**
Describe advantages and disadvantages of building car bodies from aluminium or from steel: - car body of the same car will be lighter with aluminium - car body with aluminium will corrode less - car body of the same car will be more expensive made from aluminium.	**Properties of Metals**
Explain advantages and disadvantages of building car bodies from aluminium or from steel: **- get better fuel economy because the car body of the same car will be lighter with aluminium** **- longer lifetime because the car body with aluminium will corrode less**	**Properties of Metals**
Recall the major materials needed to build a car: *- steel, copper and aluminium* *- glass, plastics and fibres.*	**Properties of Metals**
Suggest properties needed by a material for a particular use in a car.	**Properties of Metals**
Explain why a material used in a car is suited to a particular use given appropriate data (no recall expected).	**Properties of Metals**
Describe the advantages of recycling materials: *- saves natural resources* *- reduces disposal problems.*	**Metals and the Environment**
Explain the advantages and disadvantages of recycling the materials used to make cars.	**Metals and the Environment**
Explain why new laws specify that a minimum percentage of all materials used to manufacture cars must be recyclable.	**Metals and the Environment**

Evaluate information on materials used to manufacture cars (no recall expected).

C2e: Chemicals from the air - making ammonia

Recall that in the Haber process ammonia is made from nitrogen from the air and hydrogen that comes from the cracking of oil fractions or from natural gas.

Describe how ammonia is made in the Haber process:
- nitrogen + hydrogen <=> ammonia
- iron catalyst
- high pressure
- temperature in the region of 450oC
- unreacted nitrogen and hydrogen are recycled.

Construct the balanced symbol equation for the manufacture of ammonia in the Haber process (given some or all of the formulae)
N2 + 3H2 <=> 2NH3

Explain the conditions used in the Haber process:
- high pressure increases the percentage yield of ammonia
- high temperature decreases the percentage yield of ammonia
- high temperature gives a high rate of reaction
- 450℃ is an optimum temperature to give a fast reaction with a sufficiently high percentage yield
- catalyst increases the rate of reaction but does not change the percentage yield.

Construct the balanced symbol equation for the manufacture of ammonia in the Haber process (formulae not given)
N2 + 3H2 <=> 2NH3

Describe that the cost of making a new substance depends on:
- price of energy (gas and electricity)
- cost of starting materials
- wages (labour costs)
- equipment (plant)
- how quickly the new substance can be made (cost of catalyst).

Describe how different factors affect the cost of making a new substance:
- the higher the pressure the higher the plant cost
- the higher temperature the higher the energy cost
- catalysts reduce costs by increasing the rate of reaction
- when unreacted starting materials are recycled costs are reduced
- automation reduces the wages bill.

Explain that economic considerations determine the conditions used in the manufacture of chemicals:
- rate must be high enough to give a sufficient daily yield of product
- percentage yield must be high enough to give a sufficient daily yield of product
- a low percentage yield can be accepted if the reaction can be repeated many times with recycled started materials
- optimum conditions used that give the lowest cost rather than the fastest reaction or highest percentage yield.

Recognise that <=> is used to represent a reversible reaction.

Understand that a reversible reaction proceeds in both directions.

Interpret data in tabular and graphical form relating to percentage yield in reversible reactions and changes in conditions (no recall required).

Interpret data about rate, percentage yield and costs for alternative industrial processes (no recall required).	
Recall some of the uses of ammonia: *- manufacture of fertilisers* *- manufacture of nitric acid.*	**Fertilizers**
Recognise the importance of ammonia in relation to world food production.	
C2f: Acids and bases	
Describe how universal indicator can be used to estimate the pH of a solution.	**Acids and Alkalis**
Understand that some indicators show sudden changes in colour, limited to litmus.	**Acids and Alkalis**
Recall that an alkali is a soluble base.	**Acids and Alkalis**
Recall that in neutralisation: acid + base –> salt + water.	**Acids and Alkalis**
Understand that in solution all acids contain H+ ions.	
Understand that the pH of an acid is determined by the concentration of H+ ions.	
Explain why an acid is neutralised by an alkali in terms of the ions present: **- acids contain H+** **- alkalis contain OH-** **- neutralisation involves the reaction H+ + OH- <=> H2O**	
Understand that an acid can be neutralised by a base or alkali, or vice versa.	**Acids and Alkalis**
Explain why metal oxides and metal hydroxides neutralise acids because they are bases.	**Acids and Alkalis**
Recall that carbonates neutralise acids to give water, a salt and carbon dioxide.	**Acids and Alkalis**
Construct word equations to show the neutralisation of acids by bases and carbonates (names of the products not given).	**Acids and Alkalis**
Predict the name of the salt produced when a named base or carbonate is neutralised by a laboratory acid limited to: - sulfuric acid - nitric acid - hydrochloric acid - phosphoric acid.	**Acids and Alkalis**
Construct balanced symbol equations for the neutralisation of acids by bases and carbonates limited to: **- sulfuric acid, nitric acid and hydrochloric acid** **- ammonia, potassium hydroxide, sodium hydroxide and copper oxide** **- sodium carbonate and calcium carbonate.**	**Acids and Alkalis**
C2g: Fertilisers and crop yields	
Recall that fertilisers increase crop yield.	**Fertilizers**
Recall that plants absorb minerals through their roots.	**Fertilizers**
Describe fertilisers as chemicals that provide plants with essential chemical elements.	**Fertilizers**
Recall that nitrogen, phosphorus and potassium are three essential elements needed for plant growth.	**Fertilizers**
Recognise the essential elements given the formula of a fertiliser.	**Fertilizers**
Understand that the use of fertilisers can be beneficial (increasing food supply) and also cause problems eg death of aquatic organisms (eutrophication).	**Fertilizers**
Explain why fertilisers must dissolve in water before they can be absorbed by plants.	**Fertilizers**
Identify arguments for and against the use of fertilisers: - world population is rising so need to produce more food - eutrophication and pollution of water supplies can result from excessive use of fertilisers.	**Fertilizers**
Explain how the use of fertilisers increases crop yield: **- replaces essential elements used by a previous crop or provides extra essential elements** **- more nitrogen gets incorporated into plant protein so increased growth.**	**Fertilizers**
Explain the process of eutrophication: **- run-off of fertiliser** **- increase of nitrate or phosphate in river water** **- algal bloom** **- blocks off sunlight to other plants which die** **- aerobic bacteria use up oxygen** **- most living organisms die.**	**Fertilizers**

Identify the apparatus needed to prepare a fertiliser by the neutralisation of an acid with an alkali: *- burette and measuring cylinder* *- filter funnel.*	**Fertilizers**
Recall the names of two nitrogenous fertilisers manufactured from ammonia eg: *- ammonium nitrate* *- ammonium phosphate* *- ammonium sulfate* *- urea.*	**Fertilizers**
Predict the name of the acid and the alkali needed to make a named fertiliser, for example: - ammonium nitrate.	**Fertilizers**
Describe the preparation of a named synthetic fertiliser by the reaction of an acid and an alkali: **- names of reactants** **- experimental method** **- how a neutral solution is obtained** **- how solid fertiliser is obtained.**	**Fertilizers**
C2h: Chemicals from the sea: the chemistry of sodium chloride	
Recall that sodium chloride (salt) can be obtained from the sea or from salt deposits.	**Salt**
Describe how salt can also be mined as rock salt and by solution mining in Cheshire.	**Salt**
Explain how mining for salt can lead to subsidence.	**Salt**
Recall that the electrolysis of concentrated sodium chloride gives chlorine and hydrogen.	**Electrolysis of Solutions**
Recall that the chemical test for chlorine is that it bleaches moist litmus paper.	**Electrolysis of Solutions**
Recall the products of the electrolysis of concentrated sodium chloride solution (brine): - hydrogen made at the cathode - chlorine made at the anode - sodium hydroxide is also made.	**Electrolysis of Solutions**
Explain why it is important to use inert electrodes in the electrolysis of sodium chloride solution.	**Electrolysis of Solutions**
Explain how the electrolysis of sodium chloride solution (brine) produces sodium hydroxide, hydrogen and chlorine: **- NaCl(aq) contains Na+, OH-, Cl-, H+** **- cathode $2H^+ + 2\bar{e} \rightarrow H_2$** **- anode $2Cl^- - 2\bar{e} \rightarrow Cl_2$** **- ions not discharged make sodium hydroxide.**	**Electrolysis of Solutions**
Explain why the electrolysis of sodium chloride involves both reduction and oxidation.	**Electrolysis of Solutions**
Recall that sodium chloride is used: *- as a preservative* *- as a flavouring.*	**Salt**
Understand that sodium chloride is an important raw material in the chemical industry, including use as a source of chlorine and sodium hydroxide.	**Salt**
Recall that household bleach, pvc and solvents are made from substances derived from salt.	**Electrolysis of Solutions**
Recall that chlorine is used to sterilise water and to make solvents, household bleach and plastics.	**Electrolysis of Solutions**
Recall that hydrogen is used in the manufacture of margarine.	**Electrolysis of Solutions**
Recall that sodium hydroxide is used to make soap.	**Electrolysis of Solutions**
Describe how sodium hydroxide and chlorine are used to make household bleach.	**Electrolysis of Solutions**
Explain the economic importance of the chlor-alkali industry.	

OCR Gateway GCSE Science 2011

GCSE Science: Physics

Module P1: Energy for the Home	Boardworks presentation
P1a: Heating houses	
Understand that for warm bodies the rate of cooling depends on the temperature difference compared to the surroundings.	
Understand that colour in a thermogram indicates temperature.	**Thermal Radiation**
Recognise, and understand the consequences of, the direction of energy flow between bodies of different temperatures.	
Interpret data on rate of cooling.	
Understand that temperatures can be represented by a range of colours in a thermogram.	**Thermal Radiation**
Describe temperature as a measurement of hotness on an arbitrary or chosen scale.	
Understand that temperature is a measurement of the average kinetic energy of particles.	
Explain that temperatures can be represented by a range of colours in a thermogram: - hottest parts: white/yellow/red - coldest parts: black/dark blue/purple.	**Thermal Radiation**
Recall that heat is a measurement of energy and is measured in Joules (J).	**Particles and Energy Transfer**
Describe that the energy needed to change the temperature of a body depends on: *- mass* *- the material it is made from* *- the temperature change.*	**Specific Heat Capacity**
Describe an experiment to measure the energy required to change the temperature of a body.	**Specific Heat Capacity**
Understand qualitatively and quantitatively the concept of the specific heat capacity of a material.	**Specific Heat Capacity**
Use the equation: energy = mass x specific heat capacity x temperature change.	**Specific Heat Capacity**
Describe heat as a measurement of energy on an absolute scale.	**Particles and Energy Transfer**
Use the equation, including a change of subject: **energy = mass x specific heat capacity x temperature change. (An initial calculation of temperature change may be required.)**	**Specific Heat Capacity**
Interpret data which shows that there is no temperature change when materials are: *- boiling* *- melting or freezing.*	**Specific Latent Heat**
Use the equation: energy = mass x specific latent heat.	**Specific Latent Heat**
Describe how, even though energy is still being transferred, there is no temperature change when materials are: - boiling - melting or freezing.	**Specific Latent Heat**
Understand qualitatively and quantitatively the concept of the specific latent heat of a material.	**Specific Latent Heat**
Use the equation, including a change of subject: **energy = mass x specific latent heat.**	**Specific Latent Heat**

P1b: Keeping homes warm	
Explain why trapped air in a material is a very good insulator.	**Insulation**
Recall that infrared radiation is: *- reflected from a shiny surface* *- absorbed by a dull or rough surface.*	**Thermal Radiation**
Understand how absorption and reflection of infrared radiation can be applied in everyday situations.	**Thermal Radiation**
Explain how energy is transferred in terms of: - conduction - convection - radiation and how such losses can be reduced in homes by energy saving measures to include: - loft insulation - double glazing - cavity wall insulation.	**Insulation**
Explain that energy loss from houses is lost to the atmosphere.	
Describe how energy is transferred by: **- conduction - transfer of KE between particles, to include the role played by free electrons** **- convection – how expansion when a liquid or gas is heated causes a change of density which results in (bulk) fluid flow** **- radiation – infrared radiation is an electromagnetic wave and needs no medium.**	**Particles and Energy Transfer**
Explain how there will be energy loss in a cavity wall and what further measures could be taken to limit this loss.	**Insulation**
Describe everyday examples of energy saving methods in the home.	**Insulation**
Explain how the property that air is a very good insulator is used to keep homes warm: *- fibreglass, mineral or rock wool in loft insulation* *- double glazing in windows* *- insulation foam or fibreglass in cavity walls.* *- curtains at windows.* *Describe other energy saving measures:* *- reflective foil in or on walls* *- draught-proofing.*	**Insulation**
Use the equation: *efficiency = useful energy output (x100%)/total energy input* *given the useful energy output and the total energy input; efficiency can be expressed in ratio or percentage terms.*	**Energy Transformations and Efficiency / Power Stations**
Interpret data for different energy saving strategies to include calculations involving: - initial cost - annual saving on energy bills - payback time.	**Insulation**
Use the equation: efficiency = useful energy output (x100%)/total energy input given wasted energy and total energy input ; efficiency can be expressed in ratio or percentage terms.	**Energy Transformations and Efficiency / Power Stations**

Interpret and complete information presented in Sankey diagrams, to show understanding that energy is conserved.	**Energy Transformations and Efficiency**
Explain in the context of the home the concepts of conduction, convection and radiation (absorption and emission) in terms of: **- the design features of the home** **- the design and use of everyday appliances in the home** **- energy saving strategies.**	**Insulation**
Use the equation: **efficiency = useful energy output (x100%)/total energy input** **to calculate useful energy output, total energy input or wasted energy, which may be used to complete a Sankey diagram.**	**Energy Transformations and Efficiency**
Efficiency can be expressed in ratio or percentage terms.	**Energy Transformations and Efficiency**

P1c: A spectrum of waves

Identify and name the main features of a transverse wave: *- trough and crest* *- amplitude* *- wavelength.*	**Wave Properties**
Describe the main features of a transverse wave: - trough and crest - amplitude - wavelength - frequency as the number of complete waves, cycles or oscillations per second	**Wave Properties**
Recall that all electromagnetic waves travel at the same high speed in space or a vacuum.	**Wave Properties**
Use the equation: wave speed = frequency x wavelength.	**Wave Properties**
Determine the value of the wavelength or frequency of a wave from a diagram and be able to use the value in the equation: wave speed = frequency x wavelength.	**Wave Properties**
Use the equation including a change of subject and use of standard form (or the use of a scientific notation calculator): **wave speed = frequency x wavelength.**	**Wave Properties**
Recall that electromagnetic waves travel in straight lines through a particular medium.	**Reflection, Refraction and Diffraction**
Use basic ray diagrams to describe reflection at single plane (flat) boundaries.	**Reflection, Refraction and Diffraction**
Recognise that refraction involves a change in direction of a wave due to the wave passing from one medium into another.	**Reflection, Refraction and Diffraction**
Use basic ray diagrams to demonstrate reflection at multiple plane (flat) boundaries.	**Reflection, Refraction and Diffraction**
Understand that refraction occurs at the boundary between mediums due to a change in the wave speed.	**Reflection, Refraction and Diffraction**
Describe diffraction of waves at an opening.	**Reflection, Refraction and Diffraction**
Describe a diffraction pattern for waves, including the significance of the size of the opening or barrier relative to the wavelength.	**Reflection, Refraction and Diffraction**
Identify the seven types of electromagnetic waves that comprise the spectrum and place them in order of ascending frequency.	**The Electromagnetic Spectrum**
Describe an example of a communications use for radio, microwave, infra-red and visible light.	**Communicating with Visible Light and Infrared / Communicating with Radio Waves and Microwaves**
Identify the seven types of electromagnetic waves that comprise the spectrum and place them in order by frequency or wavelength.	**The Electromagnetic Spectrum**
Relate the size of a communications receiver to the wavelength for radio, microwave, infra-red and visible light.	**Communicating with Radio Waves and Microwaves**
Describe and explain the limiting effects of diffraction on wave based sensors, to include: **- telescopes** **- optical microscopes.**	**Reflection, Refraction and Diffraction**

P1D: Light and lasers

Describe how, historically, the use of light greatly increased the speed of communication but that it requires the use of a code.	**Communicating with Visible Light and Infrared**
Describe how light was used as a means of communication: - signals sent in the form of Morse code which is a series of on off signals - signals relayed between stations to cover larger distances.	**Communicating with Visible Light and Infrared**
Recognise that Morse is a type of digital signal.	**Reflection, Refraction and Diffraction**

Explain the advantages and disadvantages of using light, radio and electrical signals for communication.

Communicating with Visible Light and Infrared

Describe why Morse code is a digital signal.

Communicating with Visible Light and Infrared

Recognise, in the context of optical fibres, where Total Internal Reflection (TIR) happens:
- glass-air boundary
- water-air boundary
- perspex-air boundary.

Communicating with Visible Light and Infrared

Understand how light and infrared radiation can travel along an optical fibre from one end to another by reflection from the sides of the fibre.

Communicating with Visible Light and Infrared

Describe, what happens to light incident on a boundary, eg glass-air, water-air or perspex-air boundary below, at and above the critical angle.

Reflection, Refraction and Diffraction

Understand how light and infrared radiation can both travel along an optical fibre from one end to another by Total Internal Reflection (TIR).

Communicating with Visible Light and Infrared

Describe applications of Total Internal Reflection (TIR) in fibre optics.

Communicating with Visible Light and Infrared

Understand that lasers produce an intense, narrow beam of light which allows them to be used for:
- surgery and dental treatment
- cutting materials in industry
- weapon guidance
- laser light shows.

Understand that a laser produces a narrow beam of light of a single colour (monochromatic).

Explain why most lasers produce an intense coherent beam of light:
- waves have the same frequency
- waves are in phase with each other
- waves have low divergence.

Explain how a laser beam is used in a CD player by reflection from the shiny surface:
- information is stored on the bottom surface
- information is stored digitally
- information in the form of patterns of bumps (known as pits)
- a CD will contain billions of pits.

P1e: Cooking and communicating using waves	
Interpret information on the electromagnetic spectrum to include microwaves and infrared radiation.	**The Electromagnetic Spectrum**
Recall that warm and hot objects emit infrared radiation: *- hotter objects emit more radiation* *- black dull objects emit more radiation.*	**Thermal Radiation**
Understand that infrared radiation is absorbed by the surface of an object causing an increase in temperature: *- black surfaces are good absorbers of radiation* *- white surfaces are poor absorbers of radiation* *- shiny surfaces reflect radiation.*	
Recognise that microwaves cause heating when absorbed by water or fat and this is the basis of the microwave cooking.	**Heating with Microwaves and Infrared**
Describe properties of infrared radiation: - heats the surface of the food - is reflected by shiny surfaces.	**Heating with Microwaves and Infrared**
Describe properties of microwaves: - penetrate (about 1cm) into food - are reflected by shiny metal surfaces - can cause burns when absorbed by body tissue - pass through glass and plastics.	**Heating with Microwaves and Infrared**
Explain how microwaves and infrared transfer energy to materials: **- infrared is absorbed only by particles on the surface of the food increasing their KE** **- KE is transferred to the centre of the food by conduction or convection** **- microwaves absorbed only by water or fat particles in outer layers of food increasing their KE.**	**Heating with Microwaves and Infrared**
Describe how the energy associated with microwaves and infrared depend on their frequency and relate this to their potential dangers.	**The Electromagnetic Spectrum / Heating with Microwaves and Infrared**
Recall that mobile phones use microwave signals.	**Interference**
Understand and describe that when microwaves are used to transmit information over large distances: - there must be a “line of sight” between transmitter and receiver - some areas and places have poor signals (eg effect on the signals of mountains and large buildings; adverse weather conditions; lakes and other large water surfaces; the curvature of the Earth).	
Explain how signal loss with microwaves happens because of: **- large obstacles affect the signals** **- adverse weather, large areas of surface water and curvature of the Earth affects the signals** **- no diffraction of microwaves around large objects** **- interference between signals.**	
Describe how the problems of signal loss are reduced by: **- limited distance between transmitters** **- high positioning of transmitters.**	
Describe some concerns about children using mobile phones.	**Communicating with Radio Waves and Microwaves**
Recall that different studies into the effects of mobile phone use have reached conflicting conclusions.	**Communicating with Radio Waves and Microwaves**
Describe why there may or may not be dangers: - to residents near to the site of a mast - to users of mobile phones Describe how potential dangers may be increased by frequent use.	**Communicating with Radio Waves and Microwaves**
Explain how publishing scientific studies into the effects of mobile phone microwave radiation enables results to be checked.	**Communicating with Radio Waves and Microwaves**
Understand that in the presence of conflicting evidence individuals and society must make choices about mobile phone usage and location of masts in terms of balancing risk and benefit.	**Communicating with Radio Waves and Microwaves**

P1f: Data transmission

Describe everyday uses of infrared radiation to include: *- in remote controls (TV, video and DVD players, automatic doors)* *- short distance data links for computer or mobile phones.*	**Communicating with Visible Light and Infrared**
Describe how infrared signals can carry information to control electrical or electronic devices.	**Communicating with Visible Light and Infrared**
Explain how the signal from an infrared remote control uses a set of digital signals (or codes) to control different functions of electrical or electronic devices.	**Communicating with Visible Light and Infrared**
Understand how passive infrared sensors and thermal imaging cameras work: *- infrared sensors detect body heat*	**Thermal Radiation**
Describe the differences between analogue and digital signals: *- analogue signals have a continuously variable value* *- digital signals are either on (1) or off (0).*	**Analogue and Digital Signals**
Recall that the properties of digital signals played a part in the switch to digital T.V. and radio broadcasts.	**Analogue and Digital Signals**
Describe advantages of using digital signals: **- to allow more information to be transmitted because of multiplexing (interleaving of many digital signals on the same data line)** **- less interference (noise not recognised so is filtered out and not amplified).**	**Analogue and Digital Signals**
Describe the transmission of light in optical fibres: - optical fibres allow the rapid transmission of data - optical fibres allow the transmission of data pulses using light.	**Communicating with Visible Light and Infrared**
Describe advantages of using optical fibres to allow more information to be transmitted: **- multiplexing** **- lack of interference in the final signal.**	**Communicating with Visible Light and Infrared**

P1g: Wireless signals

Describe how radiation used for communication can be reflected.	
Recognise that wireless technology uses electromagnetic radiation for communication.	**Communicating with Radio Waves and Microwaves**
Describe the advantages of wireless technology: *- no external/direct connection to a telephone line needed* *- portable and convenient* *- allows access when on the move but an aerial is needed to pick up the signals.*	**Communicating with Radio Waves and Microwaves**
Recall how radiation used for communication can be refracted and reflected and can be an advantage or disadvantage to good signal reception.	
Describe common uses of wireless technology: - TV and radio - mobile phones - laptop computers.	**Communicating with Radio Waves and Microwaves**
Explain how long-distance communication depends on: **- the refraction and resulting reflection of waves from the ionosphere** **- being received by and re-transmitted from satellites.**	**Communicating with Radio Waves and Microwaves**
Recall that the refraction and reflection in the Ionosphere is similar to TIR for light.	**Communicating with Radio Waves and Microwaves**
Interpret simple information, including information given in diagram form, on digital and analogue signals.	**Analogue and Digital Signals**
Understand that radio stations with similar transmission frequencies often interfere.	
Describe advantages and disadvantages of DAB broadcasts: - more stations available - less interference with other broadcasts - poorer audio quality compared to FM - all areas not covered.	
Explain how the refraction and diffraction of radiation can affect communications: **- refraction at the interfaces of different layers of Earth's atmosphere** **- diffraction by transmission dishes results in signal loss.**	
Explain the advantage of digital radio in terms of lack of interference including that between other broadcasts/stations.	

P1h: Stable Earth	
Describe earthquakes as producing shock waves which can: *- be detected by seismometers* *- be recorded on a seismograph* *- cause damage to buildings and the Earth's surface* *- cause a tsunami.*	**Earthquakes**
Understand that earthquakes produce shock waves, which can also travel inside the Earth.	**Earthquakes**
Recall that two types of seismic waves are: - longitudinal P waves which travel through both solids and liquids and travel faster than S waves - transverse S waves which travel through solids but not through liquids and travel slower than P waves.	**Earthquakes**
Describe how data on seismic waves transmitted through the Earth can be used to provide evidence for its structure: **- P waves travel through solid and liquid rock (ie all layers of the Earth)** **- S waves cannot travel through liquid rock (ie the outer core).**	**Earthquakes**
Recall that exposure to ultraviolet radiation can cause: *- suntan* *- sunburn* *- skin cancer* *- cataracts* *- premature skin aging.*	**Ultraviolet Radiation**
Recognise that sunscreens (eg sun block or sun cream) can reduce damage caused by ultraviolet radiation: *- less damage when higher factors are used* *- high factors allow longer exposure without burning.*	**Ultraviolet Radiation**
Explain how darker skins reduce cancer risk: - absorb more ultraviolet radiation - less ultraviolet radiation reaches underlying body tissues.	**Ultraviolet Radiation**
Interpret given information about sun protection factor (no recall is expected).	**Ultraviolet Radiation**
Calculate how long a person can spend in the Sun without burning from knowledge of the sun protection factor (SPF) of sunscreens (eg sun block or sun cream).	**Ultraviolet Radiation**
Describe how people have been informed of the risk of exposure to ultraviolet radiation, including from the use of sun beds, in order to improve public health.	**Ultraviolet Radiation**
Describe how the ozone layer protects the Earth from ultraviolet radiation.	**Ultraviolet Radiation**
Describe how: **- environmental pollution from CFCs has depleted the ozone layer** **- this allows more ultraviolet radiation to reach Earth** **- the potential danger to human health increases because of this.**	**Ultraviolet Radiation**
Recall that the discovery of the reduction of ozone levels over Antarctica was unexpected.	**Ultraviolet Radiation**
Describe how scientists used existing scientific ideas to explain their measurements.	**Ultraviolet Radiation**
Describe how scientists verified their measurements of ozone reduction, and the steps they took to increase confidence in their explanation. - measurements repeated with new equipment - measurements repeated by different scientists - predictions tested based on the explanation.	**Ultraviolet Radiation**
Describe how the discovery of the hole in the ozone layer over Antarctica changed the behaviour of society at an international level.	**Ultraviolet Radiation**

Module P2: Living for the Future (Energy resources)

P2a Collecting energy from the Sun

Understand that photocells: *- transfer light into electricity* *- produce direct current (DC)* *- can operate in remote locations* *- have a power or current that depends on thesurface area exposed to sunlight.*	**Energy from the Sun**
Recall that DC electricity is current in the same direction all the time.	**Energy from the Sun**
Describe some advantages and disadvantages of using photocells to provide electricity: - low maintenance - no need for power cables - no need for fuel - long life - renewable energy resource - no polluting waste - no power at night or bad weather.	**Energy from the Sun**
Describe how light produces electricity in a photocell: **- energy absorbed by photocell** **- electrons are knocked loose from the silicon atoms in the crystal** **- electrons flow freely.**	**Energy from the Sun**
Describe how the current and power produced in a photocell depends on: **- light intensity** **- surface area exposed** **- distance from the light source.**	**Energy from the Sun**
Describe how the Sun's energy can be harnessed: *- radiation from the Sun can be absorbed by a surface and transferred into heat energy* *- produces convection currents (wind) to drive turbines.* *- how glass can be used to provide passive solar heating for buildings* *- light can be reflected to a focus by a curved mirror*	**Energy from the Sun**
Describe the advantages and disadvantages of wind turbines: - renewable - no polluting waste - visual pollution - dependency on wind speed - appropriate space and position needed.	**Energy Resources**
Explain why passive solar heating works: **- glass is transparent to Sun's radiation** **- heated surfaces emit infra-red radiation of longer wavelength** **- glass reflects this longer wavelength infra-red.**	**Energy from the Sun**
Recall that an efficient solar collector must track the position of the Sun in the sky.	**Energy from the Sun**

P2b: Generating electricity	
Describe how to generate electricity using the dynamo effect, by moving the coil or the magnet.	**Generators**
Recall that a generator produces alternating current (AC).	**Generators**
Recall that a battery produces direct current (DC).	**Electricity Distribution**
Describe and recognise the ways that the dynamo effect can be increased (to give more current).	**Generators**
Describe and interpret AC using a voltage-time graph.	**Electricity Distribution**
Describe the main stages in the production and distribution of electricity: *- source of energy* *- power station produces electricity* *- national grid of power lines connecting station to consumers* *- consumers are homes, factories, offices and farms.*	**Power Stations**
Describe how simple AC generators work: - coil of wire - magnetic field - coil and field close - relative motion between coil and field.	**Generators**
Describe how electricity is generated at a conventional power station: - burning fuel - producing steam - spinning a turbine - turbine turns generator.	**Power Stations**
Recognise that there is significant waste of energy in a conventional power station. *Use the equation in the context of a power station:* *efficiency = Total energy input/useful energy output (x 100%)* *given the useful energy output and the total energy input. efficiency can be expressed in ratio or percentage terms.*	**Power Stations**
Use the equation in the context of a power station: efficiency = Total energy input (x 100%)/useful energy output given the useful energy output, wasted energy and the total energy input. Efficiency can be expressed in ratio or percentage terms.	**Power Stations**
Use the equation in the context of a power station to calculate useful energy output, total energy input or wasted energy. **efficiency = Total energy input (x 100%)/useful energy output. Efficiency can be expressed in ratio or percentage terms.**	**Power Stations**

P2c: Global warming	
Understand that some gases in the Earth's atmosphere prevent heat from radiating into space. Recall and recognise that this is known as the greenhouse effect.	**Climate Change**
Recall and identify examples of greenhouse gases to include: *- carbon dioxide* *- water vapour* *- methane.*	**Climate Change**
Describe how electromagnetic radiation at most wavelengths can pass through the Earth's atmosphere, but certain wavelengths, particularly infrared, are absorbed by some gases in the atmosphere.	**Climate Change**
Recall and identify natural and man-made sources of greenhouse gases (limited to water vapour, carbon dioxide and methane).	**Climate Change**
Explain the greenhouse effect in terms of: **- short wavelength e-m radiation from the Sun is absorbed by and heats the Earth** **- the Earth radiates heat as longer wavelength infrared radiation** **- greenhouse gases absorb some infrared radiation, warming the atmosphere.**	**Climate Change**
Interpret data about the abundance and relative impact of greenhouse gases (limited to water vapour, carbon dioxide and methane).	**Climate Change**
Describe reasons for climate change caused by increased global warming: *- increased energy use* *- increased CO2 emissions* *- deforestation.*	**Climate Change**

Explain how human activity and natural phenomena both have effects on weather patterns including dust in the atmosphere: - from factories reflecting radiation from the city back to Earth causing warming - from volcanic ash and gases reflecting radiation from the Sun back into space causing cooling.	**Climate Change**
Interpret given information about increased global warming and climate change as a result of natural or human activity (no recall is expected).	**Climate Change**
Describe the difficulties of measuring global warming.	**Climate Change**
Explain why scientists working on global warming should allow other scientists to use their data.	**Climate Change**
Describe scientific evidence which supports or refutes the idea of man-made global warming.	**Climate Change**
Distinguish between opinion and evidence based statements in the context of the global warming debate.	**Climate Change**
Explain how it is possible to have good agreement between scientists about the greenhouse effect, but disagreement about whether human activity is affecting global warming.	**Climate Change**

P2d: Fuels for power

Recall that the unit of power is the watt or kilowatt.	**Using Electricity**
Interpret data to show that the cost of using expensive electrical appliances depends on: *- power rating in watts and kilowatts* *- the length of time it is switched on.*	**Using Electricity**
Calculate the power rating of an appliance using the equation: power = voltage x current	**Using Electricity**
Calculate the power rating of an appliance using the equation, including conversion of power between watts and kilowatts: power = voltage x current	**Using Electricity**
State that the unit of electrical energy supplied is the kilowatt hour.	**Using Electricity**
Calculate the number of kilowatt hours given the: - power in kilowatts - time in hours.	**Using Electricity**
Use the equation: energy supplied = power x time	**Using Electricity**
Calculate the cost of energy supplied.	**Using Electricity**
Use and manipulate the equation: power = voltage x current	**Using Electricity**
Use the kilowatt hour as a measure of the energy supplied.	**Using Electricity**
Use the equation: energy supplied = power x time to calculate: **- power in kW or W** **- time in hours.**	**Using Electricity**
Describe the advantages and disadvantages (for consumers and producers) of using off-peak electricity in the home.	**Using Electricity**
Recall that transformers can be used to increase or decrease voltage.	**Electricity Distribution**
Explain why transformers are used in the National Grid to increase the voltage: - electrical energy is transmitted at high voltage to reduce energy waste and costs.	**Electricity Distribution**
Explain how for a given power transmission, an increased voltage reduces current, so decreasing energy waste by reducing heating of cables.	**Electricity Distribution**

P2e: Nuclear radiations

Recognise examples where nuclear radiation can be beneficial or harmful: *- state one example of a beneficial use* *- harmful effect: damages living cells/causes cancer.*	**Radioactivity**
Describe examples of beneficial uses of radiation: - alpha - smoke detectors - beta – some tracers and paper thickness gauges - gamma - treating cancer, non-destructive testing, tracers and sterilising equipment.	**Radioactivity**
Understand that radioactive materials give out nuclear radiation over time.	**Ionizing Radiation** / **Radioactivity**
Recall the three types of nuclear radiation: *- alpha* *- beta* *- gamma.*	**Radioactivity**
Understand that nuclear radiation causes ionisation and this is potentially harmful.	**Radioactivity**
Describe the relative penetrating power of alpha, beta and gamma: - alpha stopped by a few thicknesses of paper - beta stopped by a few mm of aluminium - gamma mostly stopped by a few cm of lead.	**Radioactivity**

Understand that nuclear radiation can form positive ions when electrons are lost from atoms.	
Interpret information and describe experiments that show how alpha, beta and gamma can be identified by their relative penetrating powers.	**Radioactivity**
Explain how ionisation can damage the DNA in human cells.	
Describe how to handle radioactive materials safely: *- protective clothing* *- tongs / keep your distance* *- short exposure time* *- shielded and labelled storage.*	**Radioactivity**
Describe waste from nuclear power as: *- radioactive:* *- harmful* *- not causing global warming.*	**Radioactivity**
Recall that uranium is a non-renewable resource. Recall that plutonium: - is a waste product from nuclear reactors - can be used to make nuclear bombs.	**Energy Resources**
Describe some ways of disposing of radioactive waste eg: - low level waste in land-fill sites - encased in glass and left underground - reprocessed.	**Radioactivity**
Describe the advantages and disadvantages of nuclear power.	**Evaluating Energy Resources**
Explain the problems of dealing with radioactive waste: **- remains radioactive for a long time** **- terrorist risk** **- must be kept out of groundwater** **- acceptable radioactivity level may change over time.**	**Radioactivity**
P2f: Exploring our Solar System	
Identify the relative positions of the Earth, Sun and planets (includes the order of the planets).	**The Solar System**
Recall that the Universe consists of: *- stars and planets* *- comets and meteors* *- black holes* *- large groups of stars called galaxies.*	**The Universe**
Explain why stars give off their own light can be seen or detected even though they are far away.	**The Universe**
Recall the relative nature and sizes of planets, stars, comets, meteors, galaxies and black holes.	**The Universe**
Recall that circular motion requires a centripetal force.	**The Solar System**
Understand that gravitational attraction provides the centripetal force for orbital motion.	**The Solar System**
Recall that radio signals take a long time to travel through the Solar System.	**Exploring Space**
Describe a light-year as the distance light travels in a year.	**Distances in Space**
Describe some of the difficulties of manned space travel between planets.	**Exploring Space**
Explain why a light-year is a useful unit for measuring very large distances in space	**Exploring Space**
Compare the resources needed by manned and unmanned spacecraft.	**Exploring Space**
Describe why unmanned spacecraft are sent into space.	**Exploring Space**
Recall that unmanned spacecraft can withstand conditions that are lethal to humans.	**Exploring Space**
Compare how information from space is returned to Earth from different distances: - distant planets require data to be sent back - nearby samples can be brought back to Earth for analysis	
Explain the advantages and disadvantages of using unmanned spacecraft to explore the Solar System.	**Exploring Space**

P2g: Threats to Earth	
Understand that the Moon may be the remains of a planet which collided with the Earth billions of years ago.	**The Solar System**
Recall that large asteroids have collided with the Earth in the past.	**Asteroids and Comets**
Recall that asteroids are rocks.	**Asteroids and Comets**
Describe some of the consequences of a collision with a large asteroid: *- crater* *- ejection of hot rocks* *- widespread fires* *- sunlight blocked by dust* *- climate change* *- species extinction.*	**Asteroids and Comets**
Describe asteroids: - as being left over from the formation of the Solar System - as being in orbit between Mars and Jupiter.	**Asteroids and Comets**
Describe some of the evidence for past asteroid collisions: - layers of unusual elements in rocks - sudden changes of fossil numbers between adjacent layers of rock.	**Asteroids and Comets**
Explain why the asteroid belt is between Mars and Jupiter: **- the gravitational attraction of Jupiter disrupts the formation of a planet.**	**Asteroids and Comets**
Describe the make up of a comet: *- made from ice and dust* *- has a tail formed from a trail of debris*	**Asteroids and Comets**
Describe that comets: - as having highly elliptical orbits - as coming from objects orbiting the Sun far beyond the planets.	**Asteroids and Comets**
Describe how the speed of a comet changes as it approaches a star.	**Asteroids and Comets**
Explain in terms of changing gravitational attraction, why the speed of a comet changes as it approaches a star.	**Asteroids and Comets**
Describe that a Near Earth Object (NEO) as an asteroid or comet on a possible collision course with Earth.	**Asteroids and Comets**
Describe how NEOs may be seen.	**Asteroids and Comets**
Describe how observations of NEOs can be used to determine their trajectories.	**Asteroids and Comets**
Explain why it is difficult to observe NEOs.	**Asteroids and Comets**
Suggest and discuss possible actions which could be taken to reduce the threat of NEOs: **- surveys by telescope** **- monitoring by satellites** **- deflection by explosions (when they are distant enough from Earth).**	**Asteroids and Comets**

P2h: The Big Bang	
Describe some ideas about the Big Bang theory for the origin of the Universe: *- started with an explosion* *- the Universe is still expanding.*	**The Origin of the Universe**
Recall that: - all galaxies are moving away from us - distant galaxies are moving away more quickly - microwave radiation is received from all parts of the Universe.	**The Origin of the Universe**
Explain how the Big Bang theory accounts for: **- light from other galaxies shifting to the red end of the spectrum** **- more distant galaxies generally showing greater red shift** **- estimating the age and starting point of the Universe.**	**The Origin of the Universe**
Recall that stars: *- have a finite 'life'* *- start as a huge gas cloud* *- are different sizes.*	**Stars**
Understand that not even light can escape from black holes because of the strong gravitational attraction close to a black hole.	**Stars**

Describe the end of the ‘life cycle’ of a small star: - red giant - planetary nebula - white dwarf.	**Stars**
Describe the end of the ‘life cycle’ of a large star: - super-red giant - supernova - neutron star or black hole (for massive stars).	**Stars**
Describe the life history of a star: **- interstellar gas cloud** **- gravitational collapse producing a proto-star** **- thermonuclear fusion** **- long period of normal life (main sequence)** **- end depends on mass of star.**	**Stars**
Explain the properties of a black hole: **- large mass, small volume and high density** **- strong gravitational attraction due to the large mass** **- not even light can escape the gravitational attraction close to the black hole.**	**Stars**
Recognise that the accepted models of the size and shape of the Universe have changed over time.	**The Universe**
Describe and recognise the Ptolemaic and Copernican models of the Universe, and describe how they differ from each other and the modern day model.	**The Universe**
Describe the evidence or observations that caused Copernicus and Galileo to develop new scientific models of the Universe, and explain how technological advances contributed to the new models.	**The Universe**
Explain why the theories of Copernicus and Galileo models were considered controversial when they were announced, and were not widely adopted until many years had passed.	**The Universe**