OCR GCSE GATEWAY CHEMISTRY A · J248

CHEMISTRY



EXAM QUESTION PACK

WS1.4 SCIENTIFIC VOCABULARY, QUANTITIES, UNITS, SYMBOLS AND NOMENCLATURE

SCORE	PERCENTAGE
/79	%

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Gateway Chemistry A (9-1)

Scientific vocabulary, quantities, units, symbols and nomenclature

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:
Additional resources may be supplied with this paper.

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **79**.
- The total number of marks may take into account some 'either/or' question choices.

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1 Lesley has a concentrated sugar solution.

She wants to dilute it to make a sugar solution which is a **quarter** of the original concentration.
Describe how she can do this.

---

[2]

2 A sample of 42 g of magnesium carbonate contains 12 g of magnesium.

Calculate the percentage by mass of magnesium in magnesium carbonate.

Quote your answer to **one** decimal place.

percentage by mass = ---------- % **[2]**

3 A student has a solution of hydrochloric acid, HC*l*, and a solution of sodium hydroxide, NaOH.

He wants to make a pure, dry sample of sodium chloride.

Write a **balanced symbol** equation for the reaction.

---

[1]

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4 Look at the balanced symbol equation.

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

What does the symbol **(s)** represent in the balanced symbol equation?

A Solid
B Solute
C Solution
D Substance

Your answer ☐ **[1]**

5 The formula of magnesium chloride is $MgCl_2$.

What is the relative formula mass of magnesium chloride?

(A_r: Mg = 24.3, Cl = 35.5)

A 59.8
B 95.3
C 119.6
D 84.1

Your answer ☐ **[1]**

6 Sodium hydroxide reacts with hydrochloric acid. Sodium chloride and water are made.
What is the name of this type of reaction?

A Neutralisation
B Oxidation
C Reduction
D Thermal decomposition

Your answer ☐ **[1]**

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7 Neutralisation occurs when acids react with alkalis.

What is the ionic equation for neutralisation?

A $H^+ + OH^- \rightarrow H_2O$
B $H^- + OH^+ \rightarrow H_2O$
C $H^+ + OH^+ \rightarrow H_2O$
D $H^- + OH^- \rightarrow H_2O$

Your answer ☐ [1]

8 Butane has the molecular formula C_4H_{10}.

What is the **empirical** formula of butane?

A CH_5
B C_2H_5
C C_4H_{10}
D CH_{14}

Your answer ☐ [1]

9 A potassium isotope can be shown as:

$^{39}_{19}K$

What are the numbers of protons, neutrons and electrons in this potassium isotope?

A 19 protons, 19 neutrons, 20 electrons
B 19 protons, 20 neutrons, 19 electrons
C 20 protons, 19 neutrons, 19 electrons
D 20 protons, 20 neutrons, 19 electrons

Your answer ☐ [1]

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10 A student is making perfume using violet flowers.

The student does an experiment to extract the perfume from the flowers using the apparatus shown in **Fig. 21.1**.

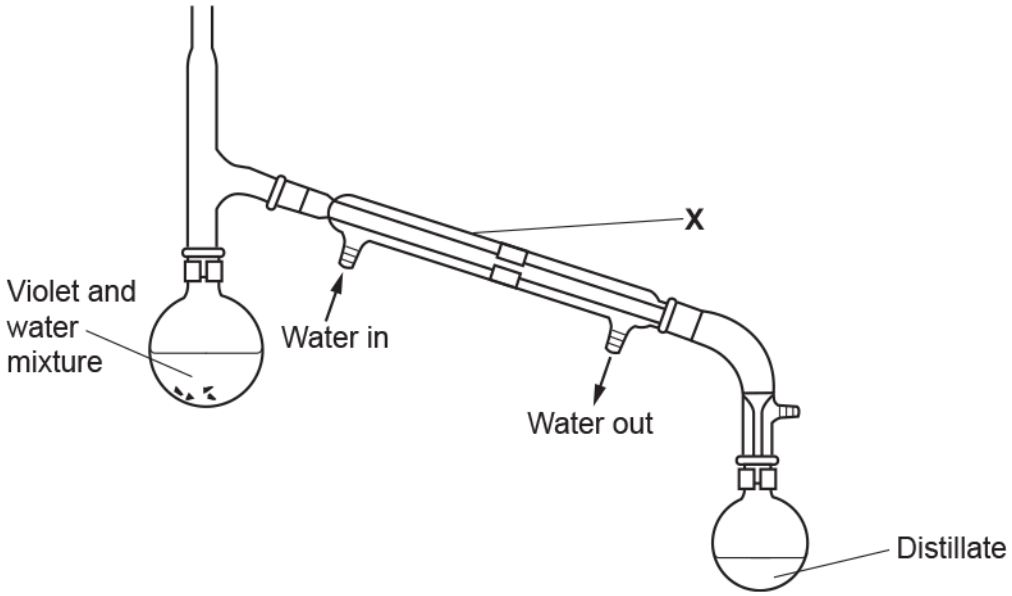


Fig. 21.1

The teacher says the apparatus is not set-up correctly.

(i) What is the name of the piece of apparatus labelled **X**?

[1]

(ii) Name the process shown in **Fig. 21.1**.

[1]

(iii) Suggest **two** changes that the student should make to set-up the apparatus correctly.

1

2

[2]

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11 Carbon-12 and carbon-14 are isotopes.

Which statement describes isotopes?

A Atoms with the same number of protons but a different number of electrons.
B Atoms with the same number of electrons but a different number of protons.
C Atoms with the same number of protons but a different number of neutrons.
D Atoms with the same number of neutrons but a different number of protons.

Your answer [1]

12 Avogadro's constant has a value of 6.02×10^{23}.

What is the number of atoms in 0.5 mol of water?

A 2.00×10^{23}
B 3.01×10^{23}
C 6.02×10^{23}
D 9.03×10^{23}

Your answer [1]

13 Magnesium powder reacts with copper(II) oxide. Magnesium oxide and copper are made.

$Mg + CuO \rightarrow MgO + Cu$

Which substance is the **reducing agent**?

A Magnesium
B Copper oxide
C Magnesium oxide
D Copper

Your answer [1]

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14 Phosphoric acid contains phosphate ions, PO_4^{3-}.

Phosphoric acid is completely neutralised by sodium hydroxide.

What is the formula of the salt that is made?

A Na_2PO_4
B Na_3PO_4
C $Na(PO_4)_3$
D $Na_2(PO_4)_3$

Your answer ☐ [1]

15(a) A student is investigating chemical reactions that produce heat.

She adds zinc to hydrochloric acid, HCl.

Zinc chloride, $ZnCl_2$, and hydrogen gas are made.

(i) Write the **balanced symbol** equation for this reaction.

[2]

(ii) What term is used to describe a reaction that produces heat?

[1]

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(b) The student draws the reaction profile for this reaction, as shown in **Fig. 18.1**.

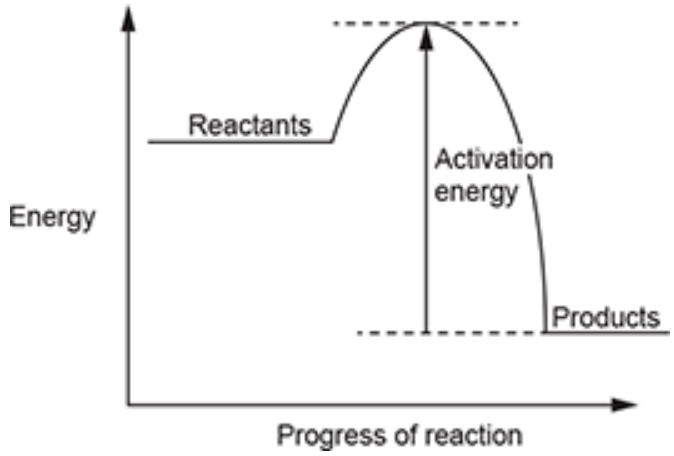


Fig. 18.1

Explain what is meant by the term **activation energy**.

---

[1]

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(c) Combustion reactions produce a lot of heat energy.

Bond energies can be used to calculate the energy change in combustion reactions.

Bond	Bond energy (kJ / mol)
C–H	413
O=O	498
C=O	805
O–H	464

Methane is a common fuel used in combustion reactions.

Methane reacts with oxygen. Carbon dioxide and water are made, as shown in **Fig. 18.2**.

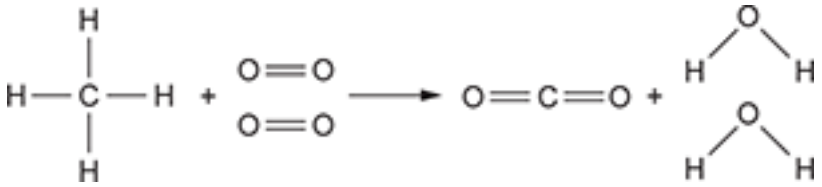


Fig. 18.2

(i) The reaction of methane with oxygen produces heat.

Explain why.

Use ideas about bond breaking and bond making in your answer.

---

[3]

(ii) Calculate the total energy transferred to break the bonds in the reactants in **Fig. 18.2**.

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Total energy transferred = ... kJ / mol **[1]**

(iii) Calculate the total energy transferred to make the bonds in the products in **Fig. 18.2**.

Total energy transferred = ... kJ / mol **[1]**

(iv) Use your answers to parts **(ii)** and **(iii)** to calculate the energy change for the reaction in **Fig. 18.2**.

Energy change = ... kJ / mol **[1]**

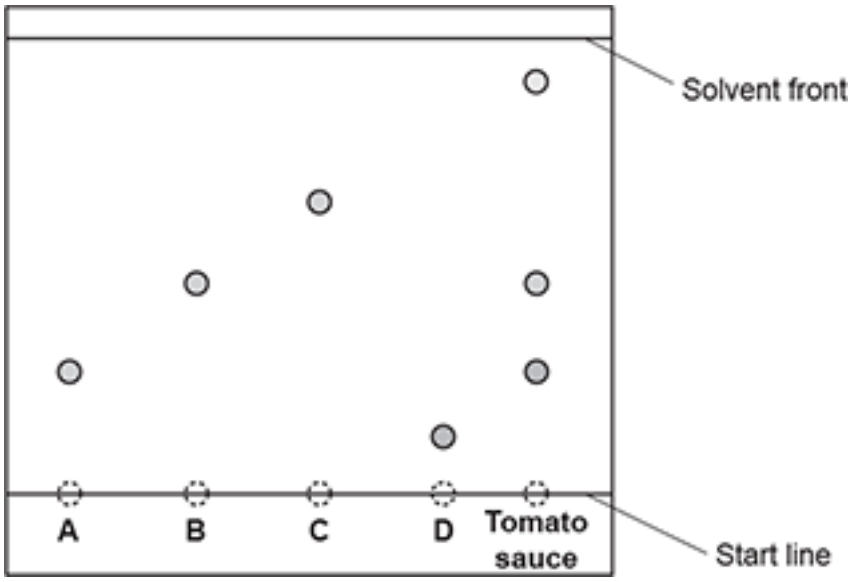
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16(a) A student analyses a sample of tomato sauce using thin-layer chromatography.

The tomato sauce was compared to four known food additives, **A**, **B**, **C** and **D**, as shown in the chromatogram.



(i) Calculate the R_f value for **C**.

Give your answer to **2** significant figures.

R_f value = ... **[3]**

(ii) Which additives are shown to be in the tomato sauce?

Tick (✓) **all the correct** boxes.

A ☐

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B ☐

C ☐

D ☐

[1]

(iii) Suggest why **D** has **not** travelled as far up the plate as **C**.

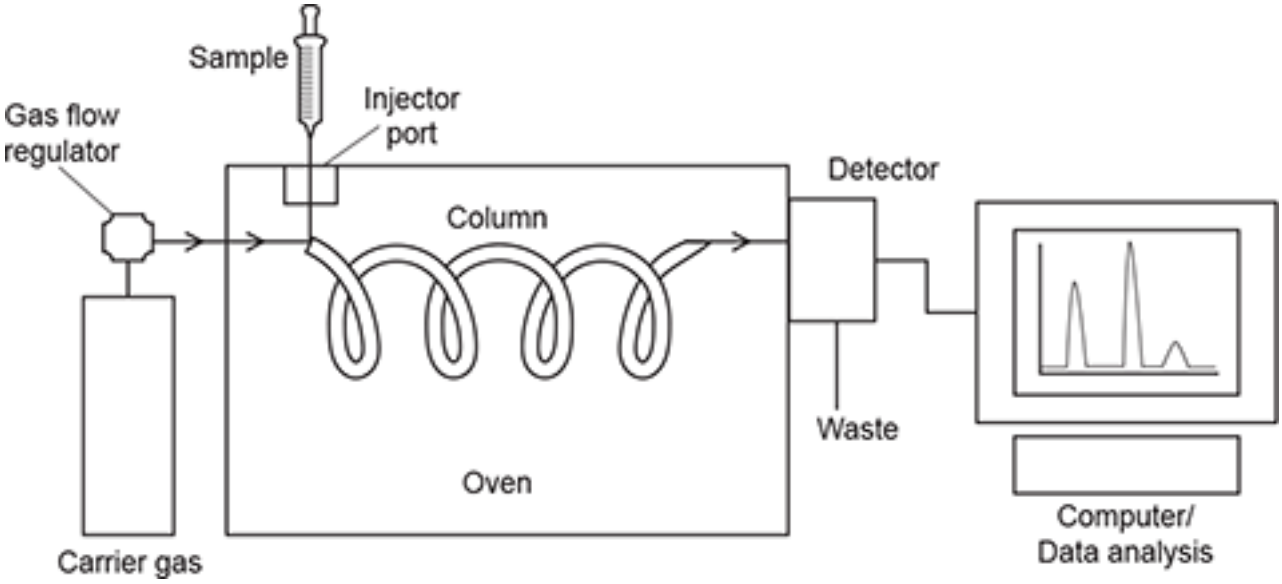
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[1]

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(b) Gas chromatography is another type of chromatography.

The diagram shows the equipment used for gas chromatography.



(i) State **one similarity** and **one difference** between gas chromatography and thin-layer chromatography.

Similarity ---

Difference ---

---

[2]

(ii) Explain why thin-layer chromatography is used instead of gas chromatography to analyse the tomato sauce.

---

[1]

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17

(i) Sodium oxide reacts with water.

An aqueous solution of sodium hydroxide is made.

Write the **balanced symbol equation** for this reaction, including **state symbols**.

[3]

(ii) Sodium hydroxide neutralises acids. It is an alkali.

Which ion do solutions of alkalis contain?

[1]

(iii) A salt is made when sodium hydroxide neutralises sulfuric acid.

Name this salt.

[1]

(iv) A sample of hydrochloric acid has a pH of 1.04.

A student adds water to the hydrochloric acid until the pH is 3.04.

The concentration of hydrogen ions decreases.

Calculate the factor by which the hydrogen ion concentration has decreased.

Decrease in hydrogen ion concentration = ... **[2]**

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18 Look at the equation for the Haber process.

$N_{27} + 3H_2 \leftrightharpoons 2NH_3$

What is meant by the symbol $\leftrightharpoons$ in the equation?

A A reaction that involves a catalyst.
B A reaction that is exothermic.
C A reaction with 100% atom economy.
D A reversible reaction.

Your answer ☐ [1]

19 DNA molecules are polymers.

What is the name of the **monomers** that make up DNA molecules?

A Amino acids
B Carbohydrates
C Nucleotides
D Proteins

Your answer ☐ [1]

20 Which of the following are the first four members of the homologous series of **alcohols**?

A CH_4, C_2H_6, C_3H_8, C_4H_{10}
B CH_3OH, C_2H_5OH, C_3H_7OH, C_4H_9OH
C $HCOOH$, CH_3COOH, C_2H_5COOH, C_3H_7COOH
D C_2H_4, C_3H_6, C_4H_8, C_5H_{10}

Your answer ☐ [1]

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21 Zinc, Zn, reacts with copper sulfate solution, $CuSO_4$.

$Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$

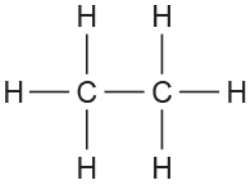
What type of reaction is this?

A Combustion
B Displacement
C Neutralisation
D Thermal decomposition

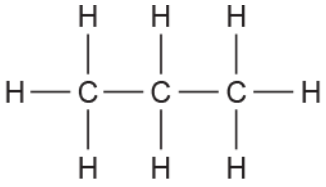
Your answer ☐ [1]

22(a) This question is about compounds of carbon.

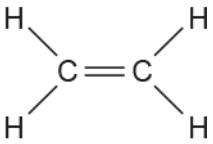
Look at the displayed formulae of ethane, propane and ethene.



Ethane



Propane



Ethene

Ethane and propane are both members of the **homologous series** called the alkanes.

Write down **two** reasons why ethane and propane are members of the same homologous series.

1 _____

2 _____

[2]

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(b) Many ethene molecules react together to form the polymer poly(ethene).

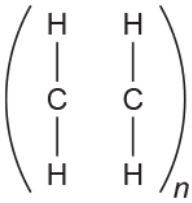
This reaction is called **polymerisation**.

(i) Why do ethene molecules undergo polymerisation but ethane molecules do not?

---

[1]

(ii) Complete the diagram to show the displayed formula of poly(ethene).



[2]

23 Enzymes are a type of catalyst.

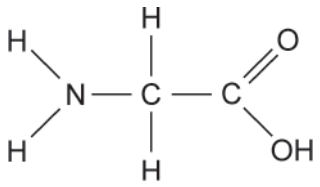
Which of the following catalysts is an example of an enzyme?

A Amylase – a catalyst found in human saliva.
B Iron – a catalyst used in the Haber process.
C Manganese(IV) oxide – a catalyst used in the decomposition of hydrogen peroxide.
D Vanadium(V) oxide – a catalyst used in the Contact process.

Your answer ☐ [1]

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24 Look at the structure of glycine.



Glycine is a monomer that reacts to form proteins.

Glycine contains **two** different functional groups that allow it to undergo polymerisation.

What are the two functional groups?

A $-NH_2$ and –C=O
B $-NH_2$ and $-CH_2-$
C $-NH_2$ and –OH
D $-NH_2$ and –COOH

Your answer ☐ [1]

25 Which of these homologous series can react together to form addition polymers?

A Alcohols and carboxylic acids
B Alkenes only
C Alkenes and alkanes
D Carboxylic acids only

Your answer ☐ [1]

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26 Which is the correct expression for calculating the concentration of a solution in g / dm^3?

A $\text{Concentration} = \frac{\text{volume of solution in dm}^3}{\text{mass of solute in g}}$

B $\text{Concentration} = \frac{\text{amount of solute in mol}}{\text{mass of solute in g}}$

C $\text{Concentration} = \frac{\text{mass of solute in g}}{\text{volume of solution in cm}^3 \times 1000}$

D $\text{Concentration} = \frac{\text{mass of solute in g}}{\text{volume of solution in dm}^3}$

Your answer [ ] [1]

27 The rate of reaction of marble chips with dilute hydrochloric acid depends on the surface area of the marble chips.

Which surface area of the marble chips gives the **highest** rate of reaction?

A 0.673 mm^2

B 1030 mm^2

C 2.18×10^3 mm^2

D 4.98×10^{-2} mm^2

Your answer [ ] [1]

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28 Sodium is in Group 1 of the Periodic Table.

Sodium ions, Na^+, are formed when sodium reacts with water.

Look at the equation. It shows how a sodium ion is formed from a sodium atom.

$Na - e^- \rightarrow Na^+$

The symbol e^- means an electron.

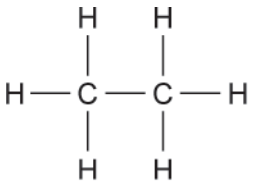
The formation of a sodium ion from a sodium atom is an example of **oxidation**.

Explain why.

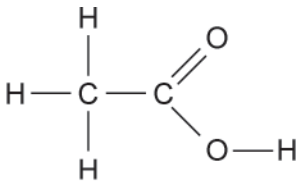
[1]

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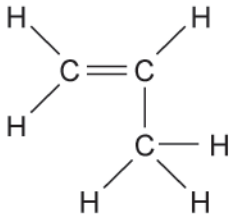
29(a) Look at the displayed formulae of some compounds.



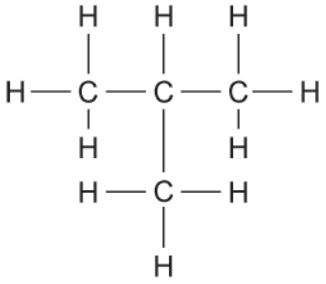
Compound **A**



Compound **B**



Compound **C**



Compound **D**

(i) Which **two** compounds are members of the same **homologous series**?

..... and .....

(ii) Write down **two** reasons for your answer in **(i)**.

1 _____

2 _____

[3]

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(b) Many molecules of compound **C** react together to form a polymer.

This reaction is called **addition polymerisation**.

(i) Draw the **displayed formula** of the polymer formed by compound **C**.

[2]

(ii) Another type of polymerisation is **condensation polymerisation**.

Describe one **difference** between addition polymerisation and condensation polymerisation.

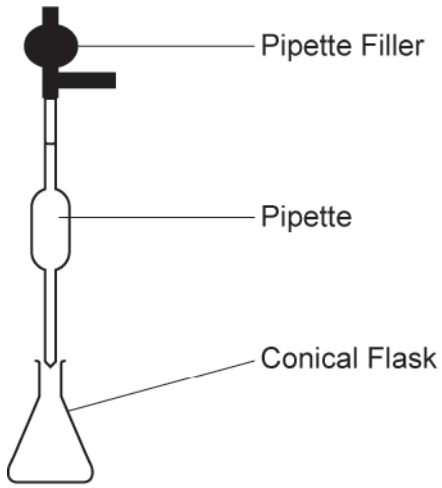
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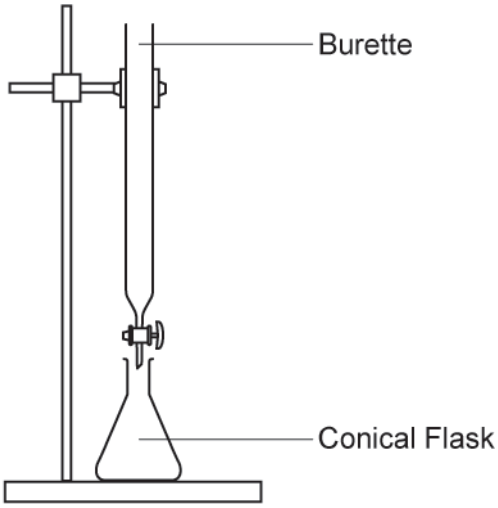
[1]

30(a) A student neutralises potassium hydroxide with dilute sulfuric acid in a titration experiment.

Look at the student's method for her experiment.

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- Measure 25.0 cm^3 of 0.200mol / dm^3 potassium hydroxide into a conical flask using a pipette.
- Add a few drops of universal indicator to the potassium hydroxide.
- Fill the burette to above the 0.00 cm^3 line with dilute sulfuric acid.
- Quickly add the dilute sulfuric acid to the potassium hydroxide until the indicator changes colour.
- Repeat the experiment.

Describe and explain **one** improvement the student should make to her method to get a more accurate titration result.

---

[2]

(b) The student repeats the experiment four times.

Look at the student's results.

Titration number	1	2	3	4
Volume of acid (cm^3)	25.75	23.60	23.70	23.65

(i) Calculate the **accurate** volume of the acid that reacts with the alkali.

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Accurate volume of acid = ... cm^3 **[2]**

(ii) Look at the equation for the reaction between sulfuric acid and potassium hydroxide.

$H_2SO_4 + 2KOH \rightarrow K_2SO_4 + 2H_2O$

Use your answer from part **(i)** to calculate the concentration of the dilute sulfuric acid, H_2SO_4, that reacted with the 25.0 cm^3 of 0.200mol / dm^3 potassium hydroxide.

Give your answer to **3** significant figures.

Concentration of dilute sulfuric acid = ... mol / dm^3 **[4]**

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31 Describe and explain what is meant by the **greenhouse effect**.

[3]

32 A student investigates the electrolysis of aqueous solutions of ionic compounds.

Aqueous solution	Product at cathode	Product at anode
Copper sulfate	Copper	Oxygen
Zinc bromide	Hydrogen	Bromine
Copper chloride	Copper	Chlorine
Sulfuric acid	Hydrogen	Oxygen

Write the formulae of the **ions** that are present in aqueous copper sulfate solution.

[2]

33(a) Look at the list of units.

cm^3	dm3
dm^3/ g	dm^3/ mol
g	g / dm^3
mol	mol / dm^3

Which **two** units are used to measure the concentration of a solution?

Choose from the list.

_____ and _____ [1]

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(b) Which **two** units are used to measure volume?

Choose from the list.

_____ and _____ [1]

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