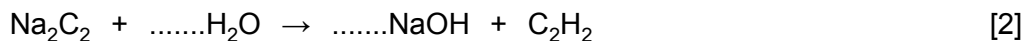




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- 1 Sodium carbide, Na_2C_2 , reacts with water to form ethyne, C_2H_2 .

(a) Complete the symbol equation for this reaction.



(b) Calculate the relative formula mass of sodium carbide.

[1]

[Total: 3]

- 2 A compound contains 85.7% carbon and 14.3% hydrogen by mass.

(a) Calculate the empirical formula of this compound.

Show your working.

..... [2]

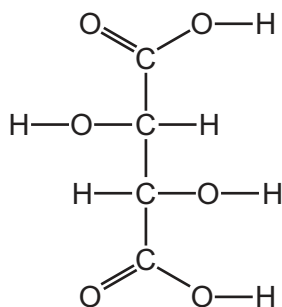
(b) The molecular mass of the compound is 112.

Calculate the molecular formula of this compound.

..... [1]

[Total: 3]

- 3 The structure of tartaric acid is shown.



- (a) On the structure, draw a circle around **one** alcohol functional group.

[1]

- (b) Deduce the formula of tartaric acid to show the number of carbon, hydrogen and oxygen atoms.

[1]

- (c) Complete the table to calculate the relative molecular mass of tartaric acid. Use your Periodic Table to help you.

type of atom	number of atoms	relative atomic mass	
carbon		12	
hydrogen	6	1	$6 \times 1 = 6$
oxygen		16	

relative molecular mass = ... [2]

[Total: 4]

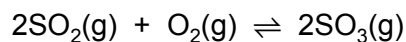
- 4 Sulfuric acid is manufactured using the Contact process. This manufacture involves four stages.

- (a) **Stage 1** involves the combustion of sulfur to form sulfur dioxide.

Write the chemical equation for **stage 1**.

[1]

(b) The equation for **stage 2** is shown.



The reaction can reach equilibrium.

Explain what is meant by the term *equilibrium*.

.....

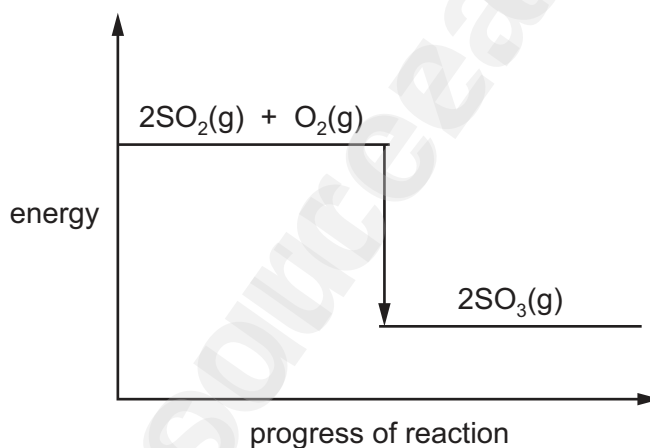
.....

.....

.....

[2]

(c) The energy level diagram for the forward reaction in **stage 2** is shown.



Explain what the diagram shows about the energy changes in the forward reaction.

.....

.....

.....

.....

[2]

(d) In **stage 3** sulfur trioxide, SO_3 , is converted to oleum, $\text{H}_2\text{S}_2\text{O}_7$.

In **stage 4** oleum reacts to form sulfuric acid, H_2SO_4 .

State what oleum reacts with in **stage 4**.

.....

[1]

[Total: 6]

- 5 Many compounds and elements have important uses.

Complete the table to show the name, formula and use of each compound and element.

name of compound or element	number of atoms in the formula	formula	use
chlorine	chlorine = 2	Cl_2	
	carbon = 1 hydrogen = 4	CH_4	
calcium carbonate	calcium = 1 carbon = 1 oxygen = 3		

[5]

[Total: 5]

- 6 Many compounds have important uses.

Complete the table to show the name, number of atoms in the formula and use.

name of compound	number of atoms in the formula	formula	use
water	hydrogen = 2 oxygen = 1	H_2O	
	sulfur = 1 oxygen = 2	SO_2	
calcium hydroxide (slaked lime)	calcium = ... oxygen = ... hydrogen = ...	Ca(OH)_2	

[5]

[Total: 5]

- 7 A solution is obtained by filtering a mixture of soil and water. The table shows the mass of some of the ions in 1000 cm^3 of this solution.

name of ion	formula of ion	mass of ion in 1000 cm^3 of soil solution / mg
aluminium	Al^{3+}	0.2
	NH_4^+	22.0
calcium	Ca^{2+}	0.2
iron(II)	Fe^{2+}	79.0
magnesium	Mg^{2+}	0.1
nitrate	NO_3^-	28.0
phosphate	PO_4^{3-}	14.0
potassium	K^+	39.0
	SO_4^{2-}	5.1

(a) Answer these questions using the information in the table.

- (i) Which negative ion has the lowest concentration?

..... [1]

- (ii) State the name of the SO_4^{2-} ion.

..... [1]

- (iii) Calculate the mass of nitrate ions in 200 cm^3 of this solution.

mass = ... mg [1]

- (iv) Name the compound that contains NH_4^+ ions and NO_3^- ions.

..... [1]

[Total: 4]

- 8 Complete the table to show the relative charge and approximate relative mass of a proton, a neutron and an electron.

type of particle	relative charge	approximate relative mass
proton	+1	
neutron		
electron		$\frac{1}{2000}$

[3]

[Total: 3]

- 9 A solution is obtained by filtering a mixture of soil and water. The table shows the mass of some of the ions in 1000 cm^3 of this solution.

name of ion	formula of ion	mass of ion in 1000 cm^3 of soil solution / mg
aluminium	Al^{3+}	0.1
	NH_4^+	35.0
calcium	Ca^{2+}	1.3
iron(II)	Fe^{2+}	47.0
magnesium	Mg^{2+}	0.2
	NO_3^-	23.0
phosphate	PO_4^{3-}	4.2
potassium	K^+	99.0
sulfate	SO_4^{2-}	7.5

Answer these questions using the information in the table.

- (a) Which negative ion has the lowest concentration?

..... [1]

- (b) State the name of the NO_3^- ion.

..... [1]

(c) Calculate the mass of phosphate ions in 250 cm^3 of this solution.

mass = ... mg [1]

(d) Name the compound that contains NH_4^+ ions and PO_4^{3-} ions.

..... [1]

[Total: 4]

10 Ammonia is manufactured by the Haber process.

(a) The equation for the reaction is shown.



(i) State what is meant by the symbol $\rightleftharpoons$.

..... [1]

(ii) State **one** source of hydrogen used in the manufacture of ammonia.

..... [1]

(b) The table shows some data for the production of ammonia.

pressure / atm	temperature / °C	percentage yield of ammonia
250	350	58
100	450	28
400	450	42
250	550	20

Deduce the effect on the percentage yield of ammonia of:

- increasing the pressure of the reaction

.....

- increasing the temperature of the reaction.

..... [2]

- (c) Explain, in terms of particles, what happens to the rate of this reaction when the temperature is increased.

.....

.....

.....

.....

.....

..... [3]

[Total: 7]

- 11 Sulfur dioxide, SO₂, is used in the manufacture of sulfuric acid.

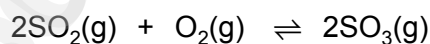
- (a) In the first stage of the process, sulfur dioxide is obtained from sulfur-containing ores.

Name **one** of these ores.

..... [1]

- (b) The next stage of the process is a reaction which can reach equilibrium.

The equation for this stage is shown.



- (i) Describe **two** features of an equilibrium.

.....

..... [2]

- (ii) Name the catalyst used in this stage.

..... [1]

- (iii) Why is a catalyst used?

..... [1]

(iv) Explain, in terms of particles, why a high temperature increases the rate of this reaction.

.....

.....

.....

.....

..... [3]

(v) In this stage, only a moderate temperature of 450 °C is used.

What does this suggest about the forward reaction?

..... [1]

(vi) Calculate the percentage by mass of sulfur in sulfur trioxide, SO₃.

percentage = ... [2]

[Total: 11]

12 When propan-1-ol is heated with concentrated sulfuric acid as a catalyst an unsaturated hydrocarbon of relative molecular mass 42 is formed and one other product.

(a) What is meant by the term *unsaturated*?

..... [1]

(b) Write the chemical equation for this reaction.

..... [2]

(c) Name the unsaturated hydrocarbon formed.

..... [1]

[Total: 4]

13 Sulfuric acid is made from sulfur in a four-stage process.

stage 1 Sulfur is converted into sulfur dioxide.

stage 2 Sulfur dioxide is converted into sulfur trioxide.

stage 3 Sulfur trioxide is converted into oleum.

stage 4 Oleum is converted into sulfuric acid.

(a) How is sulfur converted into sulfur dioxide in **stage 1**?

..... [1]

(b) Describe how sulfur dioxide is converted into sulfur trioxide in **stage 2**.

Your answer should include:

- an equation for the reaction
- the temperature used
- the name of the catalyst used.

..... [3]

(c) The reaction in **stage 2** can reach equilibrium.

What is meant by the term *equilibrium*?

..... [2]

(d) Sulfur trioxide is converted into oleum, $\text{H}_2\text{S}_2\text{O}_7$, in **stage 3**.

What is sulfur trioxide reacted with to convert it into oleum?

..... [1]

(e) Oleum is converted into sulfuric acid in **stage 4**.

Write a chemical equation for the conversion of oleum, $\text{H}_2\text{S}_2\text{O}_7$, into sulfuric acid.

..... [2]

[Total: 9]

14 The question is about elements **X**, **Y** and **Z**.

(a) An atom of element **X** is represented as $^{34}_{16}\text{X}$.

Name the different types of particles found in the nucleus of this atom of **X**.

..... [2]

(b) What is the term for the total number of particles in the nucleus of an atom?

..... [1]

(c) What is the total number of particles in the nucleus of an atom of $^{34}_{16}\text{X}$?

..... [1]

(d) What is the electronic structure of the ion X^{2-} ?

..... [1]

(e) Suggest the formula of the compound formed between aluminium and **X**.

..... [1]

[Total: 6]

15 Part of the definition of relative mass is 'the average mass of naturally occurring atoms of an element'.

Some relative atomic masses are not whole numbers.

Elements **Y** has only two different types of atoms, ^{69}Y and ^{71}Y .

The ratio of atoms present in element **Y** is shown.

$$^{69}\text{Y} : ^{71}\text{Y} = 3 : 2$$

- Calculate the relative atomic mass of element **Y** to **one decimal place**.

relative atomic mass = ...

- Identify element **Y**.

..... [3]

[Total: 3]

16 A student wanted to find the concentration of some dilute sulfuric acid by titration. The student found that 25.0 cm^3 of 0.0400 mol/dm^3 NaOH(aq) reacted exactly with 20.0 cm^3 of $\text{H}_2\text{SO}_4\text{(aq)}$.

(a) Name a suitable indicator to use in this titration.

..... [1]

(b) Calculate the concentration of the $\text{H}_2\text{SO}_4(\text{aq})$ in mol/dm^3 using the following steps.

- Calculate the number of moles of NaOH in 25.0 cm^3 .

moles = ...

- Deduce the number of moles of H_2SO_4 that reacted with the 25.0 cm^3 of $\text{NaOH}(\text{aq})$.

moles = ...

- Calculate the concentration of $\text{H}_2\text{SO}_4(\text{aq})$ in mol/dm^3 .

concentration = ... mol/dm^3 [3]

(c) Calculate the concentration of the 0.0400 mol/dm^3 $\text{NaOH}(\text{aq})$ in g/dm^3 .

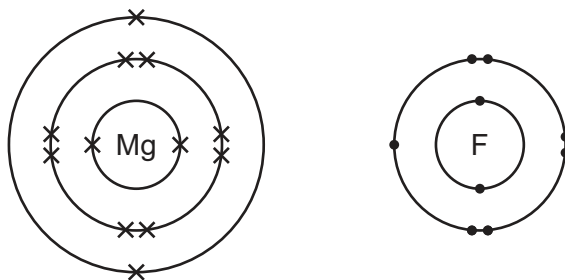
concentration = ... g/dm^3 [2]

[Total: 6]

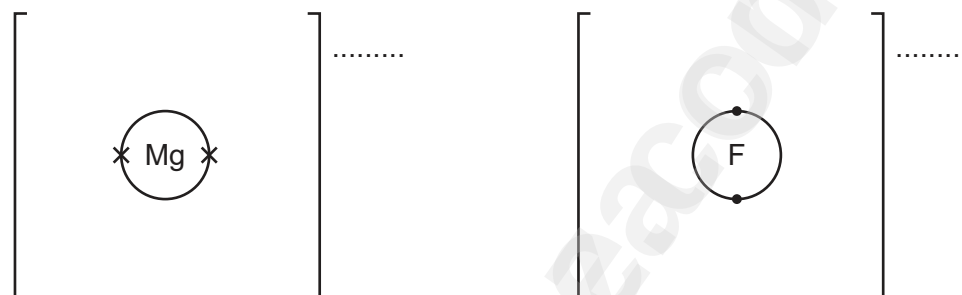
17 Fluorine forms both ionic and covalent compounds.

Magnesium reacts with fluorine to form the ionic compound magnesium fluoride.

The electronic structures of an atom of magnesium and an atom of fluorine are shown.



- (a) Complete the dot-and-cross diagrams to show the electronic structures of one magnesium ion and one fluoride ion. Show the charges on the ions.



[3]

- (b) What is the formula of magnesium fluoride?

..... [1]

[Total: 4]

- 18 Magnesium oxide forms when magnesium nitrate, $\text{Mg}(\text{NO}_3)_2$, is heated strongly. This is an endothermic reaction.

- (a) Write the chemical equation for this reaction.

..... [2]

- (b) What type of reaction is this?

..... [1]

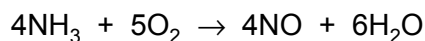
- (c) Name **two** other compounds of magnesium that form magnesium oxide when heated.

.....
 [2]

[Total: 5]

- 19 Ammonia, NH_3 , is used to produce nitric acid, HNO_3 . This happens in a three-stage process.

Stage 1 is a redox reaction.



- (a) Identify what is oxidised in **stage 1**.

Give a reason for your answer.

substance oxidised

reason

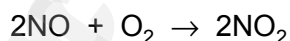
..... [2]

- (b) In this reaction the predicted yield of NO is 512 g. The actual yield is 384 g.

Calculate the percentage yield of NO in this reaction.

percentage yield of NO = ... [1]

- (c) The equation for the reaction in **stage 2** is shown.

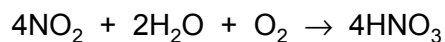


Which major environmental problem does NO₂ cause if it is released into the atmosphere?

.....

..... [1]

(d) The equation for the reaction in **stage 3** is shown.



Calculate the volume of O_2 gas, at room temperature and pressure (r.t.p.), needed to produce 1260 g of HNO_3 .
Use the following steps.

- Calculate the number of moles of HNO_3 .

moles of HNO_3 = ...

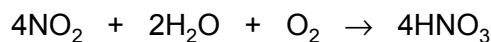
- Deduce the number of moles of O_2 that reacted.

moles of O_2 = ...

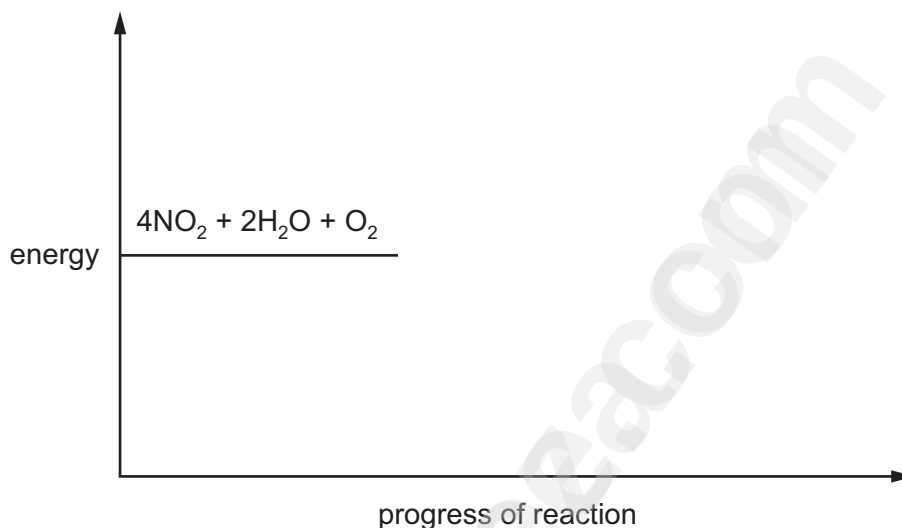
- Calculate the volume of O_2 gas that reacts at room temperature and pressure (r.t.p.).

volume of O_2 gas = ... dm^3 [4]

- (e) The reaction in **stage 3** is exothermic.



Complete the energy level diagram for this reaction. Include an arrow that clearly shows the energy change during the reaction.



[3]

[Total: 11]

- 20** Barium sulfate is an insoluble salt.

Barium sulfate can be made from aqueous ammonium sulfate using a precipitation reaction.

- (a) Name a solution that can be added to aqueous ammonium sulfate to produce a precipitate of barium sulfate.

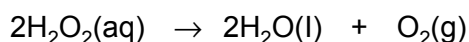
..... [1]

- (b) Write an ionic equation for this precipitation reaction. Include state symbols.

..... [2]

[Total: 3]

- 21** The equation for the decomposition of hydrogen peroxide is shown.



25.0 cm³ of aqueous hydrogen peroxide forms 48.0 cm³ of oxygen at room temperature and pressure (r.t.p.).

- (a) Calculate the concentration of aqueous hydrogen peroxide at the start of the experiment using the following steps.

- Calculate the number of moles of oxygen formed.

..... mol

- Deduce the number of moles of hydrogen peroxide that decomposed.

..... mol

- Calculate the concentration of hydrogen peroxide in mol/dm^3 .

..... mol/dm^3 [3]

- (b) Oxygen can also be produced by the decomposition of potassium chlorate(V), KClO_3 .

The only products of this decomposition are potassium chloride and oxygen.

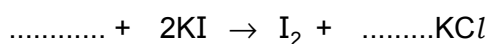
Write a chemical equation for this decomposition.

..... [2]

[Total: 5]

- 22 Iodide is formed when chlorine reacts with aqueous potassium iodide.

- (a) Complete the chemical equation for this reaction.



[2]

- (b) When aqueous iodine is mixed with aqueous potassium chloride, there is no reaction.

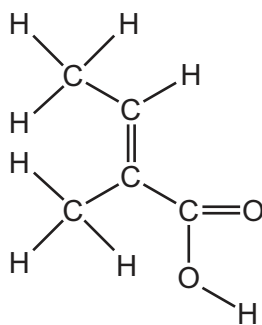
Suggest, in terms of chemical reactivity, why there is no reaction.

..... [1]

[Total: 3]

- 23 Angelic acid and ethanoic acid are both carboxylic acids.

The structure of angelic acid is shown.



(a)

- (i) On the structure of angelic acid, draw a circle around the functional group that shows that it is carboxylic acid. [1]

- (ii) Deduce the formula of angelic acid to show the number of carbon, hydrogen and oxygen atoms.

..... [1]

- (iii) Angelic acid is an unsaturated compound.

Describe a chemical test to distinguish between an unsaturated and a saturated compound.

test

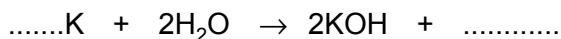
result with unsaturated compound

result with saturated compound [3]

[Total: 5]

- 24 When potassium reacts with water, a coloured flame is seen and a gas is produced that pops with a lighted splint.

- (a) Complete the chemical equation for this reaction.



[2]

- (b) State the colour of the flame when potassium reacts with water.

..... [1]

- (c) The solution formed is alkaline.

Describe how you can use universal indicator solution to determine the pH of the solution.

.....
..... [2]

[Total: 5]

25 Iron(II) sulfate can be converted to iron(III) sulfate by potassium manganate(VII) at room temperature.

(a) What is the role of potassium manganate(VII) in this reaction?

..... [1]

(b) What condition must be used for this reaction to occur?

..... [1]

(c) In terms of electron transfer, what happens to the iron(II) ions in this reaction?

..... [1]

(d) State the colour change seen during this reaction.

from purple to [1]

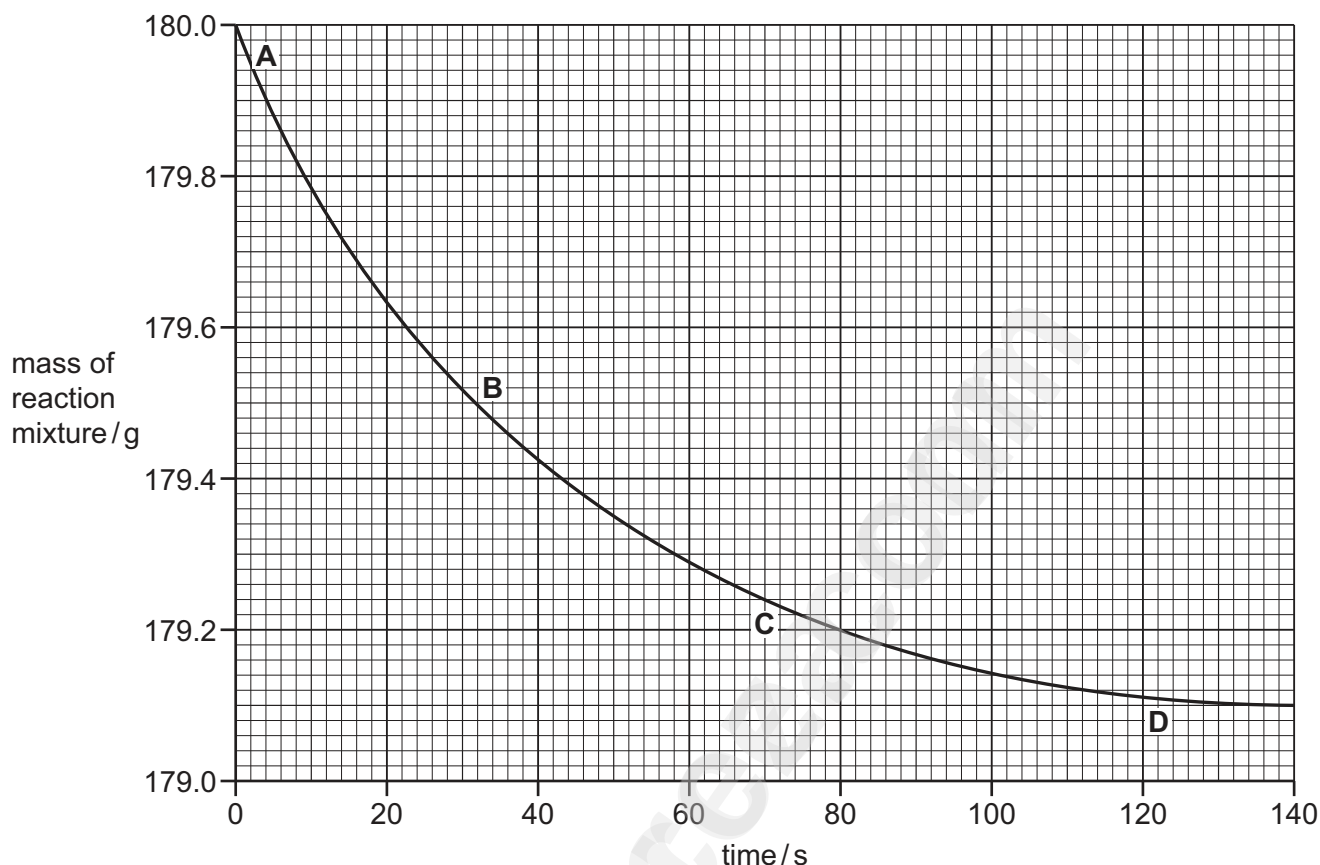
[Total: 4]

26 A student investigated the reaction of magnesium carbonate with an excess of dilute hydrochloric acid.



The rate of reaction can be found by measuring the decrease in the mass of the reaction mixture over time.

The results are shown on the graph.



- (a) Determine the mass of the reaction mixture after 58 seconds.

..... [1]

- (b) At which point on the graph, **A**, **B**, **C**, or **D**, was the rate of reaction the fastest?
Use the graph to explain your answer.

..... [2]

- (c) When 0.42 g of magnesium carbonate is used, 120 cm³ of carbon dioxide is formed.

Determine the volume of carbon dioxide produced when 1.26 g of magnesium carbonate reacts completely.

volume of carbon dioxide = ... cm³ [1]

- (d) What effect do the following have on the rate of this reaction?

- (i) • Decreasing the concentration of the acid.
All other conditions are kept the same.

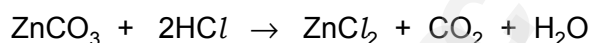
..... [1]

- (ii) • Using smaller pieces of magnesium carbonate.
All other conditions are kept the same.

..... [1]

[Total: 6]

- 27 A student investigated the reaction between zinc carbonate and an excess of dilute hydrochloric acid.



The rate of reaction can be found by measuring the decrease in the mass of the reaction mixture over time.

- (a) Describe **one** other practical method for measuring the rate of this reaction.

.....
.....
.....
.....
.....

[3]

- (b) When 6.25 g of zinc carbonate is used, 2.20 g of carbon dioxide is formed.

Calculate the mass of zinc carbonate that forms 11.00 g of carbon dioxide.

mass of zinc carbonate = ... g [1]

- (c) What effect do the following have on the rate of this reaction?

- (i) Decreasing the temperature of the reaction mixture.
All other conditions are kept the same.

..... [1]

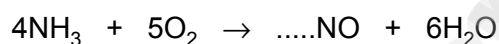
- (ii) Increasing the concentration of hydrochloric acid.
All other conditions are kept the same.

..... [1]

[Total: 6]

28 Ammonia is used in the manufacture of nitric acid.

- (a) Balance the chemical equation for the first step in the process.



[1]

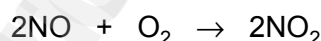
- (b) The reaction is exothermic.

What is meant by the term *exothermic*?

.....
.....

[1]

- (c) The NO produced in the first step then reacts with oxygen to produce nitrogen dioxide, NO₂.



How does this equation show that NO is oxidised?

.....
.....

[1]

- (d) Is nitrogen dioxide an acidic oxide or a basic oxide?
Give a reason for your answer.

.....
.....

[1]

[Total: 4]

29 The table shows the percentage by mass of the elements on Earth and in the Universe.

element	percentage by mass on Earth	percentage by mass in the Universe
helium	0.1	21.0
hydrogen	0.1	76.0
iron	35.0	1.0
magnesium	14.0	0.1

oxygen	29.0	0.8
silicon	14.0	0.1
sulfur	2.9	0.1
other elements		0.9
total	100.0	100.0

Answer these questions using only the information in the table.

(a) Deduce the percentage by mass of other elements present on Earth.

..... % [1]

(b) Which non-metallic element is present on Earth in the greatest percentage by mass?

..... [1]

(c) Give **two** major differences in the percentage by mass of the elements on Earth and in the Universe.

1

.....

2

..... [2]

[Total: 4]

30 Phosphorus forms a compound with hydrogen with the following composition by mass:

P, 93.94%; H, 6.06%.

(a) Calculate the empirical formula of the compound.

empirical formula = ... [2]

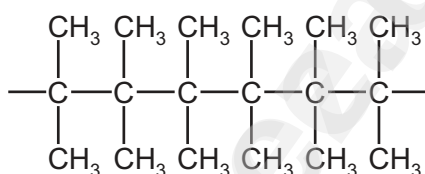
- (b) The compound has a relative molecular mass of 66.

Deduce the molecular formula of the compound.

molecular formula = ... [1]

[Total: 3]

- 31 Part of the structure of synthetic polymer **A** is shown.



- (a) What type of synthetic polymer is **A**?

..... [1]

- (b) Deduce the empirical formula of polymer **A**.

..... [1]

- (c) Draw the structure of the monomer from which polymer **A** is made.

[2]

[Total: 4]

- 32 Insoluble salts can be made by precipitation reactions.

A student mixed solutions of some soluble salts.

The results the student obtained are shown in the table.

		second salt solution		
		$\text{Co}(\text{NO}_3)_2(\text{aq})$	$\text{AgNO}_3(\text{aq})$	$\text{Pb}(\text{NO}_3)_2(\text{aq})$
first salt solution	$\text{NaI}(\text{aq})$	no change	yellow precipitate	yellow precipitate
	$\text{Na}_2\text{CO}_3(\text{aq})$	purple precipitate	yellow precipitate	white precipitate
	$\text{Na}_2\text{SO}_4(\text{aq})$	no change	white precipitate	white precipitate

All sodium salts are soluble in water.

Use only results from the table to answer the following questions.

(a) Name:

(i) an insoluble cobalt salt

..... [1]

(ii) an insoluble yellow lead salt

..... [1]

(b) Write the chemical equation for the reaction in which silver carbonate is formed.

..... [2]

(c) Write the ionic equation for the reaction in which lead(II) iodide is formed.

..... [2]

[Total: 6]

33 The manufacture of sulfuric acid by the Contact process occurs in four stages.

stage 1 Molten sulfur is burned in air to produce sulfur dioxide gas.

stage 2 Sulfur dioxide is reacted with oxygen to form sulfur trioxide.

stage 3 Sulfur trioxide is combined with concentrated sulfuric acid to form oleum, $\text{H}_2\text{S}_2\text{O}_7$.

stage 4 Oleum is added to water to form sulfuric acid.

(a) Complete the chemical equation for **stage 1** by adding the appropriate state symbols.

$\text{S}(\text{.....}) + \text{O}_2(\text{.....}) \rightarrow \text{SO}_2(\text{.....})$ [1]

(b) Name the catalyst used in **stage 2** and state the temperature used.

catalyst

temperature °C [2]

(c) Write chemical equations for the reactions in **stage 3** and **stage 4**.

stage 3

stage 4 [2]

[Total: 5]

- 34** Sulfur dioxide reacts with aqueous sodium sulfite to produce a compound with the following composition by mass:
29.1% Na, 40.5% S and 30.4% O.

Calculate the empirical formula of this compound.

empirical formula = ... [3]

[Total: 3]

- 35** Methanol, CH_3OH , is a member of the homologous series of alcohols.

Methanol can be made from methane in a two-step process.

step 1 Methane is reacted with chlorine gas to produce chloromethane, CH_3Cl .

step 2 CH_3Cl is reacted with sodium hydroxide to produce CH_3OH and one other product.

(a) What conditions are needed in **step 1**?

..... [1]

(b) Write the chemical equation for the reaction which occurs in **step 1**.

..... [1]

(c) State the type of organic reaction occurring in **step 1**.

..... [1]

(d) Complete the chemical equation for **step 2**.

$\text{CH}_3\text{Cl} + \text{NaOH} \rightarrow \text{CH}_3\text{OH} + \dots\dots\dots$ [1]

[Total: 4]

- 36** A sample of concentrated hydrobromic acid, HBr(aq) , was electrolysed using platinum electrodes.

The concentration of the hydrobromic acid was 8.89 mol/dm^3 .

- (a) Calculate the concentration of the HBr(aq) in g/dm^3 .

concentration of the HBr(aq) = ... g/dm^3 [1]

- (b) Explain why concentrated HBr(aq) can conduct electricity.

.....

 [2]

- (c) Magnesium is **not** a suitable material from which to make the electrodes.

Explain why.

.....
 [1]

- (d) Predict the product formed at the anode when concentrated HBr(aq) is electrolysed.

..... [1]

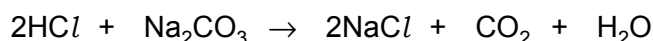
- (e) Write the ionic half-equation for the reaction occurring at the cathode.

..... [2]

[Total: 7]

- 37** Dilute hydrochloric acid, HCl(aq) , reacts with aqueous sodium carbonate, $\text{Na}_2\text{CO}_3(\text{aq})$.

The chemical equation for the reaction is shown.



A 25.0 cm^3 portion of $\text{Na}_2\text{CO}_3(\text{aq})$ was placed in a conical flask with a few drops of a suitable indicator. It was titrated against HCl(aq) of concentration 0.180 mol/dm^3 .

20.0 cm^3 of HCl(aq) was required to reach the end-point.

Calculate the concentration of the $\text{Na}_2\text{CO}_3(\text{aq})$, in mol/dm^3 , using the following steps.

(a) Calculate the number of moles of HCl used in the titration.

.....mol [1]

(b) Calculate the number of moles of Na_2CO_3 contained in the 25.0 cm^3 portion of $\text{Na}_2\text{CO}_3(\text{aq})$.

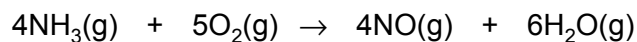
.....mol [1]

(c) Calculate the concentration of the $\text{Na}_2\text{CO}_3(\text{aq})$ in mol/dm^3 .

..... [1]

[Total: 3]

38 Ammonia reacts with oxygen as shown.



Calculate the volume of oxygen at room temperature and pressure, in dm^3 , that reacts with 4.80 dm^3 of ammonia.

volume = ... dm^3 [3]

[Total: 3]

39 The positions of some common metals in the reactivity series are shown.



- (a) When magnesium is placed in aqueous copper(II) sulfate a displacement reaction occurs immediately.

Write an ionic equation for the reaction. Include state symbols.

..... [2]

- (b) State **two** observations you would make when magnesium is placed in aqueous copper(II) sulfate.

1

2 [2]

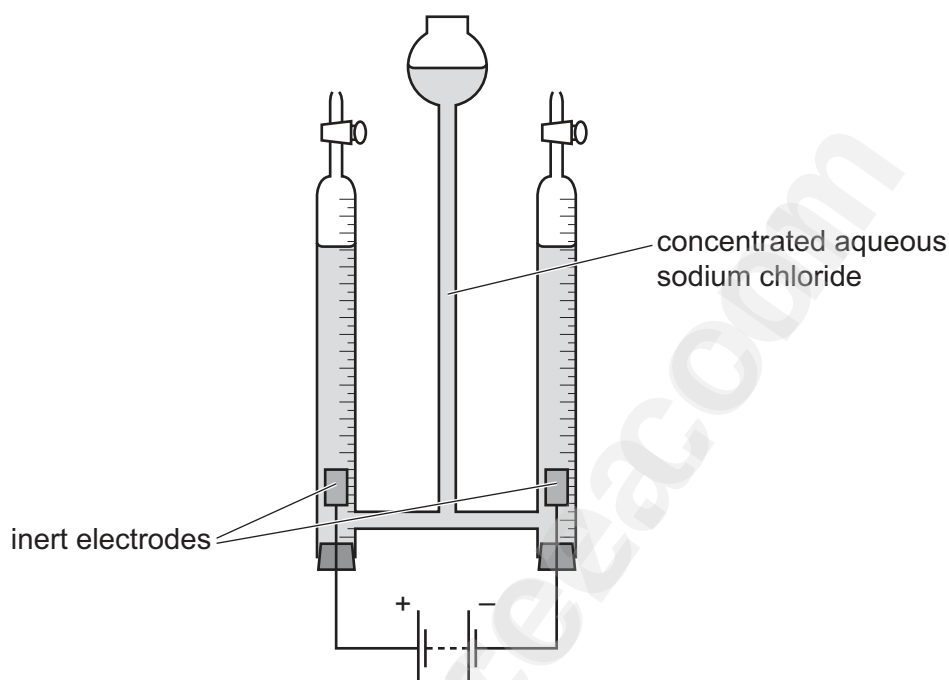
- (c) When aluminium foil is added to aqueous copper(II) sulfate no immediate reaction takes place.

Explain why.

..... [1]

[Total: 5]

- 40 A student used the following apparatus to electrolyse concentrated aqueous sodium chloride using inert electrodes.



- (a) Suggest the name of a metal which could be used as the inert electrodes.

..... [1]

- (b) Name the gas formed at the positive electrode.

..... [1]

- (c) Write an ionic half-equation for the reaction occurring at the negative electrode. Include state symbols.

..... [3]

- (d) How, if at all, does the pH of the solution change during the electrolysis? Explain your answer.

.....

 [3]

[Total: 8]