OCR (A) Chemistry GCSE

Topic 3 - Chemical Reactions

Flashcards

Write the chemical symbol of magnesium chloride

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- Ionic compound
- Magnesium forms the ion Mg^{2+}
- Chlorine forms the ion Cl^{-}
- Chemical formula: $MgCl_2$

Write the chemical formula of zinc oxide

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- Ionic compound
- Zinc forms the ion Zn^{2+}
- Oxygen forms the ion O^{2-}
- Chemical formula: ZnO

Write the chemical formula of phosphorus trichloride

Write the chemical formula of phosphorus trichloride

- Covalent compound
- Phosphorus needs to gain three electrons to become stable so will form covalent bonds with three chlorine atoms.
- Chemical formula: PCl_3

What is the balanced chemical equation for the reaction between hydrochloric acid and magnesium?

What is the balanced chemical equation for the reaction between hydrochloric acid and magnesium?

$$Mg + 2HCl \rightarrow MgCl_2 + H_2$$

Write the half equation for the formation of chloride ions from chlorine (Higher only)

Write the half equation for the formation of chloride ions from chlorine (Higher only)

$Cl_2 + 2e^- \rightarrow 2Cl^-$

Write the half equation for the formation of copper ions from copper (Higher only)

Write the half equation for the formation of copper ions from copper (Higher only)

$$Cu \rightarrow Cu^{2+} + 2e^-$$

What is the balanced chemical equation for the reaction between potassium bromide and chlorine?

What is the balanced chemical equation for the reaction between potassium bromide and chlorine?

$$Cl_2 + 2KBr \rightarrow Br_2 + 2KCl$$

Write the chemical formula of sulfuric acid

Write the chemical formula of sulfuric acid

H_2SO_4

Two H^+ ions react with a sulfate ion (SO_4^{2-}).

What is an ionic equation? (Higher only)

What is an ionic equation? (Higher only)

An equations that only shows the ions which take part in a reaction. It can be written for any reaction involving ions in solution.

Write an ionic equation for the reaction between nitric acid and sodium hydroxide?

(Higher only)

Write an ionic equation for the reaction between nitric acid and sodium hydroxide? (Higher only)

$HNO_3(aq) + NaOH(aq) \rightarrow NaNO_3(aq) + H_2O(l)$

Rewrite the equation with the ions:

$H^+ + NO_3^- + Na^+ + OH^- \rightarrow Na^+ + NO_3^- + H_2O$

Cancel any ions appearing on both side to get the ionic equation:

$H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

Write an ionic equation for the reaction between silver nitrate and sodium chloride?

(Higher only)

Write an ionic equation for the reaction between silver nitrate and sodium chloride? (Higher only)

$AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$

Rewrite the equation with ions:

$Ag^+ + NO_3^- + Na^+ + Cl^- \rightarrow AgCl + Na^+ + NO_3^-$

Cancel any ions appearing on both side to get the ionic equation:

$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$

What do the 4 state symbols mean?

What do the 4 state symbols mean?

(s) - solid

(l) - liquid

(g) - gas

(aq) - aqueous/ dissolved in water

Write the chemical equation for the reaction between calcium carbonate and hydrochloric acid. Include state symbols.

Write the chemical equation for the reaction between calcium carbonate and hydrochloric acid. Include state symbols.

$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$

Define the mole
(Higher only)

Define the mole (Higher only)

One mole is the amount of a substance containing the same number of particles as there are atoms in exactly 12.0 g of carbon-12. This is 6.02×10^{23} particles.

What is the Avogadro constant?
(Higher only)

What is the Avogadro constant? (Higher only)

The number of atoms, molecules or ions in one mole of a given substance. This has a value of 6.02×10^{23}.

What equation links the Avogadro constant to number of moles? (Higher only)

What equation links the Avogadro constant to number of moles? (Higher only)

Number of particles =

Moles x Avogadro constant

How many atoms are there in 0.622 moles of calcium?

(Higher only)

How many atoms are there in 0.622 moles of calcium? (Higher only)

Number of atoms = Moles x Avogadro's constant

$= 0.622 \times (6.02 \times 10^{23})$

$= 3.74 \times 10^{23}$ atoms

What is equal to the mass of one mole of a substance?

(Higher only)

What is equal to the mass of one mole of a substance? (Higher only)

Relative atomic mass

What equation links mass, number of moles and relative atomic mass? (Higher only)

What equation links mass, number of moles and relative atomic mass? (Higher only)

Mass (g) =

Moles x Relative atomic mass (Mr)

How many moles are there in 6.25 g of aluminium?

(Higher only)

How many moles are there in 6.25 g of aluminium? (Higher only)

Moles = Mass ÷ Relative atomic mass

= 6.25 ÷ 27

= 0.231 (3.s.f)

How many atoms are there in 0.375 g of sodium?

(Higher only)

How many atoms are there in 0.375 g of sodium? (Higher only)

Moles = 0.375 ÷ 23

= 0.0163 moles

Number of atoms = 0.0163 x (6.02×10^{23})

= 9.82×10^{21}

What is the law of conservation of mass?

What is the law of conservation of mass?

No atoms are lost or gained during a chemical reaction. Mass of products equals mass of reactants.

The law of conservation of mass states that the mass of reactants equals the mass of products. Why might you record a decrease in mass during an reaction?

The law of conservation of mass states that the mass of reactants equals the mass of products. Why might you record a decrease in mass during an reaction?

If a gaseous product is formed in a non-enclosed system, the gas will escape the reaction vessel and won't be included in the mass.

What is a limiting reagent?

What is a limiting reagent?

In a reaction between two substances, one reactants will often be used in excess to ensure that all of the other reactant is used up.

The reactant which isn't in excess is the limiting reagent as it limits the amount of product that can be formed.

How can you balance an equation if you are given the masses of the reactants and products?

(Higher only)

How can you balance an equation if you are given the mass of the reactants and products?

(Higher only)

Use the mass quantities to calculate the number of moles of the reactants and products.

Divide the number of mole of each substance by the smallest number to give the simplest ratio of the compounds. This gives the numbers for the balanced equation.

127 g of copper reacts exactly with 32 g of oxygen. Using the masses, what is the balanced equation?

(Higher only)

127 g of copper reacts exactly with 32 g of oxygen. Using the masses, what is the balanced equation? (Higher only)

159 g of CuO is formed since mass of reactants = mass of products.

Number of moles of oxygen = 1

Number of moles of copper = 2

Number of moles of copper oxide = 2

Ratio Cu:O_2:CuO is 2:1:2 so the balanced equation is $2Cu + O_2 \rightarrow 2CuO$

0.433 g of Mg reacts with some NaOH. How many moles of Na are formed?

(Higher only)

0.433 g of Mg reacts with some NaOH. How many grams of Na are formed? (Higher only)

Equation: $Mg + 2NaOH \rightarrow Mg(OH)_2 + 2Na$

Moles of magnesium = 0.433 ÷ 24 = 0.0180

Ratio of moles of magnesium to moles of sodium is 1:2

So moles of Na = 0.0180 x 2 = 0.036

Mass of Na = 0.036 x 23 = 0.828 g

What is meant if a reaction is said to be endothermic or exothermic?

What is meant if a reaction is said to be endothermic or exothermic?

Endothermic - the reaction take in energy so the temperature of the surroundings decreases.

Exothermic - the reaction releases energy so the temperature of the surroundings increases.

Give an example of a type of reaction that is exothermic

Give an example of a type of reaction that is exothermic

Combustion

Neutralisation

Give an example of an endothermic reaction

Give an example of an endothermic reaction

Thermal decomposition

Photosynthesis

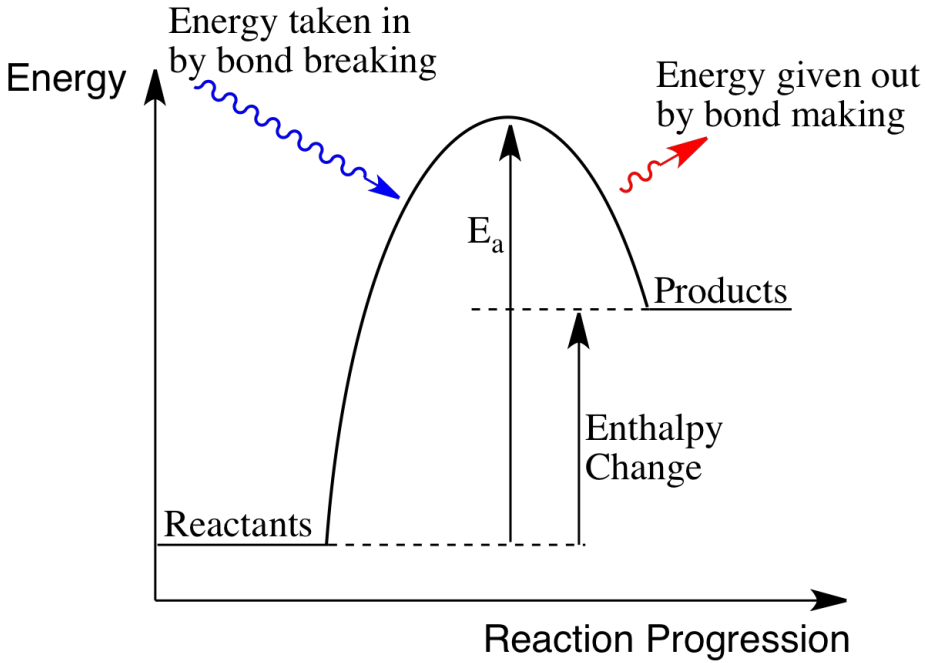
What is a reaction profile?

What is a reaction profile?

A graph that shows the activation energy of a reaction with the relative energies of the reactants and products.

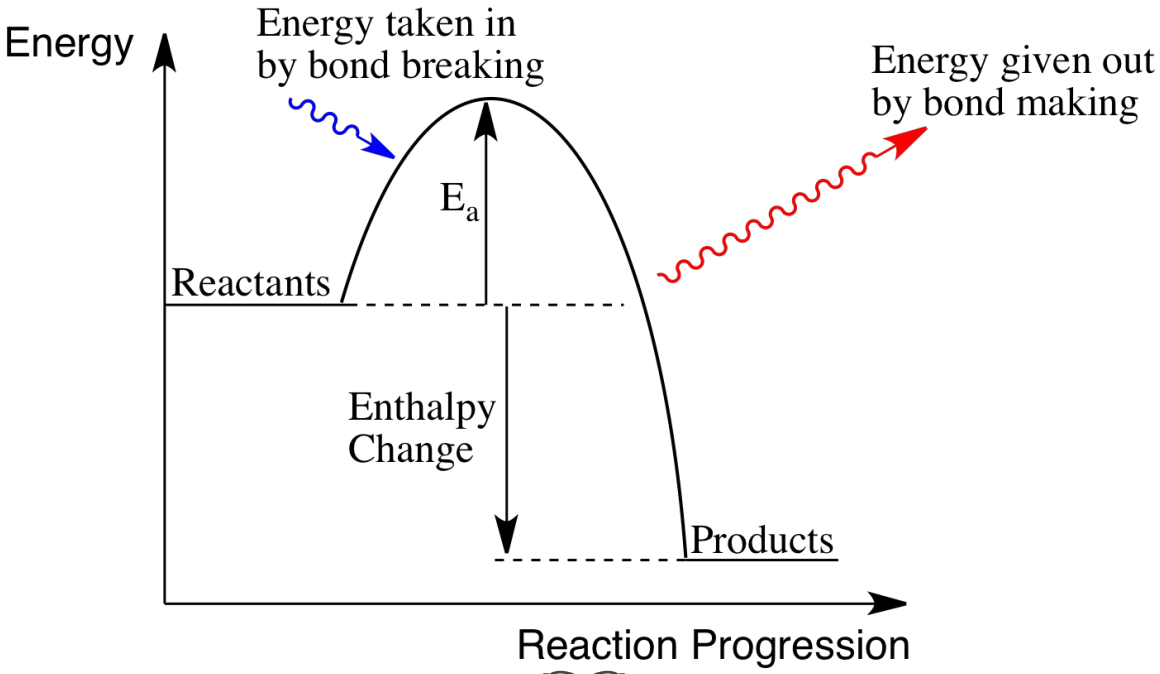
Draw a reaction profile for an endothermic reaction

Draw a reaction profile for an endothermic reaction



Draw a reaction profile for an exothermic reaction

Draw a reaction profile for an exothermic reaction



What is needed for a reaction to occur?

What is needed for a reaction to occur?

Reactant particles need to collide at the correct orientation with sufficient energy.

What is the activation energy of a reaction?

What is the activation energy of a reaction?

The minimum amount of energy required for a reaction to occur.

In terms of bond energies, what happens in a chemical reaction? Describe exothermic and endothermic reactions in terms of bonds breaking / forming.

(Higher only)

In terms of bond energies, what happens in a chemical reaction? Describe exothermic and endothermic reactions in terms of bonds breaking/ forming. (Higher only)

- Energy is needed to break bonds. Energy is released when making bonds.
- Exothermic: Energy used to break bonds is greater than the energy released when making bonds.
- Endothermic: Energy released when forming bonds is greater than the energy used to break bonds.

How can the energy change of a reaction be calculated using bond energies? (Higher only)

How can the energy change of a reaction be calculated using bond energies? (Higher only)

Energy of reaction =

total energy of bonds broken - total energy of bonds made

Describe reduction and oxidation in terms of oxygen

Describe reduction and oxidation in terms of oxygen

Reduction: Loss of oxygen atoms

Oxidation: Gain of oxygen atoms

Describe reduction and oxidation in terms of electrons

(Higher only)

Describe reduction and oxidation in terms of electrons (Higher only)

Reduction: Gain of electrons

Oxidation: Loss of electrons

What are reducing and oxidising agents?

What are reducing and oxidising agents?

Reducing agent: a substance which is oxidised when it reduces another substance.

Oxidising agent: a substance which is reduced when it oxidises another substance.

Sodium oxide is converted to sodium. Explain whether this is oxidation or reduction.

Sodium oxide is converted to sodium. Explain whether this is oxidation or reduction.

Reduction because oxygen is lost.

A copper ion is formed from copper. Explain whether this is oxidation or reduction.

(Higher only)

A copper ion is formed from copper. Explain whether this is oxidation or reduction. (Higher only)

Oxidation because electrons are lost to form Cu^{2+} from Cu.

What is a neutralisation reaction?

What is a neutralisation reaction?

A reaction between an acid and an alkali or base, forming a salt and water.

What is formed when an acid dissolves in water?

What is formed when an acid dissolves in water?

Hydrogen ions (H^+)

What is formed when an alkali dissolves in water?

What is formed when an alkali dissolves in water?

Hydroxide ions (OH^-)

Write the general ionic equation for a neutralisation reaction

Write the general ionic equation for a neutralisation reaction

$$H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$$

What is produced when an acid reacts with a metal carbonate?

What is produced when an acid reacts with a metal carbonate?

- Salt
- Water
- Carbon dioxide

Acid + metal carbonate → salt + water + carbon dioxide

What is produced when an acid reacts with a metal?

What is produced when an acid reacts with a metal?

- Salt
- Hydrogen

$$\text{Acid} + \text{metal} \rightarrow \text{salt} + \text{hydrogen}$$

Name the salt produced when zinc reacts with nitric acid

Name the salt produced when zinc reacts with nitric acid

Zinc nitrate, $Zn(NO_3)_2$

Name the salt produced when magnesium reacts with hydrochloric acid

Name the salt produced when magnesium reacts with hydrochloric acid

Magnesium chloride, $MgCl_2$

Write the word and chemical equations for the reaction between sulfuric acid and calcium carbonate

Write the word and chemical equations for the reaction between sulfuric acid and calcium carbonate

calcium carbonate + sulfuric acid → calcium sulfate + carbon dioxide + water

$$CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + CO_2 + H_2O$$

What is the difference between a strong and weak acid?

(Higher only)

What is the difference between a strong and weak acid? (Higher only)

The strength of the acid refers to the degree of ionisation.

Strong acids are completely ionised in an aqueous solution (lots of H^+ ions are released).

Weak acids are only partially ionised in an aqueous solution (fewer H^+ ions released).

Give examples of strong and weak acids (Higher only)

Give examples of strong and weak acids (Higher only)

Strong acid: Hydrochloric acid, sulfuric acid

Weak acid: Ethanoic acid

What do the terms dilute and concentrated mean?

(Higher only)

What do the terms dilute and concentrated mean? (Higher only)

Concentration refers to the amount of substance in a given volume of solution.

A dilute solution is one where a small amount of solute has been added to a given volume of solvent. In a concentrated solution, a large amount of solute has been added.

In terms of acids, what is the difference between the terms strong / weak and dilute / concentrated?

(Higher only)

In terms of acids, what is the difference between the terms strong / weak and dilute / concentrated? (Higher only)

Strong/weak refers to the degree of ionisation of the acid.

Dilute/concentrated refers to the amount of substance in a given volume of solution.

How is the relative acidity and alkalinity of a solution measured?

How is the relative acidity and alkalinity of a solution measured?

Using the pH scale

How can pH be measured?

How can pH be measured?

Universal indicator

pH probe

Which pH values describe an acid, alkali and neutral solution?

Which pH values describe an acid, alkali and neutral solution?

Acid: pH < 7

Neutral: pH = 7

Alkali: pH > 7

As the pH decreases by one unit, what happens to the concentration of H^+ ions?

(Higher only)

As the pH decreases by one unit, what happens to the concentration of H^+ ions? (Higher only)

Increases by a factor of 10

Describe the concentration of H^+ ions and pH of a strong acid (Higher only)

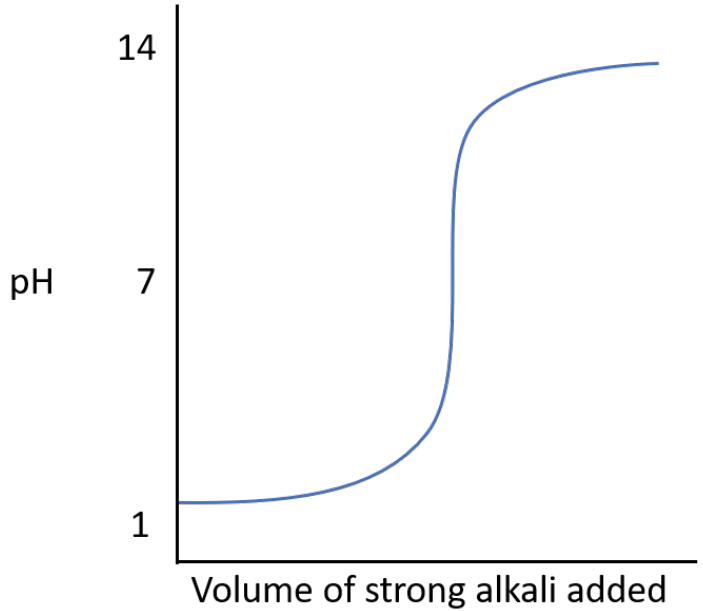
Describe the concentration of H^+ ions and pH of a strong acid (Higher only)

- High concentration of H^+ ions.
- pH value close to 0, within the range 0-7.

Draw a titration curve to show how the pH changes when a strong alkali is added to a strong acid

(Higher only)

Draw a titration curve to show how the pH changes when a strong alkali is added to a strong acid (Higher only)



What colour is phenolphthalein in acid and alkali?

What colour is phenolphthalein in acid and alkali?

Acid - Colourless

Alkali - Pink

What colour is methyl orange in acid and alkali?

What colour is methyl orange in acid and alkali?

Acid - Red

Alkali - Yellow

What happens to blue litmus paper in acid and alkali?

What happens to blue litmus paper in acid and alkali?

Acid - Turns red

Alkali - Stays blue

What happens to red litmus paper in acid and alkali?

What happens to blue litmus paper in acid and alkali?

Acid - Stays red

Alkali - Turns blue

What is a problem with using universal indicator to test the pH of a solution?

What is a problem with using universal indicator to test the pH of a solution?

- Colour of the solution to be matched to a pH colour chart which is quite subjective (people may disagree upon the colour the solution).
- Does not provide an exact pH value.

What is electrolysis?

What is electrolysis?

A process which uses electrical energy to decompose electrolytes.

What are cations and anions?

What are cations and anions?

Cations: Positive ions

Anions: Negative ions

What is the cathode and anode?

What is the cathode and anode?

Cathode: Negative electrode

Anode: Positive electrode

During electrolysis what forms at the cathode and anode?

During electrolysis what forms at the cathode and anode?

Cathode: Metal or hydrogen

Anode: Non-metal

What happens at the anode during electrolysis?

What happens at the anode during electrolysis?

The negatively charged ions are attracted to the anode where they lose electrons to form their elements.

What happens at the cathode during electrolysis?

What happens at the cathode during electrolysis?

The positively charged ions are attracted to the cathode where they gain electrons to form their elements.

How can you predict whether a metal or hydrogen will form at the cathode?

How can you predict whether a metal or hydrogen will form at the cathode?

If hydrogen is above the metal in the reactivity series then the metal will form because hydrogen in more reactive. If the metal is more reactive than hydrogen, hydrogen will form.

What will form at each electrode during the electrolysis of molten sodium chloride?

What will form at each electrode during the electrolysis of molten sodium chloride?

Cathode: Sodium

Anode: Chlorine

What will form at each electrode during the electrolysis of aqueous sodium chloride?

What will form at each electrode during the electrolysis of aqueous sodium chloride?

Cathode: hydrogen

Anode: chlorine

What is formed at each electrode during the electrolysis of copper chloride solution?

What is formed at each electrode during the electrolysis of copper chloride solution?

Cathode: copper

Anode: chlorine

What is formed at each electrode during the electrolysis of sodium sulfate solution?

What is formed at each electrode during the electrolysis of sodium sulfate solution?

Positive electrode: oxygen

Negative electrode: hydrogen

Name the process that occur at each electrode

Name the process that occur at each electrode

Anode: oxidation

Cathode: reduction

Why are inert electrodes often used during electrolysis?

Why are inert electrodes often used during electrolysis?

When the products are very reactive to prevent any further reactions occurring.

Give an example of when non-inert electrodes are used during electrolysis

Give an example of when non-inert electrodes are used during electrolysis

Purification of impure copper using copper sulfate solution.

One electrode must be the impure copper (which takes part in the reaction) rather than an inert electrode.

Describe how electrolysis of copper sulfate can be used to purify copper

Describe how electrolysis of copper sulfate can be used to purify copper

The anode is impure copper and the cathode is pure copper. Insert the electrodes into a solution of copper sulfate and connect to a power supply. Ensure the electrodes don't touch.

The copper ions from the impure anode move to the cathode where they gain electrons and form pure copper. Impurities form as sludge below the anode.