ERASMUS DARWIN ACADEMY
SCIENCE AND TECHNOLOGY FACULTY

Development Stage Science (Year 8)

Knowledge Organiser

Development Stage Science (Year 8)

Knowledge Organiser

Topic: Photosynthesis, Respiration & Circulation

Photosynthesis	Chemical reaction that plants use to make their own food. Requires light energy. Carbon dioxide & water are the reactants and glucose & oxygen are the products.
Chloroplast	Green disc containing chlorophyll. Absorb light for photosynthesis.
Palisade cells	Cells found in leaves, containing many chloroplasts.
Stomata	Small holes in the underside of leaves which let gases diffuse in and out.
Aerobic respiration	The process whereby energy is released from cells using glucose. Requires oxygen.
Anaerobic respiration	The process whereby energy is released from cells by the incomplete breakdown of glucose. Occurs when oxygen is in short supply. Releases less energy than aerobic.
Glucose	A type of sugar.
Arteries	Blood vessels that carry blood away from the heart.
Veins	Blood vessels that carry blood towards the heart.
Capillaries	Tiny blood vessels (only one cell thick) where gas exchange takes place.
Circulatory system	The system that circulates blood around the body. Consists of the heart and blood vessels.

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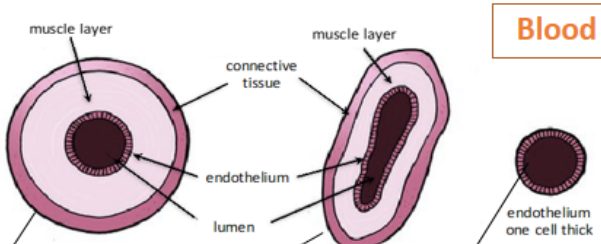
Links to GCSE Biology:

EDEXCEL GCSE Exchange and Transport in Animals Part 2.

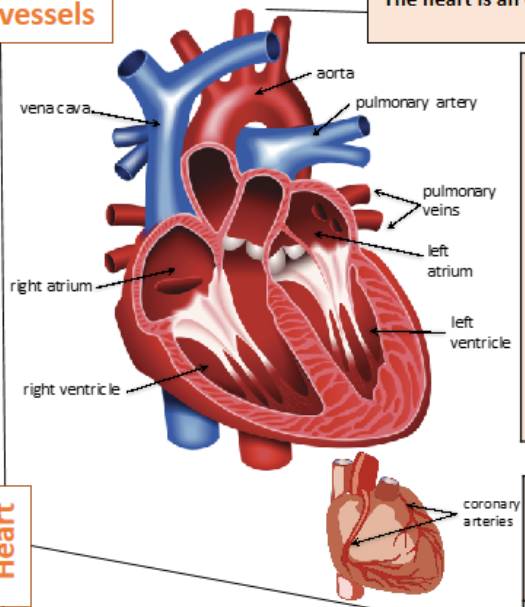
Blood vessels



Artery	Vein	Capillary
Carry blood away from the heart	*Carry blood to the heart*	*Connects arteries and veins*
Thick muscular walls, small lumen, carry blood under high pressure, carry oxygenated blood (except for the pulmonary artery).	Thin walls, large lumen, carry blood under low pressure, have valves to stop flow in the wrong direction, carry deoxygenated blood (except for the pulmonary vein).	One cell thick to allow diffusion, Carry blood under very low pressure.

Heart

The heart is an organ that pumps blood around the body in a double circulatory system



Different structure in the heart have different functions	
Right ventricle	Pumps blood to the lungs where gas exchange takes place.
Left ventricle	Pumps blood around the rest of the body. Thicker cardiac muscle in the wall.
Pacemaker (in the right atrium)	Controls the natural resting heart rate. Artificial electrical pacemakers can be fitted to correct irregularities.
Coronary arteries	Carry oxygenated blood to the cardiac muscle.
Heart valves	Prevent blood in the heart from flowing in the wrong direction.

Calculate heart rate, stroke volume and cardiac output

Cardiac output =

stroke volume x heart rate

Blood

Blood is a tissue consisting of plasma, in which blood cells, white blood cells and platelets are suspended

Plasma (55%)	*Pale yellow fluid*	Transports CO_2, hormones and waste.
Red blood cells (erythrocytes)(45%)	*Carries oxygen*	Large surface area, no nucleus, full of haemoglobin.
White blood cells (phagocytes and lymphocytes)(<1%)	*Part of the immune system*	Some produce antibodies, others surround and engulf pathogens.
Platelets (<1%)	*Fragments of cells*	Clump together to form blood clots.

Respiration

Cellular respiration is an exothermic reaction which is continuously occurring in all living cells

Aerobic respiration

Respiration with oxygen. Occurs inside the mitochondria continuously

Glucose is oxidised by oxygen to transfer the energy the organism needs to perform it's functions.

$C_6H_{12}O_6 + O_2 \longrightarrow CO_2 + H_2O$

glucose + oxygen → carbon dioxide + water

Aerobic respiration releases a large amount of energy from each glucose molecule

Anaerobic respiration

Respiration when oxygen is in short supply. Occurs during intensive exercise

During hard exercise, muscle cells are respiring so fast that blood cannot transport enough oxygen to meet their needs.

Glucose is partially oxidised to produce lactic acid which builds up in muscle tissue causing them to become painful and fatigued.

glucose → lactic acid

Anaerobic respiration releases a much smaller amount of energy than aerobic respiration.

The incomplete oxidation of glucose causes a build up of lactic acid and creates an oxygen debt

Development Stage Science (Year 8)

Knowledge Organiser

Topic: Health

Asthma	A respiratory condition marked by attacks of spasm in the bronchi of the lungs, resulting in difficulty breathing.
Carbon monoxide	A toxic gas found in cigarettes which reduces the amount of Oxygen that blood can carry.
Nicotine	a poisonous chemical, found in tobacco in cigarettes, that is addictive.
Tar	A sticky substance which contains chemicals called carcinogens which cause cancer.
Stimulant	A drug that excites any bodily function, but more specifically those that stimulate the brain and central nervous system.
Depressant	A drug that slows the activity of vital organs of the body (e.g. alcohol).
Drug	A chemical substance that changes the way the body works.
Clinical trial	Any research study that uses human participants to test medicines to evaluate the effects on health.
Placebo	A substance that has no therapeutic effect, used as a control in testing new drugs.

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Links to GCSE Biology

EDEXCEL GCSE HEALTH DISEASE AND MEDICINE part 3

Healthy weight can be calculate using waist:hip ratio and the equation for BMI.

$$BMI = \frac{mass\ (kg)}{(height\ (m))^2}$$

Lifestyle factors and their effects on non-communicable disease

Disease	lifestyle factors
Obesity and malnutrition	Lack of exercise and consuming too many/too few calories through an unbalanced diet. Schools meals are balanced to combat this in young people.
Liver disease	Large amounts of alcohol taken over a long period of time can lead to liver disease e.g. cirrhosis. The NHS spends over £500 million a year treating liver disease.
Cardiovascular disease	Smoking leads to damage and blocking of arteries supplying the heart with oxygenated blood. WHO estimates that 6 million people die globally as a result of smoking related illnesses.

Non-communicable diseases are caused by the interaction of a number of factors

Disease	Interacting factors
Cardiovascular disease	Diet, obesity, smoking, drinking alcohol, lack of exercise, genetics.
Cancer	
Lung disease	
Liver disease	
Malnutrition	

Non-communicable diseases

Discovery of new drugs

Drugs (including antibiotics) have to be tested and trialled before to check they are safe and effective

New drugs are extensively tested for:

Efficacy	Make sure the drug works
Toxicity	Check that the drug is not poisonous
Dose	The most suitable amount to take

Preclinical trials - using cells, tissues and live animals - must be carried out before the drug can be tested on humans.

Clinical trials use healthy volunteers and patients

Stage 1	*Stage 2*	*Stage 3*	*Stage 4*
Healthy volunteers try small dose of the drug to check it is safe record any side effects	A small number of patients try the drug at a low dose to see if it works	A larger number of patients; different doses are trialled to find the optimum dose	A double blind trial will occur. The patients are divided into groups. Some will be given the drug and some a placebo.

Double blind trial: patients and scientists do not know who receives the new drug or placebo until the end of the trial. This avoids bias.

A placebo can look identical to the new drug but contain no active ingredients

Monoclonal antibodies (Biology only HT)

Monoclonal antibodies — *Identical copies of one types of antibody produced in laboratory*

1. A mouse is injected with pathogen.
2. Lymphocytes produce antibodies (but do not divide).
3. Lymphocytes are removed from the mouse and fused with rapidly dividing mouse tumour cells.
4. The new cells are called hybridomas.
5. The hybridomas divide rapidly and release lots of antibodies which are then collected.

Monoclonal antibodies can be used in a variety of ways

Testing	*Diagnosis*
e.g. pregnancy test – measure the level of hormones	Can detect very small quantities of chemicals in the blood

Specific to one binding site on the antigen. Can target specific chemicals or cells in the body unlike drug and radiotherapy treatments.

Treating CVD

Evaluating different treatments for cardiovascular disease (CVD)

Life long medication	*Surgical procedures*	*Lifestyle changes*
Medicines to reduce blood pressure and cholesterol. Statins for lowering cholesterol carry a small risk of developing diabetes.	A stent can be surgically inserted into blocked blood vessel. Blocked blood vessels can be bypassed with inserted blood vessels. This treatment requires life long medication.	Giving up smoking, drinking excess alcohol and taking more exercise can reduce the risk of CVD. Some patients may not stick to lifestyle changes.

Development Stage Science (Year 8)

Knowledge Organiser

Topic: Acids & Bases

Acid	A substance that turns litmus red. It has a pH of less than 7.
Base	Substance that turns litmus blue. Has a pH of more than 7.
Alkali	A base that is soluble in water.
pH	A figure expressing the acidity or alkalinity of a solution
Corrosive	Substances that attack metals, stonework and skin are called corrosive.
Hydrochloric acid	A common acid that is also found in your stomach.
Sulfuric acid	A common acid. Use in car batteries.
Indicator	A dye that will change colour in acids and alkalis.
Universal indicator	A mixture of indicators giving a different colour depending on how weak or strong an acid or base is.
Litmus	A simple kind of indicator. It turns red in acids and blue in base
Neutral	Substance that is not an acid or an base. Has a pH of 7.
Antacid	A medicine containing an alkali used to cancel out some of the acid in the stomach to treat heartburn.

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Links to GCSE Chemistry

Base	*A base is any substance that reacts with an acid to form a salt and water only*
Examples of soluble bases	*Alkalis e.g. sodium hydroxide, potassium hydroxide*

Concentrated	*High mass of substance in a given volume of solution*
Dilute	*Low mass of substance in a given volume of solution*
Strong acids	*Completely ionised in aqueous solutions e.g. hydrochloric, nitric and sulfuric acids.*
Weak acids	*Only partially ionised in aqueous solutions e.g. ethanoic acid, citric acid.*
Hydrogen ion concentration	*As the pH decreases by one unit (becoming a stronger acid), the hydrogen ion concentration increases by a factor of 10.*

Acids

Strong and weak acids (HT ONLY)

EDEXCEL TOPIC 3: CHEMICAL CHANGES 1

Acids

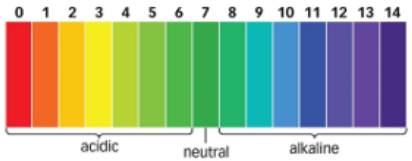
Reactions with acids		
Metals	*Metal + acid → metal salt + hydrogen*	Magnesium + hydrochloric acid → magnesium chloride + hydrogen
Metal oxides	*Metal oxide + acid → metal salt + water*	Copper oxide + sulfuric acid → copper sulfate + water
Metal hydroxides	*Metal hydroxide + acid → metal salt + water*	Sodium hydroxide + nitric acid → sodium nitrate + water
Metal carbonates	*Metal carbonates + acid → metal salt + carbon dioxide + water*	Calcium carbonate + sulfuric acid → calcium sulfate + carbon dioxide + water

Reactions with acids

Producing salts from insoluble reactants

Soluble salts	*Soluble salts can be made from reacting acids with solid insoluble substances (e.g. metals, metal oxides, hydroxides and carbonates).*
Production of soluble salts	*Add the solid to the acid until no more dissolves. Filter off excess solid and then crystallise to produce solid salts.*

Universal indicator	*Red in acid, green in neutral and blue in alkali*
Litmus	*Red in acid, purple in neutral and blue in alkali*
Methyl orange	*Red in acid, yellow in neutral and yellow in alkali*
Phenolpthalein	*Colourless in acid and in neutral and pink in alkali*



The pH scale and indicators

Gas tests

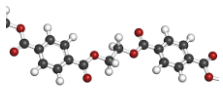
Gas	Test	Positive result
Hydrogen	*Burning splint*	'Pop' sound.
Carbon dioxide	*Limewater*	Goes cloudy (as a solid calcium carbonate forms).

Producing salts from soluble reactants

Titration	*The acid and the soluble reactant are mixed in the correct proportions and the remaining solution is only salt and water*

A neutralisation reaction is between an acid and a base	In neutralisation reactions, hydrogen ions react with hydroxide ions to produce water: $H^+ + OH^- \rightarrow H_2O$

Acids	*Acids produce hydrogen ions (H^+) in aqueous solutions.*
Alkalis	*Aqueous solutions of alkalis contain hydroxide ions (OH^-).*



Development Stage Science (Year 8)

Knowledge Organiser

Topic: Materials

Sustainability	Meeting the needs of the present, without compromising the ability of future generations to meet their own needs.
Monomer	A simple molecule.
Polymer	Very large molecules made from many smaller molecules called *monomers*.
Ceramic	Made from materials joined together by heat.
Composite	Made from two or more different materials with different properties.
Kevlar	A manufactured fibre that is very strong.
Nylon	A tough, lightweight, elastic synthetic polymer with a protein-like chemical structure.
Hydrocarbon	A chemical compound consisting entirely of hydrogen and carbon.
Combustion	A burning reaction, when a fuel combines with oxygen and releases energy.

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Links to GCSE Chemistry

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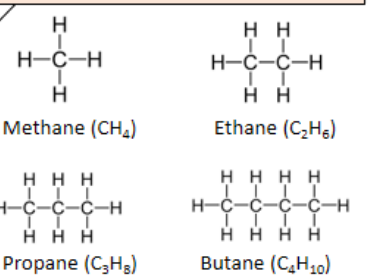
Carbon compounds as fuels and feedstock

EDEXCEL TOPIC 8: Fuels and Earth Science

Crude oil, hydrocarbons and alkanes

Crude oil	*A finite resource*	Consisting mainly of plankton that was buried in the mud, crude oil is the remains of ancient biomass.
Hydrocarbons	*These make up the majority of the compounds in crude oil*	These compounds are made up of hydrogen and carbon only.
General formula for alkanes	C_nH_{2n+2}	For example: C_2H_6 C_6H_{14}

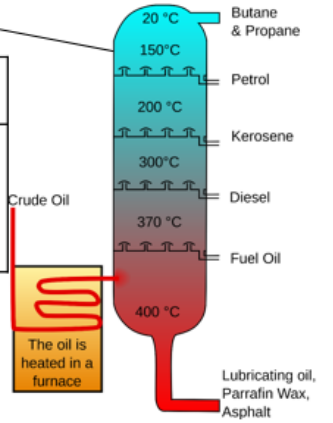
Display formula for first four alkanes



Fractional distillation and petrochemicals

Fractions	*The hydrocarbons in crude oil can be split into fractions*	Each fraction contains molecules with a similar number of carbon atoms in them. The process used to do this is called fractional distillation.
Using fractions	*Fractions can be processed to produce fuels and feedstock for petrochemical industry*	We depend on many of these fuels; petrol, diesel and kerosene. Many useful materials are made by the petrochemical industry; solvents, lubricants and polymers.

Hydrocarbon chains		
	In oil	Hydrocarbon chains in crude oil come in lots of different lengths.
	Boiling points	The boiling point of the chain depends on its length. During fractional distillation, they boil and separate at different temperatures due to this.



Cracking	*The breaking down of long chain hydrocarbons into smaller, more useful chains*	The smaller chains are more useful. Cracking can be done by various methods including catalytic cracking and steam cracking.

Fuels

Sulfur dioxide	*Released from burning hydrocarbons with sulfur impurities in*	Sulfur dioxide dissolves in rain water to form acid rain. This damages plant life and can make water habitats acidic. Acid rain can also erode limestone and sandstone structures.
Oxides of nitrogen	*Oxygen and nitrogen react under high temperatures to form these*	As pollutants, oxides of nitrogen can damage the ozone layer and are also classified as greenhouse gases. Can cause respiratory problems.

Hydrogen fuel	*Hydrogen reacts with oxygen in the engine to power the vehicle*	**Advantages:** - Water is the product - No greenhouse gases released - Renewable **Disadvantages:** - Expensive to buy - Difficult to re-fuel
Fossil fuels	*Crude oil, natural gas and coal*	Petrol, kerosene and diesel oil are non-renewable. Methane is found in natural gas and is also non-renewable.

Incomplete combustion issues	*Carbon monoxide is an odourless, toxic gas that can kill*	Soot (carbon) is also produced that builds up in the atmosphere and can cause global dimming. This reduces the amount of sunlight that reaches the Earth and can alter rainfall patterns.

Combustion	During the complete combustion of hydrocarbons, the carbon and hydrogen in the fuels are oxidised, releasing carbon dioxide, water and energy.
Incomplete combustion	During the incomplete combustion of hydrocarbons, there is not enough oxygen available for complete combustion. The products of the reaction is carbon monoxide, carbon and water.

Complete combustion of methane:
Methane + oxygen → carbon dioxide + water + energy
CH_4 (g) + $2O_2$ (g) → CO_2 (g) + 2 H_2O (l)

Boiling point (temperature at which liquid boils)	*As the hydrocarbon chain length increases, boiling point increases.*
Viscosity (how easily it flows)	*As the hydrocarbon chain length increases, viscosity increases.*
Flammability (how easily it burns)	*As the hydrocarbon chain length increases, flammability decreases.*

Development Stage Science (Year 8)

Knowledge Organiser

Topic: Energy

Energy	The word used to describe what makes thing work.
Fuel	Anything that stores energy that can be converted into heat energy, e.g. fossil fuels, nuclear and biofuels.
Joule	The unit for measuring energy. Symbol, J.
Absorb	When energy is 'soaked up' or 'taken in'. If something absorbs light it soaks it up and does not let it back out.
Conduction	The way that heat travels through solids.
Convection	Convection is a heat transferring process that occurs in **liquids** and **gasses.**
Radiation	A warm or hot object gives off infrared as heat waves, which can be absorbed by another object, heating it up.
Temperature	How hot something is, measured in ºC.

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Links to GCSE Physics

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System	An object or group of objects that interact together

Closed system	No change in total energy in system
Open system	Energy can dissipate (can enter or leave)

Dissipate	To scatter in all directions or to use wastefully

When energy is 'wasted', it dissipates into the surroundings as thermal energy and the temperature rises.

Useful energy	Energy transferred and used
Wasted energy	Dissipated energy, stored less usefully

Conduction transfers thermal energy through solid objects.

Thermal conductivity
How well a material conducts energy
Metals have high thermal conductivity.

Total energy input = useful energy output + wasted energy

Principle of conservation of energy	The amount of energy always stays the same.	Energy cannot be created or destroyed, only changed from one store to another.

Energy is only useful when it is transferred from one store to another useful store

Cavity walls	An air gap reduces the amount of energy transfer by conduction
Thick walls	Thick walls have a slow rate of energy transfer

In buildings the lower the thermal conductivity the slower the rate of energy transfer

Kinetic	Anything moving has energy in its kinetic energy store.
Thermal	Any object – the hotter it is the more energy is in its thermal energy store
Chemical	Anything that can release energy by a chemical reaction e.g. food, fuels
GPE	Anything that can fall / in a gravitational field
EPE	Anything stretched e.g. springs, rubber bands
Electrostatic	Two charges that attract or repel each other
Magnetic	Two magnets that attract or repel each other
Nuclear	Atomic nuclei release energy from this store in nuclear reactions

Energy transfers

Conservation of energy

EDEXCEL TOPIC 3 - CONSERVATION OF ENERGY (PART 1)

Efficiency

Efficiency	How much energy is usefully transferred

Efficiency = Useful output energy transfer / Total input energy transfer

Efficiency = Useful power output / Total power input

HIGHER ONLY

Efficiency can be increased by reducing the thermal energy transferred due to friction by lubricating and the energy transferred by heating by insulation.

Energy (KE, EPE, GPE, thermal)	Joules (J)
Velocity	Metres per second (m/s)
Mass	Kilogram (Kg)
Gravitational field strength	Newton per kilogram (N/Kg)
Height	Metres (m)

Gravitational Potential energy (GPE)	Energy gained by an object raised above the ground
Kinetic energy (KE)	Energy stored by a moving object

Change in GPE = Mass X gravitational field strength X change in vertical height
$\Delta GPE = m \times g \times \Delta h$

$KE = \frac{1}{2} \times mass \times (speed)^2$
$KE = \frac{1}{2} \times m \times v^2$

Transfers between stores	
Mechanical	A force acts on an object (doing work e.g. push, squash, stretch
Electrically	A charge doing work against resistance e.g. charges moving round a circuit
By heating	Energy transfers from a hot object to a cooler object e.g. hot drink
By radiation	Energy transfers by waves e.g. sunlight reaching the Earth

Energy transfer diagrams	An easy way to show what happens to the energy
	Boxes = energy stores and arrows = energy transfers

Unit
Joules (J)

Thermal energy store of hot drink

By heating Thermal energy transfers from hot liquid to cooler air and cup

Thermal energy store of cup and surrounding s

Important energy Transfers between stores	
An object projected upwards or up a slope	The object does work against gravity so energy is transferred mechanically from the object's KE store to the GPE store.
A moving object hitting an obstacle	The moving object has energy in it's KE store. Some of this is mechanically transferred to the obstacle's KE store. Some energy is mechanically transferred to the thermal energy store of the object and obstacle, to the thermal energy store of the surroundings by heat and the rest of the energy is 'carried' away by sound
An object being accelerated by a constant force	Assuming there is no air resistance, gravity does work on the object. The object accelerates constantly towards the ground. Energy is transferred mechanically from the GPE store to the object's KE store.
A vehicle slowing down	Energy in the vehicle's KE store is transferred mechanically due to friction between the road and tyres, and then by heating to the thermal energy store of the vehicle and road.
Boiling water in an electric kettle	Energy is transferred electrically from the mains to the element in the kettle. The energy is then transferred by heating to the thermal energy store of the water.

Development Stage Science (Year 8)

Knowledge Organiser

Topic: The Environment

Producer	Green plants that use the sunlight to make their food through photosynthesis
Primary Consumer	An animal that eats plants.
Secondary Consumer	An animal that feeds on small plant eating animals.
Predator	An animal that hunts other animals for food.
Prey	An animal that is hunted by other animals.
Abiotic factors	Non-living conditions that can influence where plants or animals live, e.g. temperature, the amount of light.
Bio-magnification	Bio-magnification (or bioaccumulation) refers to the ability of living organisms to accumulate certain chemicals to a high concentration.
Climate change	a change in global or regional climate patterns.
Greenhouse effect	The trapping of the sun's warmth in a planet's lower atmosphere

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Links to GCSE Biology

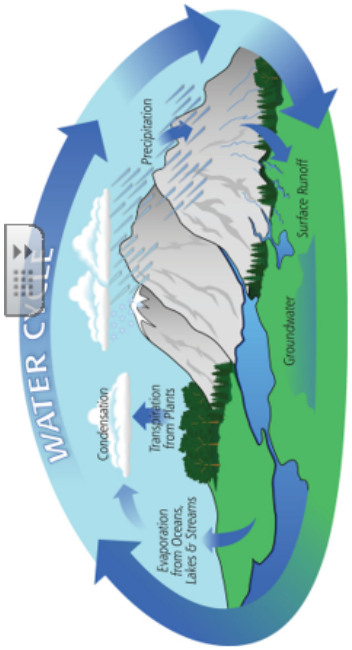
Ecosystem	
Environment	The conditions surrounding an organism; abiotic and biotic.
Habitat	Place where organisms live e.g. woodland, lake.
Population	Individuals of a species living in a habitat.
Community	Populations of different species living in a habitat.

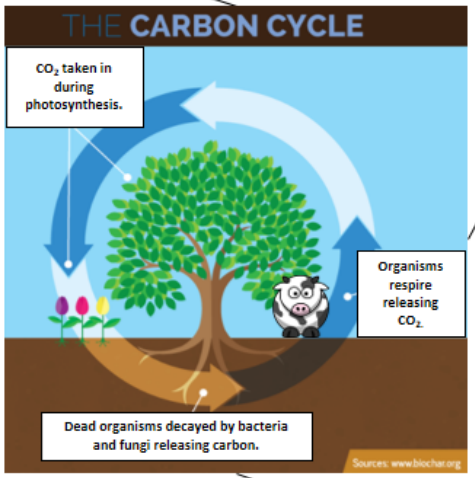
Organisms require a supply of materials from their surroundings and from the other living organisms.

Surviving and reproducing	
Competition	Plants in a community or habitat compete with each other for light, space, water and mineral ions.
	Animals compete with each other for food, mates and territory.
Interdependence	Species depend on each other for food, shelter, pollination, seed dispersal etc. Removing a species can affect the whole community

Bacteria respire when breaking down dead organisms releasing CO_2.

In times of drought desalination plants can be used to produce potable water.





Decomposition and material cycling in abiotic an biotic systems

Interdependence and competition

EDEXCEL GCSE Ecosystems and material cycles PART 1

Parasitism and mutualism	
Parasites	Parasites feed off a host causing harm to the host e.g. tape worm living inside digestive system.
Mutualistic relationships	e.g. insects and flowers in pollination. Plant ovum are successfully fertilised, insect species receive food (nectar)

Abiotic and biotic factors.

Levels of organisation

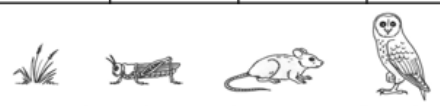
Materials are recycled to provide the building blocks for future organisms

Abiotic	Biotic
Non-living factors that affect a community	*Living factors that affect a community*
Living intensity.	Availability of food.
Temperature.	
Moisture levels.	New predators arriving.
Soil pH, mineral content.	
Wind intensity and direction.	New pathogens.
Carbon dioxide levels for a plant.	One species outcompeting so numbers are no longer sufficient to breed
Oxygen levels for aquatic organisms.	

Food chains

Feeding relationships in a community

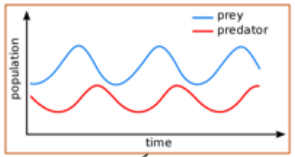
Producer	Primary consumer	Secondary consumer	Tertiary consumer



All food chains begin with a producer e.g. grass that is usually a green plant or photosynthetic algae.

Consumers that kill and eat other animals are predators and those eaten are prey.

Photosynthetic organisms are the producers of biomass for life on Earth



In a stable community the numbers of predators and prey rise and fall in cycles.

Rate of decomposition (biology only)

$$\text{Rate} = \frac{\text{mass lost}}{\text{number of days}}$$

Factors affecting rate of decay and food preservation (biology only)

Temperature, water, oxygen

Increase the rate of decay when increased. In enzyme controlled reactions raising the temperature too high will denature the enzymes.

Development Stage Science (Year 8)

Knowledge Organiser

Topic: Rocks

Rock	A solid mixture of different minerals.
Sedimentary	A type of rock consisting of layers and small grains. Often contain fossils.
Igneous	A type of rock consisting of randomly arranges, interlocking crystals. Formed when magma cools.
Metamorphic	Contain layers of crystals. Dense & hard. Formed by extreme pressure & temperature.
Weather	Break down rocks by changes in conditions.
Deposit	When rock fragments settle.
Crust	The outer solid rock that covers the surface of the earth.
Chalk	A sedimentary rock formed by cementation of sediment.
Granite	An type of igneous rock.
Marble	A metamorphic rock formed from limestone.
Cement	The minerals that bind rocks together.

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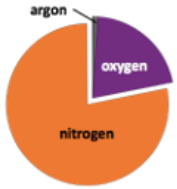
Links to GCSE Chemistry



Gas	Percentage
Nitrogen	~80%
Oxygen	~20%
Argon	0.93%
Carbon dioxide	0.04%

Proportions of gases in the atmosphere

Algae and plants	These produced the oxygen that is now in the atmosphere, through photosynthesis.	carbon dioxide + water → glucose + oxygen $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$
Oxygen in the atmosphere	First produced by algae 2.7 billion years ago.	Over the next billion years plants evolved to gradually produce more oxygen. This gradually increased to a level that enabled animals to evolve.

How oxygen increased

Volcano activity 1st Billion years	Billions of years ago there was intense volcanic activity	This released gases (mainly CO_2) that formed to early atmosphere and water vapour that condensed to form the oceans.
Other gases	Released from volcanic eruptions	Nitrogen was also released, gradually building up in the atmosphere. Small proportions of ammonia and methane also produced.
Reducing carbon dioxide in the atmosphere	When the water vapour condensed, the oceans formed and the carbon dioxide dissolved into it	This formed carbonate precipitates, forming sediments. This reduced the levels of carbon dioxide in the atmosphere.

The Earth's early atmosphere

Reducing carbon dioxide in the atmosphere	Algae and plants	These gradually reduced the carbon dioxide levels in the atmosphere by absorbing it for photosynthesis.
Formation of sedimentary rocks and fossil fuels	These are made out of the remains of biological matter, formed over millions of years	Remains of biological matter falls to the bottom of oceans. Over millions of years layers of sediment settled on top of them and the huge pressures turned them into coal, oil, natural gas and sedimentary rocks. The sedimentary rocks contain carbon dioxide from the biological matter.

How carbon dioxide decreased

Earth and atmospheric science

EDEXCEL TOPIC 8: Fuels and Earth science 2

Earth and atmospheric science

Greenhouse gases

Carbon dioxide, water vapour and methane	Examples of greenhouse gases that maintain temperatures on Earth in order to support life
The greenhouse effect	Radiation from the Sun enters the Earth's atmosphere and reflects off of the Earth. Some of this radiation is re-radiated back by the atmosphere (including carbon dioxide, methane and water vapour) to the Earth, warming up the global temperature.

Human activities and greenhouse gases

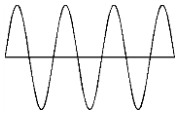
Carbon dioxide	Human activities that increase carbon dioxide levels include burning fossil fuels and deforestation.
Methane	Human activities that increase methane levels include raising livestock (for food) and using landfills (the decay of organic matter released methane).
Climate change	There is evidence to suggest that human activities will cause the Earth's atmospheric temperature to increase and cause climate change.

Testing for oxygen	Glowing splint	Re-lights the splint in the presence of oxygen.

The total amount of greenhouse gases emitted over the full life cycle of a product/event. This can be reduced by reducing emissions of carbon dioxide and methane.

Effects of climate change
Rising sea levels
Extreme weather events such as severe storms
Change in amount and distribution of rainfall
Changes to distribution of wildlife species with some becoming extinct

Carbon dioxide concentration	There is a correlation between atmospheric carbon dioxide levels, fossil fuel usage and global temperature change	There are errors with these measurements due to the location they were taken and the historical accuracy before scientific methods became more robust.



Topic: Waves

Development Stage Science (Year 8)

Knowledge Organiser

Reflect	To bounce back from a surface.
Refraction	The bending of a wave through a medium.
Light	A medium for energy to be transferred.
Medium	A material through which energy can be transferred through.
Normal	A line at right angles to a surface.
Sound	A medium for transferring energy.
Pitch	How high or low a note is.
Frequency	The number of vibrations per second.
Amplitude	The height of a wave.
Wave	How sound or light travels.

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Links to GCSE Physics

Velocity	*The speed of the wave in a certain direction*
Wavelength	*Distance from one point on a wave to the same point of the next wave*
Amplitude	*The maximum disturbance from its rest position*
Frequency	*Number of waves per second*
Wave front	*The position of all the particles of the medium, vibrating in the same state*
Period	*Time taken to produce 1 complete wave*

Wave speed	Wave speed = frequency X wavelength	$V = f X \lambda$
Wave period	Wave period = 1 ÷ frequency	$T = 1 \div f$
Wave Speed	Speed = distance ÷ time	$v = d \div t$

Sound waves travelling through different mediums, the frequency stay constant.

Equations

Core Practical

Determine the speed of frequency and wavelength of a wave in a solid and a fluid

Fluid - Using ripple tank

Solid – using peak frequency

Waves transfer energy	Waves transfer energy and information in the direction they are travelling without transferring matter

When waves travel through a medium, the particles of the medium vibrate but stay in the same place. The energy and information is transferred between particles.

Medium	*Material through which waves travel.*

Basics of waves

Air Water

EDEXCEL TOPIC 4 - WAVES

Measuring waves

Speed	*Measure the time it takes for waves to travel a certain distance*	Time how long an echo takes to reach you (air)
		Time how long a wave travels between 2 fixed points (water)

Transverse wave	*Vibration causing the wave is at right angles to the direction of energy transfer*	Energy is carried outwards by the wave.	Water and light waves, S waves.
Longitudinal wave	*Vibration causing the wave is parallel to the direction of energy transfer*	Energy is carried along the wave.	Sound waves, P waves.

Properties of waves

Speed of Light = 3×10^8 m/s

Speed of sound = 340m/s

Wave speed = frequency X wavelength so if velocity changes either frequency or wavelength (or both) also changes

When waves travel from medium to medium, velocity, frequency and wavelength may be affected.

HIGHER ONLY

Refraction	*Waves changes direction at boundary.*

Waves travel through different medium at different speeds

Speed of waves in water depends upon depth

Waves change speed due to the different density of mediums.

If the waves goes from a thinner medium to a thicker medium, (e.g. air to glass), it will slow down.

If the waves goes from a thicker medium to a thinner medium, (e.g. glass to air), it will quicken up.

What actually happens to a wave depends upon it's wavelength and the property of the material involved.

From deep water to shallow water, speed slows down

Sound waves enters a different medium, wavelength or velocity change.

Sound waves have the same pitch regardless of medium travelled through.

PHSICS HIGHER ONLY

Sonar	*Reflected off objects*	Used to determine depth of objects under the sea.
Ultra sound	*Partially reflected off boundary*	Used for medical and foetal scans.
Infra-sound	*Seismic waves (P and S) used to explore Earth's core*	P waves can travel through the core, S waves cannot.

Ultrasound	*Above 20,000Hz*
Infrasound	*Below 20Hz*

You must know how sound travels through the ear.

Hearing	*Frequencies between 20 – 20,000 Hz*

Longitudinal waves cause ear drum to vibrate, amplified by three ossicles which creates pressure in the cochlea.

Sound waves travel at different speeds in different media. Sound waves travel faster in solids, than liquids than gases.

Frequency does not change but wavelength does ($v = f\lambda$).

Wavelength increases as speed increases, if speed slows down, wavelength get shorter.

PHSICS ONLY

Absorption	*Passes into but not out of, transfers energy and heats up the object.*
Transmission	*Passes through the object.*
Reflection	*Wave bounces off the surface.*
Refraction	*Waves changes direction at boundary.*

PHSICS HIGHER ONLY

Calculating depth or distance from time and wave velocity

Energy stored inside a system by particles	Internal energy is the total kinetic and potential energy of all the particles (atoms and molecules) in a system.
Heating changes the energy stored within a system	Heating causes a change in state. As particles separate, potential energy stored increases. Heating increases the temperature of a system. Particles move faster so kinetic energy of particles increases.

Development Stage Science (Year 8)

Knowledge Organiser

Topic: Genetics

Classification	Grouping organisms based on their characteristics.
Variation	Differences in characteristics between organisms.
Inherited variation	Variation in a characteristic that is a result of genetic inheritance from the parents.
Environmental variation	Variation in characteristics caused by factors such as climate, diet, accidents, culture and lifestyle.
DNA	Carries the code that controls what cells are made of and what they do.
Gene	A section of DNA that codes for a characteristic.
Chromosome	A very long molecule of tightly coiled DNA. Each human cells contains 46.
Nucleus	Where the DNA is found in an animal/plant cell.
Selective breeding	Where humans breed plants and animals for particular chosen genetic characteristics which are either useful or for appearance.
Genetic engineering	Where a gene is taken from the DNA of one organism and placed into the DNA of another organism.

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Links to GCSE Biology

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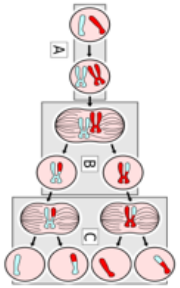
Meiosis halves the number of chromosomes

Gametes are made in reproductive organs (in animals ovaries and testes)

Cells divide by meiosis to form gametes

- Copies of the genetic information are made.
- The cell divides twice to form four daughter cells each with half the number of chromosomes.
- All haploid gametes are genetically different from each other.



Gametes join at fertilisation to restore the number of chromosomes

The new cell divides by mitosis. The number of cells increase. As the embryo develops cells differentiate.

Meiosis leads to non-identical cells being formed while mitosis leads to identical cells being formed

Meiosis

DNA and the genome

Sexual and asexual reproduction

Advantages and disadvantages of sexual and asexual reproduction (Biology only)

Reproduction advantages/disadvantages	
Sexual	***Asexual***
Needs two parents.	Only one parent needed (quicker).
Produces variation in the offspring.	Identical offspring (no variation).
If the environment changes variation gives a survival advantage by natural selection.	Vulnerable to rapidly changing conditions due to lack of variation.
Negative mutations are not always inherited.	Negative mutation can affect all offspring.
Natural selection can by speeded up using selective breeding to increase food production.	Food/medicine production can be extremely quick.

Genetic material in the nucleus is composed of a chemical called DNA.

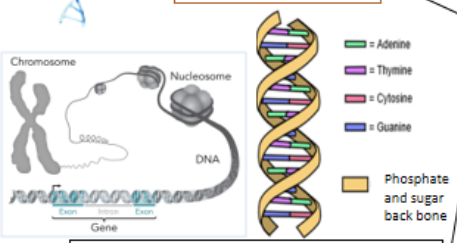
DNA structure

Polymer made up of two strands forming a double helix.

Contained in structures called chromosomes. A gene is a small section of DNA on a chromosome. Each gene codes for a sequence of amino acids to make a specific protein.

Edexcel GCSE BIOLOGY, GENETICS Part 1

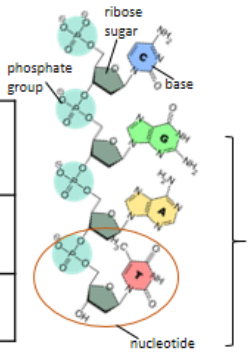
DNA structure



(HT only) Not all parts code for proteins. Non-coding parts can switch genes on and off. Mutations may affect how genes are expressed.

DNA is polymer made from four different nucleotides. Each nucleotide consists of a common sugar, phosphate group and one of 4 different bases A, C, G & T

Repeating nucleotide units.



In DNA the complementary strands C, A, T, G always link in the same way. C always linked to G on the opposite strand and A to T.

Extracting DNA

DNA can be extracted from fruit

- Dissolve salt and washing up liquid together with a mashed up sample of fruit (kiwi fruit is good) and place in a 60°C water bath for 15 minutes.
- Filter and add protease solution to the filtrate in a boiling tube. Tilt the boiling tube and carefully add ice cold ethanol.
- The white layer that forms at the interphase is DNA and can be pulled out on a glass rod

Protein synthesis (Biology HT only)

(Biology HT) A sequence of 3 bases is the code for a particular amino acid. The order of bases controls the order in which each amino acids combine and fold to produce a specific shaped protein such as enzymes..

Genetic variants.

In non coding DNA	Affects phenotype by influencing the binding of RNA polymerase and altering the quantity of protein produced.
In coding DNA	Affects phenotype by altering the sequence of amino acids and therefore the activity of the protein produced.

Making new proteins (protein synthesis) transcription and translation

Composed of chains of amino acids. A sequence of 3 bases (codon) codes for a particular amino acid.

RNA polymerase binds to non-coding DNA located in front of a gene.

⇩

RNA polymerase produces a complementary mRNA strand from the coding DNA of the gene.

⇩

mRNA moves from the nucleus and attaches to a ribosome in the cytoplasm.

⇩

Ribosomes translate each triplet of bases (codons) into specific amino acids according to mRNA template

⇩

Amino acids are transferred to the ribosome by tRNA.

⇩

Amino acids are linked together to form polypeptides.

Development Stage Science (Year 8)

Knowledge Organiser

Topic: Human Impacts on the Environment

Biofuels	Fuels produced from plant material.
Carbon cycle	The processes involved in recycling carbon.
Photosynthesis	Chemical reaction that plants use to make their own food. Requires light energy. Carbon dioxide & water are the reactants and glucose & oxygen are the products.
Respiration	A chemical reaction by which energy is released from cells.
Decomposers	Organisms (such as bacteria) that break down dead or decaying organisms.
Fossil fuels	Natural, finite fuel, formed from the remains of living organisms, e.g. coal, oil and natural gas.
Combustion	A burning reaction, when a fuel combines with oxygen and releases energy.
Climate change	A change in global or regional climate patterns.
Greenhouse effect	The trapping of the sun's warmth in a planet's lower atmosphere.
Greenhouse gas	A gas that contributes to the greenhouse effect, e.g. carbon dioxide.

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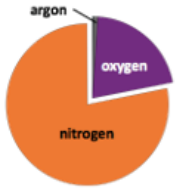
Links to GCSE Chemistry



Gas	Percentage
Nitrogen	~80%
Oxygen	~20%
Argon	0.93%
Carbon dioxide	0.04%

Proportions of gases in the atmosphere

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EDEXCEL TOPIC 8: Fuels and Earth science 2

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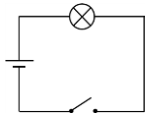

Development Stage Science (Year 8)

Knowledge Organiser

Topic: Electricity & Magnetism

Ammeter	Measures how much electricity is flowing around a circuit.
Cell	A source of electricity with a low ‘energy’. Cells push electrons round a circuit.
Electric current	The flow of electricity around a circuit.
Insulator	A material that does not let electricity flow through it.
Switch	Turns electricity on or off, by closing or opening a gap in a circuit.
Voltage	A way of saying how much energy is transferred by electricity.
Electron	Tiny particle that flows around a circuit.
Resistance	A way of saying how difficult it is for electricity to flow through something.
Resistor	A component that makes it difficult for electricity to flow – resistors are used to control the size of the current in a circuit.
Parallel circuit	A circuit with two or more wires running next to each other.
Magnetic field	Fill the space around a magnet where the magnetic forces work, where they can attract or repel magnetic materials.
Attract	Occurs when you bring a north pole and a south pole of a magnet together.
Repel	Occurs when you bring two north poles or two south poles of a magnet together.

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Links to GCSE Physics

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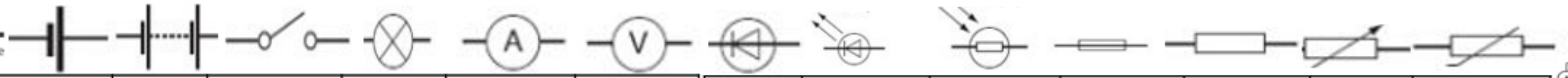
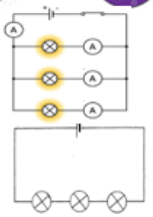


Electrons carry current. Electrons are free to move in metal.

Cell	Battery	Switch	Lamp	Ammeter	Volt meter	Diode	LED	LDR	Fuse	Resistor	Variable resistor	Thermistor
Store of chemical energy	*Two or more cells in series*	*Breaks circuit, turning current off*	*Lights when current flows*	*Measures current*	*Measures potential difference*	*Current flows one way*	*Emits light when current flows*	*Resistance low in bright light*	*Melts when current is too high*	*Affects the size of current flowing*	*Allows current to be varied*	*Resistance low at high temp*



Circuit symbols

Current and Charge

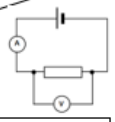
Current	*Flow of electrical charge*	Ampere (A)
Potential difference (p.d.)	*How much electrical work is done by a cell*	Volts (V)
Charge	*Amount of electricity travelling in a circuit*	Coulombs (C)

Charge = Current X time Q = I X t

Controlling current

Changing current

- *Change the p.d. of the cells*
- *Add more components*



Ammeter	*Set up in series with components*
Voltmeter	*Set up parallel to components*

R = V ÷ I

Resistance = Potential difference ÷ Current

Resistance (Ω)	*A measurement of how much current flow is reduced*
The higher the resistance, the more difficult it is for current to flow.	
Increasing resistance, reduces current.	
Increasing voltage, increases current.	

Current, potential difference and resistance

Series and parallel circuits

Series circuit	Current is the same in all components.	Total p.d. from battery is shared between all the components.	Total resistance is the sum of each component's resistance.
Parallel circuit	Total current is the sum of each component's current.	p.d. across all components is the same.	Total resistance is less than the resistance value of the smallest individual resistor.

Series	Parallel
A circuit with one loop	*A circuit with two or more loops*

Total p.d — *If cells are joined in series, add up individual cell values*

Electricity

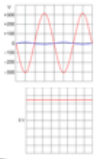
Energy transfers

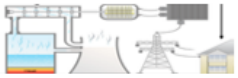
Work is done when charge flowing.

Power (W) = potential difference X current R = V X I

Power = (current)² X resistance P = I² X R

Energy transferred = Power X time E = P X t





National Grid — *Distributes electricity generated in power stations around UK*

Step-up transformers	Step-down transformers
Increase voltage, decrease current	*Decrease voltage, increase current*
Increases efficiency, reduces heat loss.	Makes safer for houses.

Domestic uses and safety

Thermistor	LDR
Resistance varies with temperature	*Resistance varies with light intensity*
Resistance decreases as temperature increases.	Resistance decreases as light increases.

Alternating current	Direct current
p.d. switches direction many times a second, current switches direction	*p.d. remains in one direction, current flows the same direction*
Generator.	Cell or battery.

'Earthing' a safety device; Earth wire joins the metal case.

Mains supply
Frequency 50Hz, 230V

3 pin plug			
	Live - Brown	Carries p.d from mains supply.	p.d between live and earth = 230V
	Neutral - Blue	Completes the circuit.	p.d. = OV
	Earth – Green and Yellow stripes	Only carries current if there is a fault.	p.d. = 0V

Current – Potential difference graphs

Ohmic conductor	*At a constant temperature, current is directly proportional to the p.d. across the resistor.*
Filament lamp	*As current increases, the resistance increases. The temperature increases as current flows.*
Diode	*Current flows when p.d. flows forward. Very high resistance in reverse.*

Static electricity

PHYSICS only

Static electricity	*Electrical charge is stationary*	When two insulating material are rubbed together, electrons move from one material to the other.

Like charges	*Repel*
Unlike charges	*Attract*

Shocks	Walking on carpet causes friction. Electrons move to the person and charge builds up. When the person touches a metal object, the electrons conduct away, making a spark.

Electric fields	Charged objects create electric fields around them. Strongest closest to the object. The field direction is the direction of force on a positive charge. Add more charge increases field strength.