OCR GCSE GATEWAY CHEMISTRY A · J248

CHEMISTRY



EXAM QUESTION PACK

M3 ALGEBRA

SCORE	PERCENTAGE
/39	%

STEMUP

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Gateway Chemistry A (9-1)

Maths 3: Algebra

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 **39**.
- The total number of marks may take into account some 'either/or' question choices.

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1 A student investigates the energy changes in different reaction mixtures, **X**, **Y** and **Z**. **Fig. 19.1** shows the apparatus she uses.

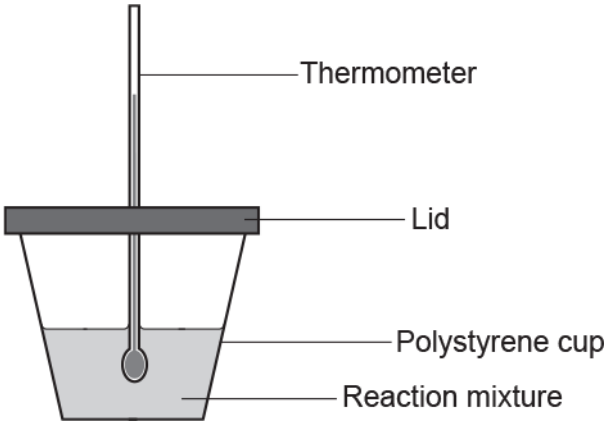


Fig. 19.1

Look at the table of the student's results.

(i) Add the temperature change for each reaction mixture.
Include a + or – sign where relevant.

Reaction mixture	Temperature at start (°C)	Temperature at end (°C)	Temperature change (°C)
X	20.0	25.5	.....
Y	19.0	8.0	.....
Z	20.0	20.0	.....

[1]

(ii) Which reaction mixture has an **endothermic** reaction?

Tick (✓) **one** box.

X ☐

Y ☐

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Z ☐

Explain your answer.

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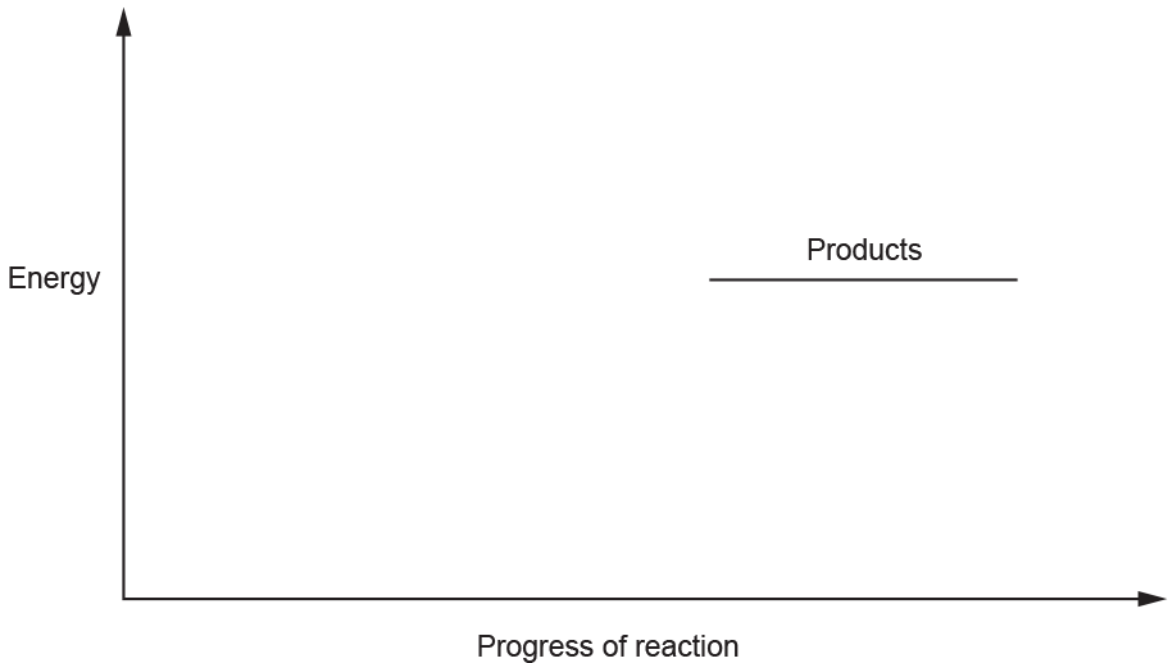
[2]

(iii) Complete the reaction profile for an **endothermic** reaction in **Fig. 19.2**.

The products have already been added.

Label the:

- reactants
- energy change
- activation energy.



[3]

Fig. 19.2

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(i) Mendeleev did not predict the existence of argon, neon, krypton or xenon.

The electron arrangement of argon is 2,8,8.

What does this tell you about the reactivity of argon?

Explain your answer.

---

[2]

(ii) Neon is an element that has isotopes. Two of the isotopes are shown below.

$^{20}_{10}Ne$ $^{22}_{10}Ne$

Complete **Table 23.3** to show the number of protons, neutrons and electrons in each neon isotope.

	$^{20}_{10}Ne$	$^{22}_{10}Ne$
Proton		
Neutron		
Electron		

Table 23.3

[3]

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The electron arrangement of argon is 2,8,8.

What does this tell you about the reactivity of argon?

Explain your answer.

---

[2]

(ii) Neon is an element that has isotopes. Two of the isotopes are shown below.

$^{20}_{10}Ne$ $^{22}_{10}Ne$

Complete **Table 17.3** to show the number of protons, neutrons and electrons in each neon isotope.

	$^{20}_{10}Ne$	$^{22}_{10}Ne$
Proton		
Neutron		
Electron		

Table 17.3

[3]

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4 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**.

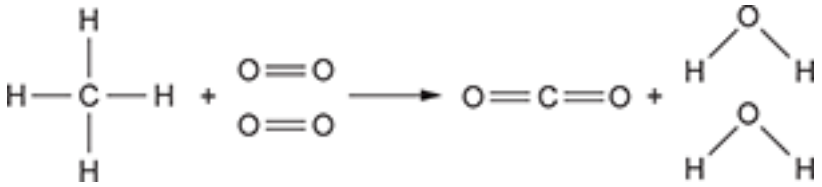


Fig. 18.2

(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]**

5 After testing some soil samples, a farmer finds that the soil in one of his fields is acidic.

Acidic soil can be neutralised by spreading magnesium carbonate, $MgCO_3$, onto the soil.

The farmer uses 25.0 kg of magnesium carbonate.

Calculate the number of moles of magnesium carbonate the farmer uses.
(A_r: C = 12.0; Mg = 24.3; O = 16.0)

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

Number of moles of magnesium carbonate = ... **[3]**

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6 Ammonium nitrate, NH_4NO_3, is fertiliser made from ammonia.

Ammonium nitrate is made by reacting ammonia with nitric acid.

$NH_3 + HNO_3 \rightarrow NH_4NO_3$

(i) Calculate the mass of **ammonium nitrate** that could be made from 25.5 tonnes of ammonia.

A_r: H = 1.0, N = 14.0, O = 16.0

Mass of ammonium nitrate = ... tonnes **[3]**

(i) A student makes some ammonium nitrate in the laboratory.

He predicts that he should make 12.5 g of ammonium nitrate.

His percentage yield is 80%.

Calculate the **actual mass** of ammonium nitrate that the student makes.

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Actual mass of ammonium nitrate = ... g **[2]**

7 Ammonium nitrate, NH_4NO_3, is a fertiliser made from ammonia.

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Actual mass of ammonium nitrate ..... g **[2]**

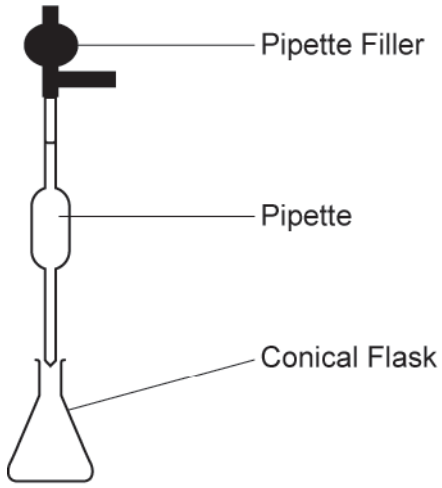
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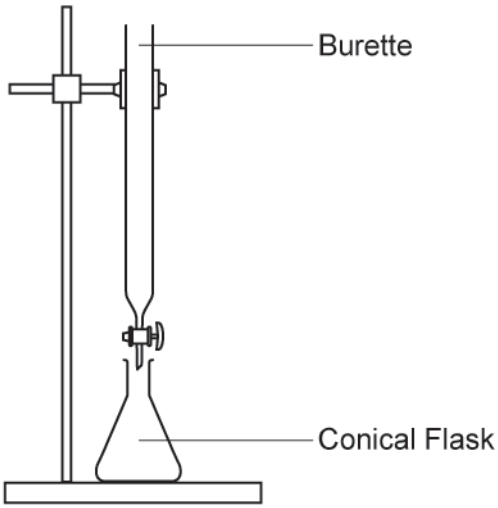
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8(a) A student neutralises potassium hydroxide with dilute sulfuric acid in a titration experiment.

Look at the student's method for her experiment.





- 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

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

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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9 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]

END OF QUESTION PAPER

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