Science

LET ALL OUR BRIGHT COLOURS SHINE

Year 8 Knowledge Organisers

8A – Food and Nutrition

1. Nutrients

Diet	The food that you eat- provides the raw materials your body needs for energy.
Nutrients	Food substances that provide the raw materials- carbohydrates, fats, proteins, vitamins, minerals
Carbohydrates	Starch and sugars
Fats	Liquid fats are oils. Fats and oils are called lipids.
Fibre	Made of plant cell walls- not used by the body. Helps food move through the intestines and stops them getting blocked.
Uses of Water	• a lubricant • dissolves substances to be carried around body • fills up cells, holding shape • sweat to cool you down
Food Labels	Show the amounts of different nutrients in food.
Starch Food Test	Add 2 drops of iodine. If it turns **blue-black** starch is present.
Protein Food Test	Add 5 drops of biuret solution. If it turns **purple** protein is present.
Fat Food Test	Rub on some white paper and hold up to the light. fats will leave a greasy mark

2. Uses of Nutrients

Uses of Carbohydrates	The body's main source of energy. *Bread, potatoes, pasta*
Uses of Fats	Another source of energy that is stored in your body. Some is stored under the skin to insulate the body. *Dairy products, fried food*
Maintaining Mass	The amount of fuel you use needs to balanced by the amount you eat.
Kilojoules (kJ)	The units for measuring the energy in food.
Respiration	The process that releases energy from food.
Energy Needs	Depends on age, sex and how active you are.
Uses of Proteins	Make new cells allowing us to grow and repair our bodies. *Meat, fish, cheese, beans, milk*
Uses of Vitamins and Minerals	Used in small amounts to maintain health.
Vitamin A	Needed for healthy skin and eyes.
Vitamin C	Helps cells in tissues stick together properly.
Calcium	Needed to make bones.
Iron	Makes red blood cells.

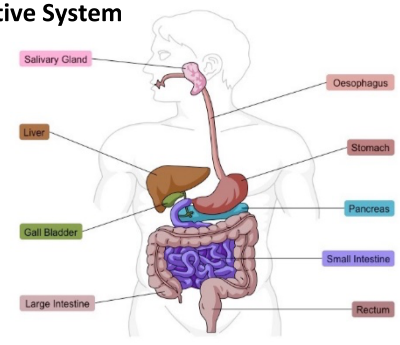
3. Balanced Diets

Balanced Diets	Eating a range of foods in the right amounts.
Malnutrition	Having too much / too little of a nutrient in your diet.
Deficiency Disease	Caused by lacking certain nutrients for a long time.
Kwashiorkor	Lack of protein causing a 'pot belly'.
Night Blindness	Lack of vitamin A.
Scurvy	Lack of vitamin C causing painful joints and bleeding gums.
Rickets	Lack of calcium / vitamin D causing bones not to form properly.
Anaemia	Lack of iron causing tiredness and shortness of breath.
Starvation	Lacking nearly all nutrients needed.
Obesity	Caused by eating food containing more energy than you need.
Heart Attack	Fat clogs arteries so little blood reaches the heart.
Reference Intakes	How much of each nutrient should be eaten in a day.

4. Digestion

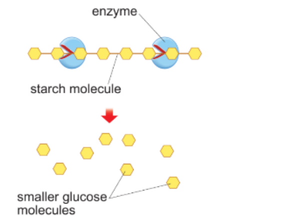
Digestion	Turning large insoluble molecules into small soluble ones.

Digestive System



Mouth	Teeth grind food and saliva helps digest food.
Gullet	(oesophagus / food pipe) Muscles contract pushing the food down.
Stomach	Food churned with acid.
Small Intestine	More digestive juices added- small digested molecules absorbed into body.
Large Intestine	Water is removed from undigested food- faeces formed.
Rectum	Stores faeces
Anus	Faeces pushed out body- egestion.
Gut Bacteria	Microorganisms needed to help digest food.
Enzymes	Substances that speed up the breaking down of large molecules- biological catalysts.

5. Absorption

Digesting Starch	
Blood	Digested nutrients dissolve in the blood plasma and are carried around the body to cells.
Diffusion	Movement of particles from an area of high concentration to low concentration.
Small Intestine Adaptations.	Has lots of tiny finger-shaped villi to increase surface area. Each villus has a folded top that forms microvilli. Villi walls are one cell thick for easier diffusion.
Alcohol	Causes fewer digestive enzymes to be released and can damage villi.

8B - Plants and their Reproduction

1. Classification and Biodiversity

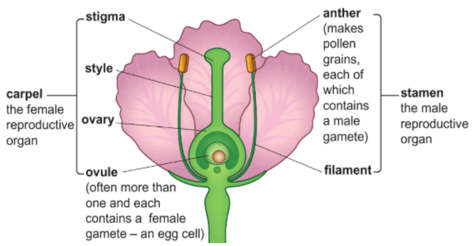
Classification	Sorting organisms into groups based on their characteristics.
Kingdoms	The five largest groups (each can be split into smaller groups)- *animals, fungi, protoctists, prokaryotes and plants*.
Plants	Members of the plant kingdom have cellulose cell walls, are multicellular and make their own food.
Scientific Name	We give organisms scientific names using the names of the last two groups- the genus and the species.
Scientific Name Advantages	Scientific names are agreed around the world so there is no confusion. Some species have the same common name in different places.
Biodiversity	The number of difference species in an area.
Advantages of High Biodiversity	Recover faster from disasters and useful substances can be found (medicines).
Extinct	When an organism dies out completely.

2. Types of Reproduction

Sexual Reproduction	Two organisms breeding to produce offspring.
Hybrids	The offspring of two different species- they are not fertile.
Fertile	Can produce offspring.
Inherited Variation	Characteristics inherited from parents (due to DNA).
Gametes	Sex cells
Zygote	The fertilised egg cell formed when the male and female gamete join.
Asexual Reproduction	Reproduction involving only one parent- produces offspring identical to the parent (clones).
Runners	An example of asexual reproduction used by strawberry plants. They spread over the ground and sprout roots to grow new identical plants.
Tubers	An example of asexual reproduction used by potato plants. They are underground stems (potatoes) that contain a store of food that can grow into a new plant.
Using Asexual Reproduction	Gardeners take cuttings of leaves/stems to grow new plants quickly and cheaply.

3. Pollination

Plant Reproductive System



Pollen	Male gamete that ripens inside the anthers.
Pollination	The pollen grain carried away and transferred to the stigmas of another plant can be by animals/wind/water/
Plant Adaptations for Animal Pollination	Brightly coloured petals, nice scent and nectar attract animals (mainly insects). The structure also makes it easier for animals to pick up / leave pollen grains.
Plant Adaptations for Wind Pollination	Pollen is smooth and light to float through air. large anthers and stigmas hang outside the flower to catch the wind.
Self-Pollination	Pollen grains from a plant land on the stigma of the same plant.
Cross-Pollination	Pollen transferred from one plant to another.

4. Fertilisation and Dispersal

Pollen Tube	Formed when a pollen grain reaches a stigma of the same species. It grows down to the ovule.
Fertilisation	The egg cell and the male gamete from the pollen grain join together to form a zygote.
Cell Division	The process by which the cell splits into two.
Embryo	Formed when the cells divide again and again.
Seed	The ovule becomes a seed. Inside the seed is the embryo and a food source.
Seed Coat	Hart outer coating of seed to protect it.
Germinate	The seed starts to grow.
Fruit	The ovary swells up and forms the fruit around the seed.
Seed Dispersal	The spreading of seeds away from the parent plant.
Attracting Animals	Fruits are fleshy, soft, juicy and taste good to attract animals for seed dispersal.
Egested	Seeds are passed out by animals in their faeces.
Other Seed Dispersal Methods	Wind, water and explosions- useful so that new plants aren't in competition with the parent plant.

5. Germination and Growth

Resources	What a plant needs to grow/germinate.
Respiration	The process of releasing energy from glucose.

Respiration Word Equation

glucose + oxygen → carbon dioxide + water

Dormant	Slow life processes but still alive- such as in a seed.
Photosynthesis	A process that plants use to make their own food.

Photosynthesis Word Equation

carbon dioxide + water → glucose + oxygen

Starch	Glucose is converted to starch to store it.
Chloroplasts	Traps light energy needed for photosynthesis.
Interdependent	Organisms that depend on one another.

8C - Breathing and Respiration

1. Aerobic Respiration

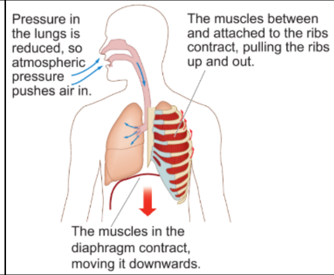
Robert Boyle	(1627-1691) placed a burning candle in a jar and sucked out all the air- the candle went out. Repeated with a mouse and the mouse died.
Joh Mayow	(1641-1679) did experiments to discover that only a certain part of the air was needed to keep candle burning and mouse alive.
Joseph Priestly & Antoine Lavoisier	(1733-1804) (1743-1794) Showed that oxygen was the part of air needed for the candle to burn and mouse to live- makes up 21% of air.
Aerobic Respiration	Using oxygen to release energy from glucose.

Aerobic Respiration Word Equation

glucose + oxygen → carbon dioxide + water

Combustion	The word equation for combustion (burning) of glucose is the same as above but occurs in a different way.
Reactants	The starting substances- written on left of word equation.
Products	The new substances made- written on right of word equation.

2. Gas Exchange System

Breathing	Muscle movement allowing the lungs to expand/contract.
Ventilation	Movement of air into / out of the lungs.
Diaphragm	Organ below the lungs that contracts / relaxes changing the size of the lungs.
Inhalation breathing in	

Mucus	Sticky liquid that traps dirt, dust and microorganisms.
Cilia	Tiny hairs on cells that sweep mucus from the lungs into the gullet to be swallowed.
Gas Exchange	The swapping of gases between the lungs and the blood.
Diffusion	Movement of particles from a high concentration to low.
Alveoli	Little pockets on the lungs.
Adaptations of Alveoli	They increase the surface area for faster diffusion. The walls are one cell thick for faster diffusion.

3. Getting Oxygen

Red Blood Cells	Take in oxygen when it gets into the blood.
Haemoglobin	Where the oxygen binds to in red blood cells.
Arteries	Blood vessels that carry blood from the heart to the body.
Capillaries	Tiny blood vessels that the arteries divide into. oxygen leaves red blood cells here and dissolves into the plasma.
Plasma	Liquid part of the blood that leaks out of the capillaries into the tissue fluid.
Tissue Fluid	Carries the oxygen to the cells.
Veins	Carry blood back towards the heart.
Exercise	Your muscles must release more energy so need more oxygen and glucose- your breathing and heart rates increase.
Frostbite	Blood vessels in skin narrow to avoid heat loss and less blood reaches cell. If the cells die this causes frostbite.
Heart Attack	Fatty substances build up inside blood vessels reducing blood flow causing cells to die.
Carbon Monoxide	Poisonous gas found in cigarette smoke- sticks to haemoglobin so red blood cells carry less oxygen.
Tar	In tobacco smoke- irritates alveoli and causes them to break apart leading to emphysema.
Asthma	Tiny tubes in lungs become narrow and fill with mucus meaning less air gets into and out of the lungs.

4. Comparing Gas Exchange

Limewater	Turns cloudy in the presence of carbon dioxide.
Hydrogen Carbonate Indicator	Turns from pink to yellow as carbon dioxide increases and the pH drops.
Gills	Water flows over feathery strands where oxygen diffuses into the blood and carbon dioxide out.
Stomata	Tiny holes in leaves that allow gas exchange.

5. Anaerobic Respiration

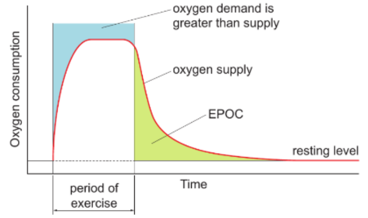
Anaerobic Respiration	Respiration that occurs in the cytoplasm of cells when oxygen isn't present during strenuous exercise.

Anaerobic Respiration Word Equation

Glucose → lactic acid

Energy	Anaerobic respiration releases less energy than aerobic.
Anaerobic Advantages	Allows for a quick, sudden burst of energy.
After Strenuous Exercise	Lactic acid enters the blood, is carried to the liver and converted back to glucose.
EPOC	Excess post-exercise oxygen consumption (or oxygen debt). Extra oxygen is needed after strenuous exercise to replace lost oxygen from blood / muscles and convert lactic acid to glucose.

Effect of exercise on oxygen demand



8D - Unicellular Organisms

1. Unicellular or Multicellular

Cells	The basic unit of life. All organisms are made up of cells.
Unicellular	An organism made up of one cell.
Microorganisms	Organisms that are so small they can only be seen with a microscope.
Multicellular	An organisms made of many cells.
Diffusion	When particles spread to fill the area that they are in.
Kingdoms	All living organisms can be grouped into one of the five kingdoms.
Prokaryotes	Unicellular organisms that do not have a nucleus.
Protoctists	Mainly unicellular organisms. All have a nucleus.
Fungi	Mainly multicellular organisms that do not make their own food and have a nucleus.
Plants	Multicellular organisms that have a nucleus and make their own food.
Animals	Multicellular organisms that have a nucleus, do not make their own food and do not have a cell wall.
Bacteria	A type of microorganisms in the prokaryote kingdom.
Viruses	Not classed as living organisms because they cannot live without being inside a host.

2. Microscopic Fungi

Asexual Reproduction	Producing new organisms from one parent only.
Budding	Type of asexual reproduction used by fungi in which a small new cell grows out from a parent cell.
Aerobic Respiration	Glucose + oxygen → carbon dioxide + water
Anaerobic Respiration	A type of respiration which does not require oxygen.
Fermentation	The anaerobic respiration of microorganisms. Glucose → carbon dioxide + water
Population	The number of a certain organism found in a certain area.
Limiting Factor	Something that stops a population growing.

3. Bacteria

Lactic Acid	Produced by the anaerobic respiration of bacteria. Glucose → lactic acid
Enzymes	A substance that can speed up some processes in living organisms.
Binary Fission	Type of asexual reproduction used by bacteria in which a cell splits into two.
Chromosome	A long molecule that contains instructions for organisms and their cells.
Flagella	A tail-like structure that rotates, allowing a unicellular organism to move.
Statement Key	A series of descriptive statements used to work out what something is.

4. Protoctists

Algae	A type of protoctist that uses photosynthesis.
Photosynthesis	Carbon dioxide + water → glucose + oxygen
Chloroplast	Found in plant and some protoctist cells- the site of food production through photosynthesis.
Chlorophyll	The green substance inside chloroplasts that absorbs light.
Producers	Organisms that are able to make their own food- always the start of a food chain.
Food Chains	A way of showing what eats what in an ecosystem.
Energy Transfer	Represented by an arrow on a food chain diagram.
Pyramids of Numbers	A way of showing the numbers of different organisms in a food chain.
Poison	Can build up and become more concentrated as you move along a food chain.

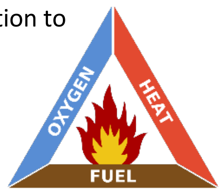
5. Decomposers & Carbon

Ecosystem	All the physical environmental factors and all the organisms that are found in a habitat.
Decomposers	Organisms that feed on dead organisms or animal waste which allows substances to be recycled.
Decay	The breakdown of dead organisms or animal waste.
Soluble	A substance that can dissolved in a liquid.
Carbon Cycle	Shows how carbon compounds are recycled in an ecosystem.
Combustion	Burning fuels and releasing carbon dioxide into the air.
Feeding	Transfers carbon compounds stored in plants to the animals eating them.
Carbohydrates	A nutrient used as the main source of energy.
Proteins	A nutrient used for growth and repair.
Fats	A nutrient used for storing energy and as a thermal insulator.

8E – Combustion

1. Burning Fuels	
Fuel	A chemical substance from which stored energy can be transferred usefully to make things happen.
Fuel Cell	Used in hydrogen-powered vehicles, releasing energy from hydrogen.
Fuel Cell Word Equation Hydrogen + oxygen → water	
Reactants	The starting substances- on left of word equation.
Products	The new substances made- on right of word equation.
Combustion	Burning, usually in air. The reaction gives out energy which is transferred to the surroundings by heating or light.
Fossil Fuels	Fuels formed from living organisms that died millions of years ago- *petrol, diesel*
Hydrocarbons	Only contain carbon and hydrogen atoms- *petrol, diesel*
Combustion of Hydrocarbons	The carbon and hydrogen atoms react with oxygen. The carbon reacts to form carbon dioxide.
Carbon Dioxide	Carbon dioxide will turn limewater cloudy.

2. Oxidation	
Oxidation	Reacting with oxygen.
Oxide	Compound formed by oxidation.
Metal Oxides	Formed when metals react with oxygen. *Metal + oxygen → metal oxide*
Conservation of Mass	Mass is never gained or lost in a chemical reaction. The atoms in reactants just rearrange to form the products, no new atoms are made and none disappear.
Heating Zinc in Air	Forms a white powder zinc oxide. The mass will appear to increase because the zinc has combined with the oxygen in air.
Gas Products	If the product is a gas it may escape and make it seem like the mass has decreased.
Phlogiston	A substance scientists used to think explained why things burned that was then proven not to exist.

3. Fire Safety	
Exothermic	A reaction that releases energy that we can feel as heat- *combustion*
Thermometer	Used to measure a change in the temperature.
Fire Triangle	Three factors allow combustion to occur. 
Putting Out a Fire	You must remove at least one of the three factors.
	**Explosive** Heating may cause an explosion.
	**Flammable** These substances catch fire easily.
	**Oxidising** These substances release oxygen.
Fire Extinguishers	Work by cooling a fire or stopping oxygen getting to the fuel.
Oil Fire	Water will sink through the oil and turn to steam making the fire spread out. Use foam or a fire blanket to keep oxygen away.
Electrical Fire	Water conducts electricity so you may get a serious shock. Turn off the electricity and use a powder or carbon dioxide extinguisher.

4. Air Pollution	
Complete Combustion	Carbon burns in plenty of air only forming carbon dioxide.
Incomplete Combustion	Not enough oxygen for all the carbon to react with.
Products of Incomplete Combustion	• carbon dioxide- linked to global warming • carbon monoxide- poisonous gas • soot- damage lungs and trigger asthma
Impurities	Small amounts of other substances in fuels.
Sulfur Dioxide	Formed when hydrocarbons have a sulfur impurity.
Nitrogen Oxide	Formed by high engine temperatures causing nitrogen and oxygen in air to react.
Pollutants	Something that can harm living things and damage the environment.
Catalytic Converter	Found in cars to react carbon monoxide with more oxygen forming carbon dioxide. Also breaks down nitrogen oxides.
Acid Rain	Sulfur dioxide and nitrogen oxides rise into the air and dissolve in water vapour. The rain is now more acidic.
Controlling Acid Rain	Neutralisation reactions used to remove acidic gases from chimney smoke. Acidic soil /water can be neutralised by adding calcium carbonate.

5. Global Warming	
Greenhouse Gases	Trap energy from the Sun in the atmosphere *e.g. carbon dioxide*
Greenhouse Effect	Energy trapped by greenhouse gases is transferred back to the Earth's surface causing it to warm up.
Earth's Temperature Over Time	The temperature of the Earth has fluctuated over time it is rising rapidly now though.
Global Warming	Increase in global temperature due to more greenhouse gases in the air and the greenhouse effect.
Climate Change	Resulting from global warming- changes to weather patterns, more storms, flood, droughts, etc.
Evidence	There is now lots of evidence for global warming. Average temperatures are increasing and ice caps are melting.

8F - The Periodic Table

1. Dalton's Atomic Model

Matter	All things are made of matter.
John Dalton	(1766-1844) An English chemist.
Dalton's Atomic Theory	• all matter is made up of atoms. • atoms in an element are identical. Each element has its own type of atom. • atoms cannot be destroyed or created. • In compounds each atom is always joined to a fixed number of other atoms. • atoms rearrange during chemical reactions to form new substances.
Atoms	Small particles that all matter is made up of.
Element	A substance made up of one kind of atom.
Compound	Contains atoms of two or more different elements chemically joined together.
Physical Properties	The properties that describe a substance on its own. *(colour, strength, density, etc.)*
Physical Changes	A change in which no new substances are formed.
Symbols	Letters used to represent the elements. *e.g. C represents Carbon*

2. Chemical Properties

Chemical Properties	How a substance reacts with other substances.
Hypothesis	An idea about how something works that can be tested using experiments.
Prediction	What you think will happen in experiment and why.
Conserving Mass	The mass of the products of a reaction will be the same as the mass of the reactants.
Chemical Formulae	The combination of symbols and numbers that shows how many atoms of different element are in a particular molecule. *e.g. water is H_2O*
Ratio	Comparison of the proportion of two quantities *e.g. in water there are 2 hydrogens for every oxygen, the ratio is 2:1*

3. Mendeleev's Table

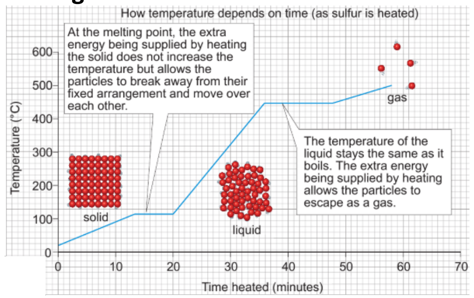
Johann Döbereiner	(1780-1849) German chemist who highlighted some groups of 3 elements had similar physical / chemical properties.
John Newlands	(1837-1898) English chemist who ordered elements by the mass of atoms and noticed every 8^{th} element has similar properties.
Dmitri Mendeleev	(1834-1907) Russian chemist who published the first periodic table by ordering elements by increasing masses of their atoms forming groups of similar properties.
Gaps	Mendeleev left gaps in his table for undiscovered elements and predicted their properties.

Group	A vertical column in the Periodic Table- contains elements with similar properties.
Alkali Metals	Group 1 Very reactive metals, they even react with water.
Halogens	Group 7 React with most metals to form solid compounds.
Noble Gases	Group 0 Unreactive gases

4. Physical Trends

Melting Point	When a substance changes from a solid into a liquid
Boiling Point	When a substance changes from a liquid into a gas.
Freezing Point	When a substance changes from a liquid into a solid- the same as the melting point.

Heating Substances



Periods	The horizontal rows in the Periodic table.
Transition Metals	Block of elements in the middle of the Periodic table- separates the eight main groups.
Metal Properties	High melting points, strong, flexible, malleable, shiny, good conductors.
Non-Metal Properties	Low melting points, brittle, dull, poor conductors.

5. Chemical Trends

Alkali Metals & Water	Alkali metals produce metal hydroxides and hydrogen when reacting with water. *(sodium + water → sodium hydroxide + hydrogen)*
Alkali Metals & Oxygen	Alkali metals produce metal oxides when reacting with oxygen. *(lithium + oxygen → lithium oxide)*
Reactivity	How quickly / vigorously something reacts.
Alkali Metal Reactivity	As you move down the group the reactivity increases.
Oxides	Formed when elements react with oxygen.
Oxide Trends	When we dissolve oxides in water there is a trend in their pH. Further to the left of the Periodic table oxides formed are more alkaline. Further to the right they are more acidic.

8G – Metals and Their Uses

1. Metal Properties

Physical Properties	The properties that describe a substance on its own. *(colour, strength, density, etc.)*
Chemical Properties	How a substance reacts with other substances.
Properties of Metals	High melting points, strong, flexible, malleable, shiny, good conductors.
Copper	Used in electrical circuits because it is a good conductor of electricity and unreactive. Used in water pipes because it is unreactive, non-poisonous and malleable.
Aluminium	Used in window frames because it is strong and light.
Metals & Oxygen	Most metals react with oxygen. Metal + oxygen → metal oxide *e.g. zinc + oxygen → zinc oxide*
Metals & Halogens	Metals react with halogens and other non-metals. *e.g. zinc + fluorine → zinc fluoride*
Catalysts	Speed up chemical reactions without being permanently changed themselves.
Catalytic Converter	Found in cars to help convert dangerous gases into harmless ones- often contain platinum, palladium and rhodium.

2. Corrosion

Corrosion	Any reaction with oxygen at the surface of a metal.
Rusting	The corrosion of iron.

Word Equation for Corrosion of Titanium	titanium + oxygen → titanium oxide
Symbol Equation for Corrosion of Titanium	Ti + O_2 → TiO_2
Formula	Used to represent the products and reactants in a symbol equation.
Ratio	Comparison of the proportion of two quantities *e.g. in TiO_2 there are two oxygen atoms for every titanium- the ratio is 1:2*
Rusting of Iron	More complex than general corrosion- requires water as well.
Rusting of Iron Word Equation	Iron + oxygen + water → iron hydroxide
Preventing Rust	Use a barrier such as paint/plastic/oil to keep away air/water

3. Metals and Water

Reactivity of Metals

Metal	Reaction with oxygen in air	Reaction with cold water
potassium	can catch fire	can catch fire
sodium	can catch fire	✓✓✓
lithium	can catch fire	✓✓
calcium	can catch fire	✓✓
magnesium	can catch fire	✓
aluminium	✓✓✓	•••
zinc	✓✓	•••
iron	✓✓	•••
tin	✓	•••
lead	✓	•••
copper	✓	✗
mercury	•••	✗
silver	•••	✗
gold	✗	✗
platinum	✗	✗

Reactivity	How quickly / vigorously something reacts.
Reactivity Series	A list of metals in the order of their reactivity.
Metals & Water	Metals produce metal hydroxides and hydrogen when reacting with water. *(sodium + water → sodium hydroxide + hydrogen)*

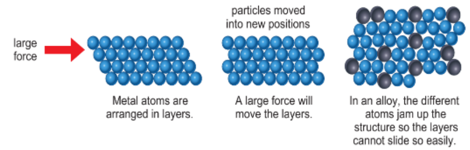
4. Metals and Acids

Potassium – Lithium	React explosively with dilute acids.
Calcium – Zinc	React very quickly with dilute acids.
Iron – Lead	React slowly with dilute acids.
Copper – Platinum	Do not appear to react with dilute acids at all.
Effervescence	The production of a gas. Occurs when metals react with an acid.
Metals & Acids	Metals react with acids to form hydrogen and a salt.
Metals & Acids Word Equation	metal + acid → salt + hydrogen *e.g. magnesium + sulfuric acid → magnesium sulfate + hydrogen*
Naming Salts	The first word in the salt is the metal the second depends on the acid used.
Hydrochloric Acid	HCl – forms salts ending in chloride
Sulfuric Acid	H_2SO_4 – forms salts ending in sulfate
Nitric Acid	HNO_3 – forms salts ending in nitrate
Obtaining Salts	Mix the acid and the metal. Filter the solution to remove any excess metal. Heat the solution to evaporate water leaving just the solid salt.

5. Pure Metals and Alloys

Pure	Substance made up of one type of atom.
Alloys	Mixtures of metals.
Solder	Lead mixed with tin- lower melting point than lead used for fixing pipes / electrical equipment.
Duralumin	Aluminium mixed with copper and magnesium making it lighter and stronger. Used in aircraft.
Stainless Steel	Iron mixed with carbon, chromium and nickel making it stronger and more resistant to corrosion. Used in cutlery.

Explaining How Alloys Are Strong



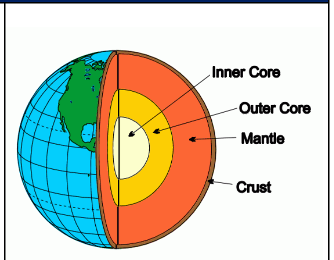
Melting / Boiling Points	Melting and boiling points for pure substances are fixed and occur at precise temperatures. Alloys melt and boil over a range of temperatures.

8H – Rocks

1. Rocks and their Uses

Geologist	A scientist who studies rocks and the Earth.
Rocks	Naturally occurring substances made up of different grains.
Grains	Made from one or more chemical compounds.
Minerals	The chemical compounds in rocks- rocks are mixtures of different minerals.
Texture	The combination of sizes and shapes of grains in a rock.
Interlocking Crystals	The grains all fit together with no gaps. They are hard and do not wear away easily.
Rounded Grains	Some rocks have rounded grains with gaps in between. They are not strong and can be worn away more easily.
Porous	Rounded grain rocks can absorb water because it gets into the gaps.
Permeable	Water can run through.
Cement	A building material made from limestone.
Gravel	A mixture of cement, sand and gravel.

2. Igneous and Metamorphic

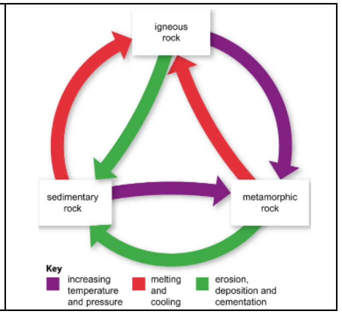
The Structure of the Earth	
Igneous Rocks	Formed when molten rock cools down *e.g. basalt, granite*
Magma	Molten rock
Lava	Magma that reaches the Earth's surface.
Small Crystals	Formed when molten rock cools down fast due to less time for particles to become ordered.
Large Crystals	Formed when molten rock cools down slowly due to more time for a large grid pattern to form.
Extrusive	Igneous rocks formed from cooling lava above the surface.
Intrusive	Igneous rocks formed underground.
Metamorphic Rocks	Formed by pressure and heat changing other rocks. *e.g. Schist, gneiss (both formed from granite) slate (from mudstone) and marble (from limestone)*
Metamorphic Rock Texture	Always made from interlocking crystals which may form coloured bands.

3. Weathering and Erosion

Weathering	When rocks are broken up by physical, chemical or biological processes.
Chemical Weathering	When rocks are broken up by chemical reactions. *e.g. gases in air making rainwater slightly acidic which then reacts with minerals in rock wearing them away.*
Biological Weathering	When rocks are broken up by living organisms. *e.g. growing plants splitting rocks apart with their roots.*
Physical Weathering	When rocks are broken up by physical processes. *e.g. changes in temperature causing expansion and contraction over time, cracking rocks.*
Expanding	Rocks get bigger when they are heated.
Contracting	Rocks get smaller when they are cooled.
Freeze-Thaw Action	Water gets into cracks in rocks, freezes, expands and then forces the crack to get bigger.
Erosion	The movement of loose and weathered rock.
Abrasion	When rock fragments bump into each other and are worn away.
Sediment	Bits of rock and sand in streams or rivers.
Glacier	Rivers of ice that move slowly but can transport large pieces of rock.

4. Sedimentary Rocks

Sedimentary Rocks	Formed when layers of sediment build up over time followed by compaction then cementation. *e.g. sandstone, mudstone*
Compaction	Pressure forces water out from the gaps between grains squashing the grains closer together.
Cementation	Dissolved minerals between the gaps act as a glue and 'cement' the grains together.
Sedimentary Rock Texture	They are always made from rounded grains. Properties depend on the type of sediment that forms them.

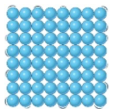
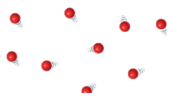
The Rock Cycle	

5. Materials in the Earth

Native State	Metals found as pure elements in rocks.
Ores	Rocks that contain enough of a metal / metal compound to be worth mining.
Extracting Ores	Ores are obtained by mining, then crushed and chemical reactions used to obtain the metal.
Mining Problems	Damages the environment by destroying habitats and causes pollution.
Rare Metals	Hard to obtain which makes them expensive.
Recycling	Using a material again.
Recycling Advantages	Cuts down on pollution from mining and landfill sites, allows supplies to last longer and requires less energy.

8I – Fluids

1. The Particle Model

States of Matter	The three forms that a substance can be in; solid, liquid or gas.
Solid Properties	Do not flow, fixed shape, fixed volume, cannot be compressed
Liquid Properties	Can flow, no fixed shape, fixed volume, cannot be compressed
Gas Properties	Can flow, no fixed shape, no fixed volume, can be compressed
Particle Theory	Used to explain the different properties and observations of solids, liquids and gases.
Solid Particle Properties	Fixed arrangement of particles held closely together that cannot move over each other but vibrate. 
Liquid Particle Properties	Held closely together but not in a fixed arrangement and can move over each other. 
Gas Particle Properties	Far apart from each other and free to move about in all directions. 
Diffusion	The movement of particles spreading out and mixing with each other without anything moving them.

Brownian Motion	An erratic movement of small specks of matter caused by being hit by the moving particles that make up liquids or gases.
Expanding	Materials expand when heated because the particles vibrate more, taking up more space.
Contract	Materials contract when cooled because the particles vibrate less and take up less space.
Density	The mass of a certain volume of a material. $density = \frac{mass}{volume}$

2. Changing State

Changes of State	Changing from one state of matter to another. Physical changes because no new chemicals are made.
Melting	Turning from a solid to a liquid- occurs at melting point
Freezing	Turning from a liquid to a solid- occurs at freezing point
Condensing	Turning from a gas into a liquid.
Sublimation	Turning from a solid to a gas.
Evaporation	Turning from a liquid into a gas. Can occur at the surface of a liquid at any temperature.
Boiling	When evaporation occurs within a liquid- occurs at the boiling point
Pure	A substance made up of a single type of atom or compound.
Pure Substances Changing State	Occurs at a set temperature. The temperature stays constant when changing state as bonds are broken or made.

Mixtures Changing State	Occurs over a range of temperatures as it contains substances with different melting/boiling points.
Water	Contracts as it is cooled up until 4°c and then it expands slightly. Ice takes up more space than water and is less dense

3. Pressure in Fluids

Fluids	Liquids and Gases
Pressure	The force of particles hitting things- comes from all directions in gases and liquids.
Pressure Units	**Pascals (Pa)** One pascal is the a force of one newton on every square metre.
Atmospheric Pressure	The pressure of the air- 100,000 Pa
Tyres	Contain air under high pressure because they are pumped with extra air causing more particles to hit the inside walls.
Temperature	Pressure in fluids increases as you increase temperature because particles move faster and hit the walls of the container harder.
Volume	If you compress a gas into a smaller volume the pressure increases because the particles hit the walls more.
Pressure From Above	As you go down the ocean there is more water above you so pressure increases. As you go up a mountain there is less air above you so pressure decreases.

4. Floating and Sinking

Upthrust	The force of water pushing upwards.
Weight	The amount of force with which gravity pulls on a mass.
Water	The density of water is 1 g/cm^3
Floating	If something has a density less than water it will float in water.
Sinking	If something has a density greater than water it will sink in water.
Air	The density of air at sea level is around 0.001 g/cm^3
Hot Air Balloons	Fly because the overall density of the balloon is less than the air around it.

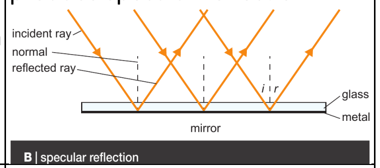
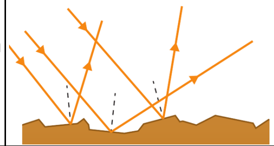
5. Drag

Drag	A resistance force acting on an object to slow it down.
Water Resistance	Type of drag that occurs in water.
Air Resistance	Type of drag that occurs in air.
Friction	Partly causes the drag on a moving object.
Streamlined	Smooth shape to reduce air / water resistance.
Speed	The faster an object is moving, the greater the drag.
Balanced Forces	Equal forces acting in opposite directions.
Engine	Forward force of an engine needs to balance the drag.

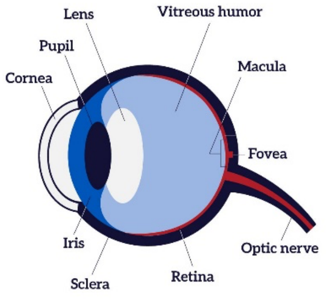
8J - Light

1. Light on the move	
Vacuum	A completely empty space, containing no particles.
Matter	All things are made of matter. There are three states of matter: solid, liquid, gas.
Longitudinal wave	A wave where the particles vibrate in the same direction as the wave is travelling. 
Transverse wave	A wave where the vibrations are at right angles to the direction the wave is travelling. 
Ray	A narrow beam of light, or an arrow on a diagram representing the path of light and the direction in which it is travelling.
Transparent	A material that light can travel through without scattering. (Note: transparent substances may be coloured or colourless.)
Transmit	To pass through a substance.
Reflect	To bounce off a surface instead of passing through it or being absorbed.
Absorb	'To soak up' or 'to take in'.

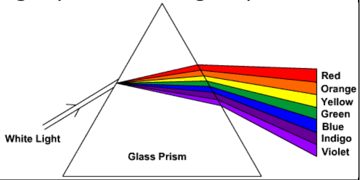
Translucent	Material that lets light through but scatters it. You cannot see things clearly through translucent materials.
Opaque	Material that does not let light through. It is not possible to see through an opaque substance.
Scattered	Scattering occurs when light or other energy waves pass through an imperfect medium (such as air filled with particles of some sort) and are deflected from a straight path.
Reflected ray	A ray of light bouncing off a mirror.
Source	Where a sound wave or other wave begins.
Image	A picture that forms in a mirror or on a screen, or is made by a lens. You see an image when looking down a microscope.
Pinhole camera	A piece of apparatus that forms an image of an object on a screen when light rays travel through a tiny hole in the front
Shadow	A place where light cannot get to, because an opaque object is blocking the light.

2. Reflection	
Plane mirror	A smooth, flat mirror.
Ray box	A piece of equipment that produces a narrow beam of light.
Ray tracing	A method of investigating what happens to light by marking the path of a light ray.
Ray diagram	A diagram that represents the path of light using arrows.
Normal	An imaginary line at right angles to the surface of a mirror or other object where a ray of light hits it.
Incident ray	A ray of light going towards the mirror or other object.
Reflected ray	A ray of light bouncing off a mirror.
Angle of incidence	The angle between an incoming light ray and the normal.
Angle of reflection	The angle between the normal and the ray of light leaving a mirror.
Specular reflection	When light is reflected evenly, so that all reflected light goes off in the same direction. Mirrors produce specular reflection. 
Diffuse reflection	Reflection from a rough surface, where the reflected light is scattered in all directions. 
Law of reflection	The angle of incidence is equal to the angle of reflection.

3. Refraction	
Refraction	The change in direction when light goes from one transparent material to another.
Interface	The boundary between two materials.
Lens	A curved piece of glass or other transparent material that can change the direction of rays of light.
Converging lens	A lens that makes rays of light come together.
Angle of refraction	The angle between the normal and a ray of light that has been refracted.
Focal point	The place where parallel rays of light are brought together by a converging lens.
Focal length	The distance between the centre of the lens and the focal point.

4. Cameras and eyes	
Digital camera	A camera that uses electronics to record an image.
Sensor	An instrument that detects something. In a digital camera, the sensors detect light and change it to electrical signals.
Memory card	Part of a digital camera that stores the images.
Aperture	A hole in a camera that controls how much light goes to the sensor.
Shutter	A device that shields and protects the sensor in a digital camera. It opens when the picture is taken.
Human eye	
Retina	The part at the back of the eye that changes energy transferred by light into nerve impulses.
Pupil	The hole in the front of the eye that light can pass through.
Rod cell	A cell in the retina that detects low levels of light. It cannot detect different colours.
Cone cell	A cell in the retina that detects different colours of light.
Cornea	The transparent front part of the eye, which covers the iris and pupil.
Iris	The coloured part of the eye.

Optic nerve	The nerve that takes impulses from the retina to the brain.
Primary colour	One of three colours that are detected by the cone cells in our eyes. The primary colours are red, green and blue.
Secondary colour	A colour made when two primary colours mix. The secondary colours are magenta, cyan and yellow.

5. Colour	
White light	Normal daylight, or the light from light bulbs, is white light.
Frequency	The number of vibrations (or the number of waves) per second. Different frequencies of light have different colours.
Spectrum	The seven colours that make up white light.
Dispersio n	The separating of the colours in light, for example when white light passes through a prism. 
Prism	A block of clear, colourless glass or plastic. Usually triangular.
Filter (physics)	Something that only lets certain colours through and absorbs the rest.

8K - Energy Transfers

1. Temperature Changes

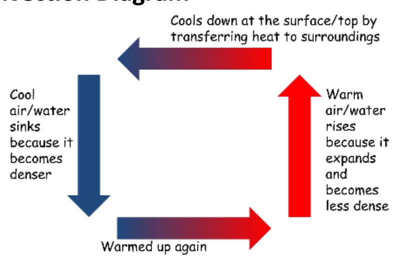
Temperature	How hot or cold an object is. *Measured in degrees Celsius (°C)*
Internal / Thermal Energy	The energy stored in the movement of particles. *Measured in Joules (J)*
Factors Affecting Amount of Internal Energy Stored	• temperature • material • mass
Energy Transfer	Always from a hotter object to a cooler one.
Evaporation	When a liquid turns into a gas. A way of transferring energy.
Cooling by Evaporation	The fastest moving particles escape a liquid to form a gas. The particles left are storing less energy so the temperature of the remaining liquid is lower.

2. Transferring Energy

Transferring Energy	Energy can be transferred by heating via evaporation, conduction, convection and radiation.
Radiation	A way of transferring Energy by heating through waves (it does not need a medium).

Emitting Radiation	All things give out (emit) infrared radiation, the hotter it is the more it emits.
Thermal Images	Instruments that measure infrared radiation and convert into maps of temperatures.
Conduction	When a solid is heated the particles vibrate more and these vibrations are passed through the solid transferring energy.
Thermal Conductors	Energy is transferred easily through them- metals.
Thermal Insulators	Energy is not transferred through them easily- wood / plastic.
Convection	In fluids (liquids and gases) when part of it is heated it become less dense and rises. Cooler fluid moves in to take its place and a convection current forms.

Convection Diagram



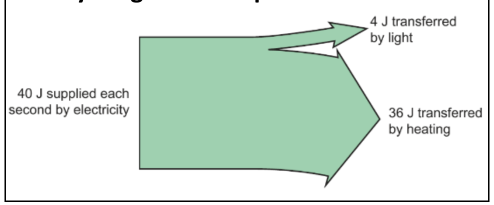
3. Controlling Transfers

Cold Climates	Houses are kept warm by burning fuel for heating and insulating houses to keep warmth inside.
Good Insulators	Brick, wood, carpet, feathers, wool.
Air	A very poor conductor because the particles are far apart
Hot Climates	Houses are kept cool by painting them white (light and shiny surfaces reflect infrared radiation).
Solar Panels	Painted black because dark colours absorb and emit infrared radiation well.
Vacuum Flask	Designed to reduce energy transfers and keep contents hot: • Plastic stopper to stop convection (and it is an insulator). • Glass walls with silver coating reflect radiation back in. • Vacuum between walls so no conduction or convection can occur.

4. Power and Efficiency

Power	The amount of energy transferred by an appliance per second.
Watts (W)	The units for measuring power. 1000W = 1kW (kilowatt)
Power Ratings	Tell us how much energy an appliance transfers.
Efficiency	The amount of useful energy transferred by a device compared with the amount of energy supplied to it.
Sankey Diagram	A diagram that represents energy transfers.

Sankey Diagram Example



Efficiency Formula

$$\text{efficiency} = \frac{\text{useful energy transferred}}{\text{total energy supplied}} \times 100\%$$

5. Paying for Energy

Kilowatt-hour (kWh)	The amount of energy transferred in 1 hour by an appliance. Used by energy companies to measure energy use.

Energy Use Formula

$$\underset{(\text{kWh})}{\text{energy use}} = \underset{(\text{kW})}{\text{power rating}} \times \underset{(\text{hours})}{\text{time}}$$

Saving Money on Electricity / Gas Bills	Not using as much energy will save money. Insulating houses and using more efficient appliances will help with this.
Payback Time	How long it will take you to save the money that an efficiency measure costs.
Payback Time Formula	$\text{payback time} = \frac{\text{cost of change}}{\text{saving per year}}$

8L - Sound

1. Making Sounds

Making Sounds	Sounds are made by something vibrating.
Intensity	How loud or soft a sound is- its volume.
Pitch	How high or low a sound is.
Frequency	The number of vibrations each second. The higher the frequency the higher the pitch.
Hertz (Hz)	The units for measuring frequency.
Amplitude	The size of vibrations. The bigger the amplitude the louder the note.
Humans Making Sounds	Two flaps (vocal folds) across the windpipe vibrate when air moves across them.
Grasshoppers Making Sounds	Male grasshoppers chirp by rubbing one leg against a wing.
Gorillas Making Sounds	Male gorillas thump their chests or thump the ground to threaten other males.

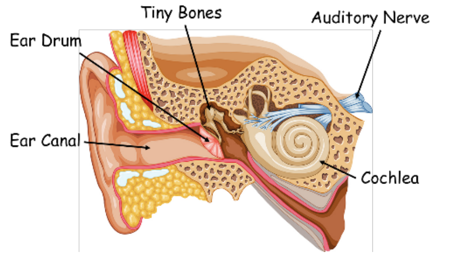
2. Moving Sounds

Moving Sounds	Sounds can only travel through a medium (a solid, liquid or gas).
Vacuum	A completely empty space. Sound cannot travel through.
Particles	Tiny pieces of matter that make up everything.
Sound Moving Through the Air	Air particles vibrate and cause nearby particles to vibrate so the vibrations spread through the air.

Sound Wave	Formed by the moving vibrations.
Pressure Wave	The air particles are pushed together in some place (high pressure) and spread out in other places
Sound Wave Frequency	The number of waves passing a point per second.
Sound Wave Amplitude	The distance moved by air particles as the sound wave passes.
Energy	Energy is transferred from one place to another by sound waves. They do not transfer particles.
Speed of Sound	Sound travels faster in solids because the particles are close together.
Moving Away from A Source	As you move away from a source of sound, the energy carried has spread out further so there is less energy for your ear to detect- it sounds quieter.

3. Detecting Sounds

The Ear



Ear Protection	Loud sounds damage our ears- people who work in noisy surroundings need ear protection. Certain soft materials (carpets, curtains, etc.) also absorb energy transferred by sound waves.
How Ears Detect Sounds	1. sound waves enter the ear canal. 2. the eardrum (a thin membrane) vibrates. 3. vibrations pass to the tiny bones which amplify the vibrations. 4. vibrations pass to the liquid inside the cochlea. 5. tiny hairs inside the cochlea detect vibrations and create electrical signals (impulses). 6. impulses travel along the auditory nerve to the brain.
How Microphones Detect Sounds	Sounds make a thin sheet of materials (a diaphragm) vibrate and electrical circuits convert these vibrations into electrical currents.
Decibels (dB)	The units for measuring the loudness of a sound.
Auditory Range	The range of frequencies an organism can hear 20Hz – 20000Hz in humans
Infrasound	Sounds below 20Hz
Ultrasound	Sounds above 20000Hz

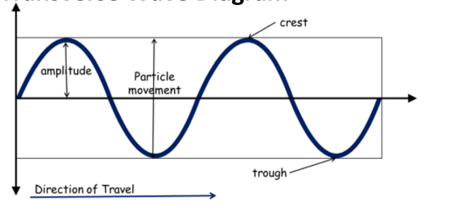
4. Using Sound

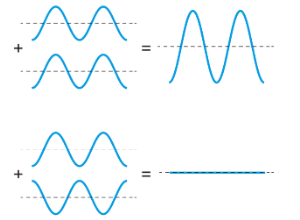
Using Sound	Sound is often used for communication.
Transmitted	Energy from sound waves goes through some materials.
Reflected	Energy from sound waves bounces off some materials.
Using High Frequency Waves	• Treat injuries • Clean delicate objects by making tiny bubbles that loosen dirt when the burst.
Echo	A reflected sound
Echolocation	Used by animals (bats, dolphins, etc.) to find their way around/find prey.
Sonar	Pulse of ultrasound is given off and reflected by the sea bed. It is then detected by sonar equipment to find the depth.

5. Comparing Waves

Longitudinal Waves	Particles vibrate in same direction wave is moving.
Transverse Waves	Particles vibrate at right angles to direction wave is moving.

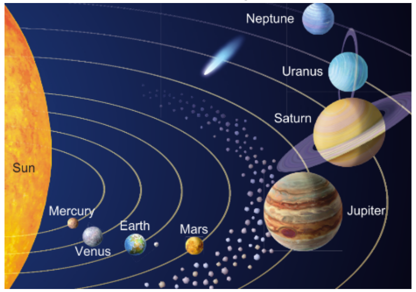
Transverse Wave Diagram

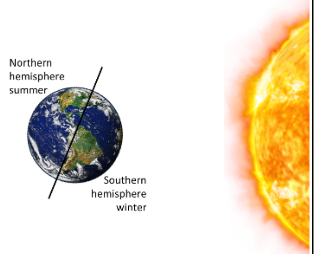


Superposition	As waves pass through each other their effects add up or cancel out.
Superposition Diagram	

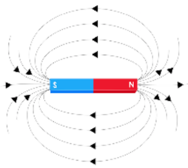
8M - Earth and Space

1. Gathering the Evidence	
Astronomer	A scientist that studies space.
Early Astronomers	Could only use their eyes to make observations.
Ptolemy	Egyptian astronomer (*90-168*) Proposed a model with the Earth in the centre and the Moon, Sun and planets orbiting the Earth.
Nicolaus Copernicus	Polish astronomer (*1473-1543*) Suggested the Earth and other planets move in circles around (orbit) the Sun.
Reaction to Copernicus' Model	It was not accepted straight away. However observation made by Galileo using one of the first telescopes provided more evidence to support it.
Johannes Kepler	German astronomer (*1571-1630*) Proposed the model used today. The Sun is at the centre with the planets moving around in elliptical orbits. Moons orbit planets.

The Model of the Solar System	
	
Phases of the Moon	The Moon appears different shapes at different times due to its position relative to the Earth and Sun. 
Spacecraft	Allowed scientists to investigate space more by collecting samples and taking readings on other planets.

2. Seasons	
Summer	Longer days than nights, Sun high in the sky.
Winter	Longer nights than days, Sun not very high in the sky.
Cause of Seasons	Due to the tilt of the Earth's axis by 23.5°.
Causing Summer	When the northern hemisphere is tilted towards the Sun it is summer in the UK.
Causing Winter	When the northern hemisphere is tilted away from the Sun it is winter in the UK.
Causing Seasons Diagram	

Summer Sun	Because the Sun is higher in the sky in summer the heat is more concentrated, making it feel warmer

3. Magnetic Earth	
Compass	A magnet that points north.
North-Seeking pole	The end of a bar magnet that points north- shortened to north pole.
South-Seeking pole	The end of a bar magnet that points south- shortened to south pole.
Attract	When two magnets are pulled together. Opposite poles will attract each other.
Repel	When two magnets are pushed apart. The same poles will repel each other.
Magnetic Field	The area around a magnet where it has an effect. Can be found using iron filings or a small compass.
Magnetic Field Diagram	
Magnetic Field Strength	Strongest closest to each pole, the field gets weaker as you get further from the magnet.
Magnetic Field Direction	The direction of a magnetic field is always from the north pole towards the south pole.

4. Gravity in Space	
Gravity	Force exerted by all objects with mass trying to pull other objects towards it.
Bigger Mass	The bigger the mass of an object, the stronger the force it exerts.

Weight	The force of gravity pulling on you. *Measured in Newtons (N)*
Gravitational Field	The space around the Earth where gravity attracts things.
Gravitational Field Strength (*g*)	At the surface of the Earth it is about 10 newtons per kilogram (N/kg).
Weight Formula	Weight = mass x g
Gravity and Orbits	The force of gravity keeps the Earth in its orbit of the Sun.
Satellite	Anything that orbits a planet.
Natural Satellite	Moons are examples of natural satellites.
Artificial Satellite	Can be put into orbit around Earth for photographing / transmitting TV programs etc

5. Beyond the Solar System	
Constellation	Pattern of stars
Stars	Huge balls of gas that give out large amounts of energy. The Sun is a star.
Stars At Night	Appear less bright than the Sun because they are further away.
Galaxies	Large groups of stars.
Milky Way	The galaxy our Sun is in.
Universe	Made up by all of the millions of galaxies.
Light Year	Measurement of distance- the distance travelled by light in 1 year. Approximately ten million million kilometres.
Proxima Centauri	Nearest star to the Sun, about 4.22 light years away.