Edexcel
GCSE Science 2011

GCSE Science: Biology

Unit B1: Influences on life	Boardworks presentation
Topic 1: Variation	**Presentation**
1.1 Describe the characteristics that are used to classify organisms in the plant or animal kingdoms: a most plants have chloroplasts and the ability to make their own food b most animals are complex organisms that have nervous systems	**Classifying Organisms**
1.2 Demonstrate an understanding of the issues surrounding the classification of fungi, bacteria, algae and viruses: a fungi are not classified as plants because they lack chloroplasts and a cellulose cell wall and are placed in their own kingdom **b bacteria lack nuclei and are placed in the prokaryote kingdom** **c algae have features of both plants and animals (as illustrated by Euglena) and are placed in the protoctist kingdom** **d viruses are regarded by most scientists as non-living and therefore are not placed in any kingdom**	**Classifying Organisms**
1.3 Describe the main characteristics of vertebrates and invertebrates	**Classifying Organisms**
1.4 Explain how vertebrate animals are classified into five groups: a most fish have wet scales and gills b most amphibians have smooth, moist, permeable skin c most reptiles have dry, scaly skin d most birds have feathers and a beak e most mammals have hair and produce milk	**Classifying Organisms**
1.5 Define the term species as organisms that are capable of interbreeding to produce fertile offspring	**Classifying Organisms**
1.6 Demonstrate an understanding of why scientists around the world use the binomial system as a basis for naming species	**Classifying Organisms**
1.7 Demonstrate an understanding of why accurate classification is needed to identify, study and conserve species, and recognise areas of greater biodiversity	**Classifying Organisms**
1.8 Demonstrate an understanding of how variations within a species make accurate classification complicated, including: a hybridisation in ducks b ring species	**Classifying Organisms**
1.9 Construct and use keys to show how species can be identified	**Classifying Organisms**
1.10 Investigate the variations within a species to illustrate continuous variation and discontinuous variation	**Classifying Organisms / Similarity and Variation**
1.11 Explain that organisms are adapted to their environment and that some organisms are adapted to survive in extreme environments, including deep-sea hydrothermal vents and polar regions	**Adaptation**
1.12 Demonstrate an understanding of the process of evolution by means of Darwin's theory of natural selection, including that: a there is variation within and between species b organisms compete for resources that are limited c organisms best suited to the environment survive and reproduce d organisms less well suited are unable to compete and this may lead to the extinction of the species	**Evolution / Effects of Environmental Change**
1.13 Describe the structure of the nucleus of the cell as containing chromosomes, on which genes are located	**Similarity and Variation** **Inheritance**
1.14 Demonstrate an understanding that genes exist in alternative forms called alleles which give rise to differences in inherited characteristics	**Inheritance**
1.15 Recall the meaning of, and use appropriately, the terms: dominant, recessive, homozygous, heterozygous, phenotype and genotype	**Inheritance**
1.16 Analyse and interpret patterns of monohybrid inheritance using a genetic diagram, Punnett squares and family pedigrees	**Inheritance**
1.17 Calculate and analyse outcomes (using probabilities, ratios and percentages) from monohybrid crosses	**Inheritance**
1.18 Describe the symptoms of the genetic disorders: a sickle cell disease b cystic fibrosis	**Inherited Disorders**
1.19 Demonstrate an understanding of the inheritance of the genetic disorders: **a sickle cell disease** **b cystic fibrosis**	**Inherited Disorders**

Topic 2: Responding to change	
2.1 Define homeostasis as the maintenance of a stable internal environment	**Homeostasis**
2.2 Recall that regulating body water content and body temperature are both examples of homeostasis	**Homeostasis / Controlling Water Content**
2.3 Demonstrate an understanding of how organisms are able to respond to changes in their surroundings in order to maintain their internal environment, with reference to the function of the skin in the control of body temperature, including: a sweat glands release sweat that contains water and salts b the evaporation of water in sweat transfers heat from the skin c shivering involves the movement of muscles which releases heat	**Homeostasis**
2.4 Demonstrate an understanding of the process of vasoconstriction and vasodilation in relation to the control of body temperature	**Homeostasis**
2.5 Recall that the central nervous system consists of the brain and spinal cord	**The Nervous System**
2.6 Describe how stimulation of receptors in the sense organs sends electrical impulses along neurones	**The Nervous System**
2.7 Investigate human responses to external stimuli	**The Nervous System**
2.8 Explain that a coordinated response requires a stimulus, a receptor, a sensory neurone, the central nervous system, a motor neurone, an effector and a response	**The Nervous System**
2.9 Demonstrate an understanding of a simple reflex arc that bypasses the brain to create a faster response that is essential for protecting the body	**Reflex Reactions**
2.10 Explain that transmission between neurones is at a synapse through the release of chemical messengers called neurotransmitters	**The Nervous System**
2.11 Recall that hormones are produced in endocrine glands and are transported by the blood to their target organs	**Homeostasis / Controlling Blood Sugar**
2.12 Explain how blood glucose levels are regulated by insulin and excess blood glucose is converted to glycogen in the liver	**Controlling Blood Sugar**
2.13 Explain how blood glucose levels are regulated by glucagon and glycogen is converted to glucose	**Controlling Blood Sugar**
2.14 Explain that Type 1 diabetes is caused by a lack of insulin	**Controlling Blood Sugar**
2.15 Explain that Type 1 diabetes can be controlled by injection of insulin usually into the subcutaneous fat	**Controlling Blood Sugar**
2.16 Explain that the dosage of insulin depends upon the balance between activity and diet	**Controlling Blood Sugar**
2.17 Explain that Type 2 diabetes is caused by a person becoming resistant to insulin	**Controlling Blood Sugar**
2.18 Explain that Type 2 diabetes can be controlled by diet and physical activity	**Controlling Blood Sugar**
2.19 Demonstrate an understanding of the correlation between obesity (including calculations of BMI) and Type 2 diabetes	**Controlling Blood Sugar**
2.20 Explain that plants use hormones to respond to stimuli, including: a shoots are positively phototropic b roots are positively geotropic (gravitropic)	**Plant Hormones**
2.21 Demonstrate an understanding of how auxin brings about shoot curvature involving cell elongation	**Plant Hormones**
2.22 Investigate tropic responses	**Plant Hormones**
2.23 Analyse, interpret and evaluate data from plant hormone experiments, including the action of auxins and gibberellins	**Plant Hormones**
2.24 Demonstrate an understanding of the uses of plant hormones, including: **a selective weedkillers** **b rooting powder** **c seedless fruit** **d fruit ripening**	**Plant Hormones**

Topic 3: Inter-relationships	
3.1 Define a drug as a substance that changes the way in which the body works	**Drug Development**
3.2 Describe the general effects of: a painkillers that block nerve impulses, including morphine b hallucinogens that distort sense perception, including LSD c stimulants that increase the speed of reactions and neurotransmission at the synapse, including caffeine d depressants that slow down the activity of the brain, including alcohol	**Drug Use and Addiction**
3.3 Investigate reaction times	**The Nervous System**
3.4 Explain the effects of some chemicals in cigarette smoke, including: a nicotine as an addictive drug b tar as a carcinogen c carbon monoxide reducing the oxygen-carrying ability of the blood	**Alcohol and Tobacco**
3.5 Evaluate data relating to the correlation between smoking and its negative effects on health	**Alcohol and Tobacco**
3.6 Describe some harmful effects of alcohol abuse: a in the short term – blurred vision, lowering of inhibitions, slowing of reactions b in the long term – liver cirrhosis, brain damage	**Alcohol and Tobacco**
3.7 Demonstrate an understanding of the ethics of organ transplants, including: a liver transplants for alcoholics b heart transplants for the clinically obese c the supply of organs	
3.8 Recall that infectious diseases are caused by pathogens	**Causes of Disease**
3.9 Describe how pathogens are spread, including: a in water, including cholera bacterium b by food, including Salmonella bacterium c airborne (eg sneezing), including influenza virus d by contact, including athlete's foot fungus e by body fluids, including HIV f by animal vectors, including: i housefly: dysentery bacterium ii Anopheles mosquito: malarial protozoan	**Causes of Disease**
3.10 Demonstrate an understanding of how animals defend themselves against attack from pathogens by the use of chemical and physical barriers	**The Body's Defences**
3.11 Demonstrate an understanding that plants produce chemicals that have antibacterial effects in order to defend themselves, some of which are used by humans	
3.12 Describe how antiseptics can be used to prevent the spread of infection	**Combatting Infection**
3.13 Demonstrate an understanding of the use of antibiotics to control infection, including: **a antibacterials to treat bacterial infections** **b antifungals to treat fungal infections**	**Combatting Infection**
3.14 Demonstrate an understanding of how resistant strains of bacteria, including MRSA, can arise from the misuse of antibiotics	**Combatting Infection**
3.15 Investigate the effects of antiseptics or antibiotics on microbial cultures	**Combatting Infection**
3.16 Explain how all living things are interdependent	**Interdependence**
3.17 Demonstrate an understanding of how some energy is transferred to less useful forms at each trophic level and this limits the length of a food chain	**Energy Transfer in Food Chains**
3.18 Explain how the shape of a pyramid of biomass is related to the energy transferred at each trophic level	**Energy Transfer in Food Chains**

3.19 Explain how the survival of some organisms may depend on the presence of another species: a parasitism, including: i fleas ii headlice iii tapeworms iv mistletoe b mutualism, including: i oxpeckers that clean other species ii cleaner fish **iii nitrogen-fixing bacteria in legumes** **iv chemosynthetic bacteria in tube worms in deep-sea vents**	**Interdependence**
3.20 Analyse, interpret and evaluate data on global population change	**Human Impacts on the Environment**
3.21 Explain how the increase in human population contributes to an increase in the production of pollutants, including phosphates, nitrates and sulfur dioxide	**Human Impacts on the Environment**
3.22 Demonstrate an understanding of the problems caused by eutrophication when excessive nitrate levels build up in lakes, seas and rivers	**Human Impacts on the Environment** / **Measuring Environmental Change**
3.23 Investigate the effect of pollutants on plant germination and growth	
3.24 Demonstrate an understanding of how the presence or absence of indicator species can be used to assess the level of pollution: a polluted water indicator – bloodworm, sludgeworm b clean water indicator – stonefly, freshwater shrimps c air quality indicator – lichen species, blackspot fungus on roses	**Measuring Environmental Change**
3.25 Demonstrate an understanding of how recycling can reduce the demand for resources and the problem of waste disposal, including paper, plastics and metals	**Measuring Environmental Change**
3.26 Demonstrate an understanding of how carbon is recycled: a during photosynthesis plants remove carbon dioxide from the atmosphere b carbon compounds pass along a food chain c during respiration organisms release carbon dioxide into the atmosphere d decomposers release carbon dioxide into the atmosphere e combustion of fossil fuels releases carbon dioxide into the atmosphere	**The Carbon Cycle**
3.27 Demonstrate an understanding of how nitrogen is recycled: **a nitrogen gas in the air cannot be used directly by plants and animals** **b nitrogen-fixing bacteria living in root nodules or the soil can fix nitrogen gas** **c the action of lightning can convert nitrogen gas into nitrates** **d decomposers break down dead animals and plants** **e soil bacteria convert proteins and urea into ammonia** **f nitrifying bacteria convert this ammonia to nitrates** **g plants absorb nitrates from the soil** **h nitrates are needed by plants to make proteins for growth** **i nitrogen compounds pass along a food chain or web** **j denitrifying bacteria convert nitrates to nitrogen gas**	**The Nitrogen Cycle**

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GCSE Science: Chemistry

C1: Chemistry in our world	Boardworks presentation
0.1 Recall the formulae of elements and simple compounds in the unit	Chemical Reactions
0.2 Represent chemical reactions by word equations ***and simple balanced equations***	Chemical Reactions
0.3 Write balanced equations including the use of state symbols (s), (l), (g) and (aq) for a wide range of reactions in this unit	Chemical Reactions
0.4 Assess practical work for risks and suggest suitable precautions for a range of practical scenarios for reactions in this unit	Chemical Reactions
0.5 Demonstrate an understanding that hazard symbols used on containers: *a indicate the dangers associated with the contents* *b inform people about safe-working procedures with these substances in the laboratory*	Acids and Alkalis
Topic 1 - The Earth's sea and atmosphere	
1.1 Explain that the gases produced by volcanic activity formed the Earth's early atmosphere	Evolution of the Atmosphere
1.2 Recall that the early atmosphere contained: a little or no oxygen b a large amount of carbon dioxide c water vapour and small amounts of other gases	Evolution of the Atmosphere
1.3 Explain that there are different sources of information about the development of the atmosphere which makes it difficult to be precise about the evolution of the atmosphere	Evolution of the Atmosphere
1.4 Explain that condensation of water vapour formed oceans	Evolution of the Atmosphere
1.5 Describe how the amount of carbon dioxide in the atmosphere was reduced by: a the dissolution of carbon dioxide into the oceans b the later incorporation of this dissolved carbon dioxide into marine organisms which eventually formed carbonate rocks	Evolution of the Atmosphere
1.6 Explain that the growth of primitive plants used carbon dioxide and released oxygen by photosynthesis and consequently the amount of oxygen in the atmosphere gradually increased	Evolution of the Atmosphere
1.7 Investigate the proportion of oxygen in the atmosphere	Earth's Atmosphere
1.8 Describe the current composition of the atmosphere and interpret data sources showing this information	Earth's Atmosphere
1.9 Demonstrate an understanding of how small changes in the atmosphere occur through: a volcanic activity b human activity, including the burning of fossil fuels, farming and deforestation	Changing the Atmosphere
Topic 2 - Materials from the Earth	
2.1 Describe that igneous rocks, such as granite, are: a formed by the solidification of magma or lava b made of crystals whose size depends on the rate of cooling	Igneous Rock Formation
2.2 Describe chalk and limestone as examples of sedimentary rocks	Rocks as Resources
2.3 Describe how sedimentary rocks are formed by the compaction of layers of sediment over a very long time period	Rocks as Resources
2.4 Recall that sedimentary rocks: a may contain fossils b are susceptible to erosion	Rocks as Resources
2.5 Describe marble as an example of a metamorphic rock	Rocks as Resources
2.6 Describe the formation of metamorphic rocks by the action of heat and/or pressure, including the formation of marble from chalk or limestone	Rocks as Resources
2.7 Recall that limestone, chalk and marble exist in the Earth's crust and that they are all natural forms of calcium carbonate	Calcium Carbonate
2.8 Demonstrate an understanding of the balance between the demand for limestone and the economic, environmental and social effects of quarrying it	Calcium Carbonate
2.9 Demonstrate an understanding of the commercial need for quarrying calcium carbonate on a large scale, as a raw material, for the formation of glass, cement and concrete	Calcium Carbonate
2.10 Describe the thermal decomposition of calcium carbonate into calcium oxide and carbon dioxide	Calcium Carbonate

2.11 Investigate the ease of thermal decomposition of carbonates, including calcium carbonate, zinc carbonate and copper carbonate	**Calcium Carbonate**
2.12 Describe the ease of thermal decomposition of different metal carbonates	**Calcium Carbonate**
2.13 Demonstrate an understanding that: a atoms are the smallest particles of an element that can take part in chemical reactions b during chemical reactions, atoms are neither created nor destroyed c during chemical reactions, atoms are rearranged to make new products with different properties from the reactants	**Chemical Reactions**
2.14 Describe the effect of water on calcium oxide	**Calcium Carbonate**
2.15 Explain that calcium hydroxide dissolves in water to form a solution, known as limewater	**Calcium Carbonate**
2.16 Demonstrate an understanding that the total mass before and after a reaction in a sealed container is unchanged, as shown practically by a precipitation reaction	**Chemical Reactions**
2.17 Explain how calcium oxide, calcium hydroxide and calcium carbonate can be used to neutralise soil acidity	**Calcium Carbonate**
2.18 Explain how calcium carbonate can be used to remove acidic gases from coal-fired power station chimneys, reducing harmful emissions and helping to reduce acid rain	**Calcium Carbonate**
Topic 3 - Acids	
3.1 Recall that hydrochloric acid is produced in the stomach in order to: a help digestion b kill bacteria	**Acids and Alkalis**
3.2 Describe indigestion remedies as containing substances that neutralise excess stomach acid	**Acids and Alkalis**
3.3 Investigate the effectiveness of different indigestion remedies	**Acids and Alkalis**
3.4 Explain that acids are neutralised by: a metal oxides b metal hydroxides c metal carbonates to produce salts (no details of salt preparation techniques or ions are required)	**Acids and Alkalis**
3.5 Explain that: a hydrochloric acid produces chloride salts b nitric acid produces nitrate salts c sulfuric acid produces sulfate salts	**Acids and Alkalis**
3.6 Describe electrolysis as a process in which electrical energy, from a d.c. supply, decomposes compounds, by considering the electrolysis of dilute hydrochloric acid to produce hydrogen and chlorine (explanations of the reactions at the electrodes are not required)	**Electrolysis of Solutions**
3.7 Investigate the electrolysis of dilute hydrochloric acid	**Electrolysis of Solutions**
3.8 Describe the chemical test for hydrogen	**Electrolysis of Solutions**
3.9 Describe the chemical test for chlorine	**Electrolysis of Solutions**
3.10 Recall that chlorine can be obtained from sea water by electrolysis (explanations of the reactions at the electrodes are not required)	**Electrolysis of Solutions**
3.11 Describe chlorine as a toxic gas and that this leads to potential hazards associated with its large-scale manufacture	**Electrolysis of Solutions**
3.12 Describe the use of chlorine in the manufacture of bleach and of the polymer poly(chloroethene) (PVC)	**Electrolysis of Solutions**
3.13 Recall that water can be decomposed by electrolysis to form hydrogen and oxygen	**Electrolysis of Solutions**
3.14 Describe the chemical test for oxygen	**Electrolysis of Solutions**

Topic 4 - Obtaining and using metals	
4.1 Recall that: a most metals are extracted from ores found in the Earth's crust b unreactive metals are found in the Earth as the uncombined elements	**Extracting Metals by Reduction**
4.2 Explain that most metals are extracted from their ores by: a heating with carbon, illustrated by iron b electrolysis, illustrated by aluminium (knowledge of the blast furnace or the electrolytic cell for aluminium extraction are not required)	**Extracting Metals by Reduction / Extracting Metals by Electrolysis**
4.3 Explain that the method used to extract a metal is related to its position in the reactivity series	**Extracting Metals by Electrolysis**
4.4 Investigate methods for extracting a metal from its ore	**Extracting Metals by Electrolysis**
4.5 Describe oxidation as the gain of oxygen and reduction as the loss of oxygen	**Properties of Metals**
4.6 Explain that the extraction of metals involves reduction of ores	**Extracting Metals by Reduction**
4.7 Explain that the oxidation of metals results in corrosion	**Properties of Metals**
4.8 Demonstrate an understanding that a metal's resistance to oxidation is related to its position in the reactivity series	**Properties of Metals**
4.9 Discuss the advantages of recycling metals, including economic implications and how recycling preserves both the environment and the supply of valuable raw materials	**Metals and the Environment**
4.10 Describe the uses of metals in relation to their properties, including: a aluminium b copper c gold d steel	**Properties of Metals**
4.11 Use models to explain why converting pure metals into alloys often increases the strength of the product	**Alloys**
4.12 Demonstrate an understanding that iron is alloyed with other metals to produce alloy steels with a higher strength and a greater resistance to corrosion	**Alloys**
4.13 Describe how alloying changes the properties of metals, including: **a smart or shape memory alloys, including nitinol, an alloy of nickel and titanium** **b gold alloys with higher strength, including fineness (parts per thousand) and carats to indicate the proportion of pure gold**	**Alloys**
4.14 Demonstrate an understanding that new materials are developed by chemists to fit new applications, such as the creation of new shape memory alloys for use, for example, in spectacle frames and as stents in damaged blood vessels	**Alloys**
Topic 5 - Fuels	
5.1 Describe hydrocarbons as compounds that contain carbon and hydrogen only	**Crude Oil**
5.2 Describe crude oil as a complex mixture of hydrocarbons	**Crude Oil**
5.3 Describe the separation of crude oil into simpler, more useful mixtures by the process of fractional distillation (details of fractional distillation are not required)	**Crude Oil / Fractional Distillation**
5.4 Recall the name and uses of the following fractions: a gases, used in domestic heating and cooking b petrol, used as a fuel for cars c kerosene, used as a fuel for aircraft d diesel oil, used as fuel for some cars and trains e fuel oil, used as fuel for large ships and in some power stations f bitumen, used to surface roads and roofs	**Fractional Distillation**
5.5 Describe that hydrocarbons in different fractions differ from each other in: a the number of carbon and hydrogen atoms their molecules contain b boiling points c ease of ignition d viscosity	**Fractional Distillation**

5.6 Explain that the complete combustion of hydrocarbons: a involves the oxidation of the hydrocarbons b produces carbon dioxide and water c gives out energy	**Combustion**
5.7 Describe the chemical test for carbon dioxide (using limewater)	**Calcium Carbonate**
5.8 Explain that the incomplete combustion of hydrocarbons can produce carbon and carbon monoxide	**Incomplete Combustion**
5.9 Describe how carbon monoxide behaves as a toxic gas	**Incomplete Combustion**
5.10 Demonstrate an understanding of the problems caused by incomplete combustion producing carbon monoxide and soot in appliances that use carbon compounds as fuels	**Incomplete Combustion**
5.11 Explain why impurities in some hydrocarbon fuels result in the production of sulfur dioxide	**Fossil Fuels and the Environment**
5.12 Demonstrate an understanding of some problems associated with acid rain caused when sulfur dioxide dissolves in rain water.	**Fossil Fuels and the Environment**
5.13 Explain that various gases in the atmosphere, including carbon dioxide, methane and water vapour, trap heat from the Sun and that this keeps the Earth warm	**Changing the Atmosphere**
5.14 Demonstrate an understanding that the Earth's temperature varies and that human activity may influence this	**Changing the Atmosphere**
5.15 Demonstrate an understanding that the proportion of carbon dioxide in the atmosphere varies, due to human activity, and that chemists are investigating methods to control the amount of the gas in the atmosphere by: a iron seeding of oceans b converting carbon dioxide into hydrocarbons	**Changing the Atmosphere**
5.16 Evaluate how far the correlation between global temperature and the proportion of carbon dioxide in the atmosphere provides evidence for climate change	**Changing the Atmosphere**
5.17 Describe biofuels as being possible alternatives to fossil fuels	**Alternative Fuels**
5.18 Recall that one example of a biofuel is ethanol obtained by processing sugar cane or sugar beet and that it can be used to reduce the demand for petrol	**Alternative Fuels**
5.19 Evaluate the advantages and disadvantages of replacing fossil fuels with biofuels, including: a the fact that biofuels are renewable b that growing the crops to make biofuels requires land and may affect the availability of land for growing food c the balance between the carbon dioxide removed from the atmosphere as these crops grow and the carbon dioxide produced when they are transported and burned	**Alternative Fuels**
5.20 Demonstrate an understanding of the factors that make a good fuel, including: a how easily it burns b the amount of ash or smoke it produces c the comparative amount of heat energy it produces (calculations involving conversion to joules are not required) d how easy it is to store and transport	**Hydrocarbon Fuels**
5.21 Recall that a simple fuel cell combines hydrogen and oxygen to form water and that this reaction releases energy	**Alternative Fuels**
5.22 Evaluate the advantages and disadvantages of using hydrogen, rather than petrol, as a fuel in cars	**Alternative Fuels**
5.23 Describe petrol, kerosene and diesel oil as non-renewable fossil fuels obtained from crude oil and methane as a non-renewable fossil fuel found in natural gas	**Hydrocarbon Fuels**
5.24 Compare the temperature rise produced when the same volume of water is heated by different fuels	**Hydrocarbon Fuels**
5.25 Explain that alkanes are saturated hydrocarbons, which are present in crude oil	**Crude Oil**
5.26 Recall the formulae of the alkanes methane, ethane and propane, and draw the structures of these molecules to show how the atoms are bonded together (No further knowledge of bonding is required in this unit)	**Crude Oil**
5.27 Explain that alkenes are unsaturated hydrocarbons	**Cracking Hydrocarbons**
5.28 Recall the formulae of the alkenes ethene and propene and draw the structures of their molecules to show how the atoms are bonded together (No further knowledge of bonding is required in this unit)	**Cracking Hydrocarbons**
5.29 Describe how bromine water is used to distinguish between alkanes and alkenes	**Cracking Hydrocarbons**
5.30 Explain that cracking involves the breaking down of larger saturated hydrocarbon molecules (alkanes) into smaller, more useful ones, some of which are unsaturated (alkenes)	**Cracking Hydrocarbons**

5.31 Explain why cracking is necessary, including by using data on the composition of different crude oils and the demand for fractions in crude oil	**Cracking Hydrocarbons**
5.32 Describe the cracking of liquid paraffin in the laboratory	**Cracking Hydrocarbons**
5.33 Recall that: a many ethene molecules can combine together in a polymerisation reaction b the polymer formed is called poly(ethene) (conditions and mechanisms not required but **equations required**)	**Making Polymers**
5.34 Explain that other polymers can be made by combining together other monomer molecules, to include poly(propene), poly(chloroethene) (PVC) and PTFE	**Making Polymers**
5.35 Relate uses of the polymers poly(ethene), poly(propene), poly(chloroethene) (PVC) and PTFE to the properties of the compounds	**Properties and Uses of Polymers**
5.36 Explain that most polymers are not biodegradable, persist in landfill sites and that many produce toxic products when burnt	**Polymers and the Environment**
5.37 Explain that some problems associated with the disposal of polymers can be overcome by recycling, or by developing biodegradable polymers	**Polymers and the Environment**

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GCSE Science: Physics

Unit P1: Universal physics	Boardworks presentation
0.1 use equations given in this unit, or in a given alternate form	
0.2 use and rearrange equations given in this unit	
0.3 demonstrate an understanding of which units are required in equations	
Topic 1: Visible light and the Solar System	
1.1 Describe how ideas about the structure of the Solar System have changed over time, including the change from the geocentric to the heliocentric models and the discovery of new planets	**The Solar System**
1.2 Demonstrate an understanding of how scientists use waves to find out information about our Universe, including: a the Solar System b the Milky Way	**The Universe**
1.3 Discuss how Galileo's observations of Jupiter, using the telescope, provided evidence for the heliocentric model of the solar system	**The Solar System**
1.4 Compare methods of observing the Universe using visible light, including the naked-eye, photography and telescopes	**The Universe**
1.5 Explain how to measure the focal length of a converging lens using a distant object	
1.6 Investigate the behaviour of converging lenses, including real and virtual images	
1.7 Use converging lenses to: *a measure the focal length using a distant object* *b investigate factors which affect the magnification of a converging lens (formulae are not needed)*	
1.8 Explain how the eyepiece of a simple telescope magnifies the image of a distant object produced by the objective lens (ray diagrams are not necessary)	**The Universe**
1.9 Describe how a reflecting telescope works	**The Universe**
1.10 Recall that waves are reflected and refracted at boundaries between different materials	**The Universe / Reflection, Refraction, Diffraction**
1.11 Explain how waves will be refracted at a boundary in terms of the change of speed and direction	**Reflection, Refraction and Diffraction**
1.12 Describe that waves transfer energy and information without transferring matter	**Wave Properties**
1.13 Use the terms of frequency, wavelength, amplitude and speed to describe waves	**Wave Properties**
1.14 Differentiate between longitudinal and transverse waves by referring to sound, electromagnetic and seismic waves	**Wave Properties**
1.15 Use of both the equations below for all waves: wave speed (metre/second, m/s) = frequency (hertz, Hz) × wavelength (metre, m) $v = f \times \lambda$ Wave speed (metre/second, m/s)= distance (metre, m)/time (second, s) $v = x/t$	**Wave Properties**
Topic 2: The electromagnetic spectrum	
2.1 Demonstrate an understanding of how Herschel and Ritter contributed to the discovery of waves outside the limits of the visible spectrum	**The Electromagnetic Spectrum**
2.2 Demonstrate an understanding that all electromagnetic waves are transverse and that they travel at the same speed in a vacuum	**Wave Properties**
2.3 Describe the continuous electromagnetic spectrum including (in order) radio waves, microwaves, infrared, visible (including the colours of the visible spectrum), ultraviolet, X-rays and gamma rays	**The Electromagnetic Spectrum**
2.4 Demonstrate an understanding that the electromagnetic spectrum is continuous from radio waves to gamma rays, but the radiations within it can be grouped in order of decreasing wavelength and increasing frequency	**The Electromagnetic Spectrum**
2.5 Demonstrate an understanding that the potential danger associated with an electromagnetic wave increases with increasing frequency	**The Electromagnetic Spectrum**

2.6 Relate the harmful effects, to life, of excessive exposure to the frequency of the electromagnetic radiation, including: a microwaves: internal heating of body cells b infrared: skin burns c ultraviolet: damage to surface cells and eyes, leading to skin cancer and eye conditions d X-rays and gamma rays: mutation or damage to cells in the body	**Heating with Microwaves and Infrared / Ionizing Radiation / Ultraviolet Radiation**
2.7 Describe some uses of electromagnetic radiation a radio waves: including broadcasting, communications and satellite transmissions b microwaves: including cooking, communications and satellite transmissions c infrared: including cooking, thermal imaging, short range communications, optical fibres, television remote controls and security systems d visible light: including vision, photography and illumination e ultraviolet: including security marking, fluorescent lamps, detecting forged bank notes and sterilising water f X-rays: including observing the internal structure of objects, airport security scanners and medical X-rays g gamma rays: including sterilising food and medical equipment, and the detection of cancer and its treatment	**Ultraviolet Radiation / Communicating with Visible Light and Infrared / Communicating with Radio Waves and Microwaves / Heating with Microwaves and Infrared / Ionizing Radiation**
2.8 Recall that ionising radiations are emitted all the time by radioactive sources	**Ionizing Radiation / Radioactivity**
2.9 Describe that ionising radiation includes alpha and beta particles and gamma rays and that they transfer energy	**Radioactivity**
Topic 3: Waves and the Universe	
3.1 Recall that the Solar System is part of the Milky Way galaxy	**The Universe**
3.2 Describe a galaxy as a collection of stars	**The Universe**
3.3 Recall that the Universe includes all of the galaxies	**The Universe**
3.4 Compare the relative sizes of and the distances between the Earth, the Moon, the planets, the Sun, galaxies and the Universe	**The Universe**
3.5 Describe the use of other regions of the electromagnetic spectrum by some modern telescopes	**The Universe**
3.6 Describe the methods used to gather evidence for life beyond Earth, including space probes, soil experiments by landers, Search for Extraterrestrial Intelligence (SETI)	**Exploring Space**
3.7 Demonstrate an understanding of the impact of data gathered by modern telescopes on our understanding of the Universe, including a the observation of galaxies because of improved magnification b the discovery of objects not detectable using visible light c the ability to collect more data	**The Universe**
3.8 Construct a simple spectrometer, from a CD or DVD, and use it to analyse common light sources	
3.9 Explain why some telescopes are located outside the Earth's atmosphere	**The Universe**
3.10 Analyse data provided to support the location of telescopes outside the Earth's atmosphere	
3.11 Describe the evolution of stars of similar mass to the Sun through the following stages: a nebula b star (main sequence) c red giant d white dwarf	**Stars**
3.12 Describe the role of gravity in the life cycle of stars	**Stars**
3.13 Explain that the evolution of stars with a mass larger than the Sun is different, and may end in a black hole or neutron star	**Stars**
3.14 Demonstrate an understanding of the Steady State and Big Bang theories	**The Origin of the Universe**
3.15 Describe evidence supporting the Big Bang theory, limited to redshift and the cosmic microwave background (CMB) radiation	**The Origin of the Universe**
3.16 Recognise that as there is more evidence supporting the Big Bang theory than the Steady State theory, it is the currently accepted model for the origin of the Universe	**The Origin of the Universe**
3.17 Describe that if a wave source is moving relative to an observer there will be a change in the observed frequency and wavelength	**The Origin of the Universe**

3.18 Demonstrate an understanding that if a wave source is moving relative to an observer there will be a change in the observed frequency and wavelength	**The Origin of the Universe**
3.19 Describe the red-shift in light received from galaxies at different distances away from the Earth	**The Origin of the Universe**
3.20 Explain why the red-shift of galaxies provides evidence for the Universe expanding	**The Origin of the Universe**
3.21 Explain how both the Big Bang and Steady State theories of the origin of the Universe both account for red-shift of galaxies	**The Origin of the Universe**
3.22 Explain how the discovery of the CMB radiation led to the Big Bang theory becoming the currently accepted model	**The Origin of the Universe**

Topic 4: Waves and the Earth	
4.1 Recall that sound with frequencies greater than 20 000 hertz, Hz is known as ultrasound	
4.2 Describe uses of ultrasound, including: a sonar b communication between animals c foetal scanning	
4.3 Calculate depth or distance from time and velocity of ultra sound	
4.4 Recall that sound with frequencies less than 20 hertz, Hz is known as infrasound	
4.5 Describe uses of infrasound, including: a communication between animals b detection of animal movement in remote locations c the detection of volcanic eruptions and meteors	
4.6 Recall that seismic waves are generated by earthquakes or explosions	**Earthquakes**
4.7 Investigate the unpredictability of earthquakes, through sliding blocks and weights	**Earthquakes**
4.8 Explain why scientists find it difficult to predict earthquakes and tsunami waves even with available data	**Earthquakes**
4.9 Recall that seismic waves can be longitudinal (P) waves and transverse (S) waves and that they can be reflected and refracted at boundaries between the crust, mantle and core	**Earthquakes**
4.10 Explain how data from seismometers can be used to identify the location of an earthquake	**Earthquakes**
4.11 Demonstrate an understanding of how P and S waves travel inside the Earth including reflection and refraction	**Earthquakes**
4.12 Explain that the Earth's outermost layer is composed of (tectonic) plates in relative motion due to convection currents in the mantle	**Plate Tectonics**
4.13 Demonstrate an understanding of how, at plate boundaries, plates may slide past each other sometimes causing earthquakes	**Earthquakes**

Topic 5: Generation and transmission of electricity	
5.1 Explain that current is the rate of flow of charge and voltage is an electrical pressure giving a measure of the energy transferred	**Using Electricity**
5.2 Define power as the energy transferred per second and measured in watts	**Using Electricity**
5.3 Use the equation: electrical power (watt, W) = current (ampere, A) × potential difference (volt, V) $P = I \times V$	**Using Electricity**
5.4 Investigate the power consumption of low-voltage electrical item	**Using Electricity**
5.5 Discuss the advantages and disadvantages of methods of largescale electricity production using a variety of renewable and nonrenewable resources	**Energy Resources** / **Evaluating Energy Resources**
5.6 Demonstrate an understanding of the factors that affect the size and direction of the induced current	**Generators**
5.7 Investigate factors affecting the generation of electric current by induction.	**Generators**
5.8 Explain how to produce an electric current by the relative movement of a magnet and a coil of wire a on a small scale b in the large-scale generation of electrical energy	**Generators**
5.9 Recall that generators supply current which alternates in direction	**Generators**
5.10 Explain the difference between direct and alternating current	**Electricity Distribution**
5.11 Recall that a transformer can change the size of an alternating voltage	**Electricity Distribution**

5.12 Use the turns ratio equation for transformers to predict either the missing voltage or the missing number of turns	**Electricity Distribution**
5.13 Explain that transmitting electrical energy at high voltages improves the efficiency by reducing heat loss in transmission lines	**Electricity Distribution**
5.14 Explain where and why step-up and step-down transformers are used in the transmission of electricity in the National Grid	**Electricity Distribution**
5.15 Describe the hazards associated with electricity transmission	**Electricity Distribution**
5.16 Recall that energy from the mains supply is measured in kilowatt-hours	**Using Electricity**
5.17 Use the equation: Cost(p) = power (kilowatts, kW) × time (hour, h) × cost of 1 kilowatt-hour (p/kW h)	**Using Electricity**
5.18 Demonstrate an understanding of the advantages of the use of low energy appliances	**Using Electricity**
5.19 Use data to compare and contrast the advantages and disadvantages of energy saving devices	**Using Electricity**
5.20 Use data to calculate cost-efficiency and payback times	**Insulation**
5.21 Use the equation: power (watt, W) = energy used (joule, J) / time taken (second, s) P = E/t	**Using Electricity**

Topic 6: Energy and the future	
6.1 Demonstrate an understanding that energy is conserved	
6.2 Describe energy transfer chains involving the following forms of energy: thermal (heat), light, electrical, sound, kinetic (movement), chemical, nuclear and potential (elastic and gravitational)	**Energy Transformations and Efficiency**
6.3 Demonstrate an understanding of how diagrams can be used to represent energy transfers	**Energy Transformations and Efficiency**
6.4 Apply the idea that efficiency is the proportion of energy transferred to useful forms to everyday situations	**Energy Transformations and Efficiency**
6.5 Use the efficiency equation: efficiency = (useful energy transferred by the device)/(total energy supplied to the device) × 100%	**Energy Transformations and Efficiency**
6.6 Demonstrate an understanding that for a system at a constant temperature it needs to radiate the same average power that it absorbs	**Energy Transformations and Efficiency**
6.7 Investigate how the nature of a surface affects the amount of thermal energy radiated or absorbed	**Thermal Radiation**