

Describe ionic bonding	Occurs between metals and non-metals. Electrons are transferred. There is an electrostatic force of attraction between oppositely charged ions.
Describe covalent bonding	Occurs between non-metals. Electrons are shared in pairs
Describe metallic bonding	Occurs between metals. Regular arrangement of positive ions surrounded by a 'sea' of delocalised electrons.
Why do ionic compounds have high melting and boiling points?	Strong forces between ions that need a lot of energy to break.
Why do giant covalent compounds have high melting and boiling points?	Strong bonds between atoms that need a lot of energy to break.
Why do simple covalent molecules have low melting and boiling points?	Weak forces between molecules that don't need much energy to break.
Why do ionic compounds only conduct when molten or in solution?	Because the ions are free to move.
Why do metallic substances conduct electricity?	Because they have free electrons that can move throughout the structure.
Why don't covalent compounds conduct electricity?	Because there are no free electrons.
HT Why does MgO have a higher melting point than NaCl?	Magnesium and oxide ions have greater charges (2+ and 2-) so has a stronger attraction.
Why is diamond hard?	Each carbon is strongly bonded to four others (covalent bonds)
Why is graphite soft?	Each carbon is covalently bonded to three others in hexagonal layers. There are weak forces between layers so they can slide over each other.
Why can graphite conduct electricity?	Each carbon is covalently bonded to three others, the fourth electron is free to move throughout structure.
What can fullerenes be used for?	drug delivery, lubricants, catalysts
Give three properties of carbon nanotubes?	high strength, low density, good conductors

What does nanometre mean and how big is a nanoparticle?	nm = 1 billionth of a metre, nano particle = 1-100atoms
Give properties and uses of nano particles of silver.	Properties: antibacterial, antiviral, antifungal Uses: plasters, antiseptic sprays, socks, deoderant sprays
Give properties and uses of nano particles of titanium dioxide.	Properties: absorb and reflect UV light, transparent Uses: sunscreen, self cleaning windows.
HT What are the possible risks of nanoscience?	long term affects are unknown, could easily be absorbed into body or environment
What is a smart material?	materials that have properties that change reversibly when a change occurs in their environment.
What do thermochromic pigments do?	Change colour with temperature
What do photochromic pigments do?	Change colour with changing light intensity
What do polymer gels do?	absorb water and swell or release water and shrink due to changes in pH or temperature
What do shape memory alloys and polymers do?	Regain original shape when heated
What colour would a strong acid appear with univeral indicator and what pH does it have?	Red, pH 1-2
What colour would a strong alkali appear with univeral indicator and what pH does it have?	Purple, pH 13-14
What colour would a neutral substance appear with univeral indicator and what pH does it have?	Green, pH 7
What ions do acids and alkalis contain?	Acids: H ⁺ (Hydrogen ions) Alkalis: OH ⁻ (Hydroxide ions)
What is made when an acid reacts with a metal?	A salt and hydrogen
What would you see when an acid reacts with a carbonate?	Fizzing because carbon dioxide is made

What is made when an acid reacts with a base?	A salt and water
HT What is the ionic equation for neutralisation?	$H^+ + OH^- \rightarrow H_2O$
How would you test to identify sulfate ions?	Add barium chloride, a white precipitate should be seen.
What is an ore?	A mineral found in the Earth's crust that contains enough metal to make it worthwhile extracting.
State two metals which are found in the ground in their native state.	Gold and Silver
Describe oxidation and reduction in terms of oxygen.	Oxidation is gaining oxygen, reduction is losing oxygen
What is a displacement reaction?	A chemical reaction in which a more reactive element displaces a less reactive element from its compound
What are the 4 raw materials added to the blast furnace?	Iron ore, coke, limestone, hot air
Why is coke added to the blast furnace?	Used as a fuel and produces carbon monoxide for reduction.
Why is limestone added to the blast furnace?	To remove impurities as slag
Why is hot air blasted in at the bottom of the furnace?	Provides oxygen so that the coke can burn.
What is electrolysis?	Splitting up of a compound using electricity.
What is oxidation and reduction in terms of electrons?	Oxidation is loss of electrons, Reduction is gain of electrons.
What happens to positive ions when they move to the negative electrode?	They gain electrons (are reduced)
What happens to negative ions when they move to the positive electrode?	They lose electrons (are oxidised)

Why is aluminium ore dissolved in molten cryolite for electrolysis?	It dissolves at a temperature much lower than its melting point so saves energy.
What happens to the oxygen produced during the electrolysis of aluminium oxide?	It reacts with the carbon electrodes producing carbon dioxide.
Give 5 properties of metals.	high melting points, malleable, ductile, good conductors of heat and electricity
Where are the transition metals found on the periodic table?	Between groups 2 and 3.
What properties do transition metals have that are different to 'normal' metals?	Form more than one type of ion, form coloured compounds.
HT What colour solutions to Fe^{2+} , Fe^{3+} and Cu^{2+} ions form?	Fe^{2+} - pale green Fe^{3+} - brown and Cu^{2+} - blue
What is an alloy?	A mixture made by mixing molten metals.
What factors influence the location of metal extraction plants.	transport links, electricity supply, how far away a town or city is.
What is the activation energy?	The minimum amount of energy needed to start a reaction?
Describe an exothermic reaction	Exothermic reactions release energy to the surroundings (increasing temperature).
Describe an endothermic reaction	Endothermic reactions absorb energy from the surroundings (decreasing temperature).
What is crude oil?	A mixture of hydrocarbons.
What is a hydrocarbon?	A compound made of hydrogen and carbon only.
How is crude oil separated ?	Fractional distillation: vaporised, then condensed at different points in column.
How does carbon chain length affect viscosity and colour?	The longer the chain the more viscous the compound is, also the darker in colour it becomes.

How does carbon chain length affect boiling point? Why?	The longer the chain the higher the boiling point as there are stronger forces between molecules.
How does carbon chain length affect ignition?	The shorter the chain length, the easier it is to ignite.
Describe combustion of fuels	Burning in oxygen to produce carbon dioxide and water.
Give 2 advantages of using hydrogen as a fuel.	Water is the only product of combustion so doesn't contribute to global warming. Made from water so is renewable.
Give two disadvantages of using hydrogen as a fuel.	Lots of energy needed to produce it, storage requires bulky and heavy pressurized containers.
Which three things make up the fire triangle?	Fuel, oxygen, heat
What is cracking?	heating hydrocarbons at high temperatures with a catalyst to make them break down into smaller molecules.
What is the general formula for an alkene?	C_nH_{2n}
Describe how you would prepare crystals of salt from an acid and an insoluble base.	Add excess base to use up all the acid, filter to remove excess base, evaporate water to form crystals.
Name the first five alkanes	methane, ethane, propane, butane, pentane
How would you test for alkenes?	Add bromine water, will change from orange brown to colourless.
What is a monomer?	A small reactive molecule that can be joined together to make a polymer.
State the uses of polythene and poly(propene)	polythene = bags, plastic bottles, poly(propene) = ropes and crates
State the uses of poly(vinylchloride) and poly(tetrafluoroethene)	PVC = drain pipes, window frames, PTFE = non-stick pans
What are the environmental issues with using plastics?	take up space in landfill, don't bio-degrade, made from crude oil (a non-renewable resource)

Triple ONLY	
Give the equation for calculating the number of moles in a solutions	Moles = Volume (dm ³) x Concentration (moldm ⁻³)
What is the difference between a strong and weak acid?	Stronger acids have a lower pH (pH1-2), weaker acids have a higher pH (3-4)
What is the difference between a dilute and a concentrated acid?	Concentrated acids don't contain much water wheres dilute acids do.
How would you identify Fe ²⁺ , Fe ³⁺ and Cu ²⁺ ions with sodium hydroxide solution?	Fe ²⁺ - green precipitate Fe ³⁺ - brown precipitate and Cu ²⁺ - blue precipitate.
Give the ionic equation for Fe ²⁺ reaction with OH ⁻	$Fe_{(aq)}^{2+} + OH_{(aq)}^{-} + Fe(OH)_{2(s)}$
What are the products of electrolysis of water?	Hydrogen and Oxygen
What happens during electrolysis if there are more than one positive and negative ion?	When there are competing ions it is the least reactive ion that will form at the electrode.
What are the products of electrolysis of slt water?	Chlorine gas, hydrogen gas and sodium hydroxide solution.
Give two other uses of electrolysis.	electroplating, purification of copper.
How is ethanol made from sugar?	fermentation of sugar using an enzyme found in yeast. Carbon dioxide is produced as a waste product.
How can you test for alcohols?	Use acidified potassium dichromate, a colour change from orange to green is seen
What issues arise from the use of ethanol in alcoholic drinks?	anti social behaviour, health issues such as liver damage.
Give two other uses of ethanol	solvent and fuel
What are the benefits of using bioethanol as a fuel?	renewable, carbon neutral

Triple ONLY	
What happens during oxidation of ethanol?	ethanoic acid is made, this is slow process and leads to beer and wine going 'off'
What is infrared spectroscopy used for?	Identify the presence of certain bonds in organic molecules.
What is meant by a reversible reaction?	A reaction that can go in either direction and is represented by \rightleftharpoons
Ammonia is made in the Haber process, state the conditions and raw materials.	Conditions: 350-450°C, 150-200 atmospheres in pressure and an iron catalyst. Raw materials: nitrogen gas from air and hydrogen gas made from methane.
What test is used to identify ammonia gas?	Damp red litmus paper turns blue in the presence of ammonia
Briefly describe the production of sulfuric acid in the Contact process.	1. sulfur is burned in air to make sulfur dioxide, 2. sulfur dioxide reacts with more oxygen to make sulfur trioxide, 3. sulfur trioxide reacts with water to make sulfuric acid
Give 6 uses of sulfuric acid	making fertilisers, paints, dyes, fibres, plastics and detergents
What would you observe when reacting concentrated sulfuric acid with sugar and hydrated copper sulfate?	Copper sulfate changes from blue to white. Sugar turned black and swelled.
How can you identify ammonium ions?	Add sodium hydroxide and warm gently to release ammonia gas (which turns damp red litmus blue)
What are the benefits of using nitrogenous fertilisers?	Nitrogen is needed to make protein which is needed for healthy plant growth.
What are the problems of using nitrogenous fertilisers?	If they become washed into waterways they can cause Eutrophication.