



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

CENTRE
NUMBER

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CANDIDATE
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CHEMISTRY

0620/21

Paper 2

May/June 2012

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may need to use a pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer **all** questions.

A copy of the Periodic Table is printed on page 16.

At the end of the examination, fasten all your work securely together.

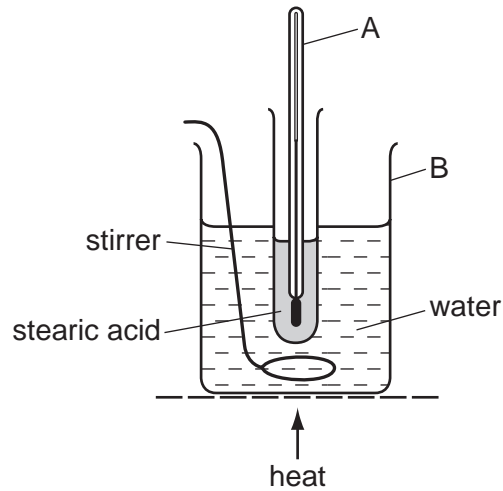
The number of marks is given in brackets [] at the end of each question or part question.

| For Examiner's Use | |
|--------------------|--|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| Total | |

This document consists of **15** printed pages and **1** blank page.



- 1 Stearic acid is a solid at room temperature.
The diagram below shows the apparatus used for finding the melting point of stearic acid.
The apparatus was heated at a steady rate and the temperature recorded every minute.



- (a) State the name of the piece of apparatus labelled

A,

B. [2]

- (b) (i) Suggest why the water needs to be kept stirred during this experiment.

.....

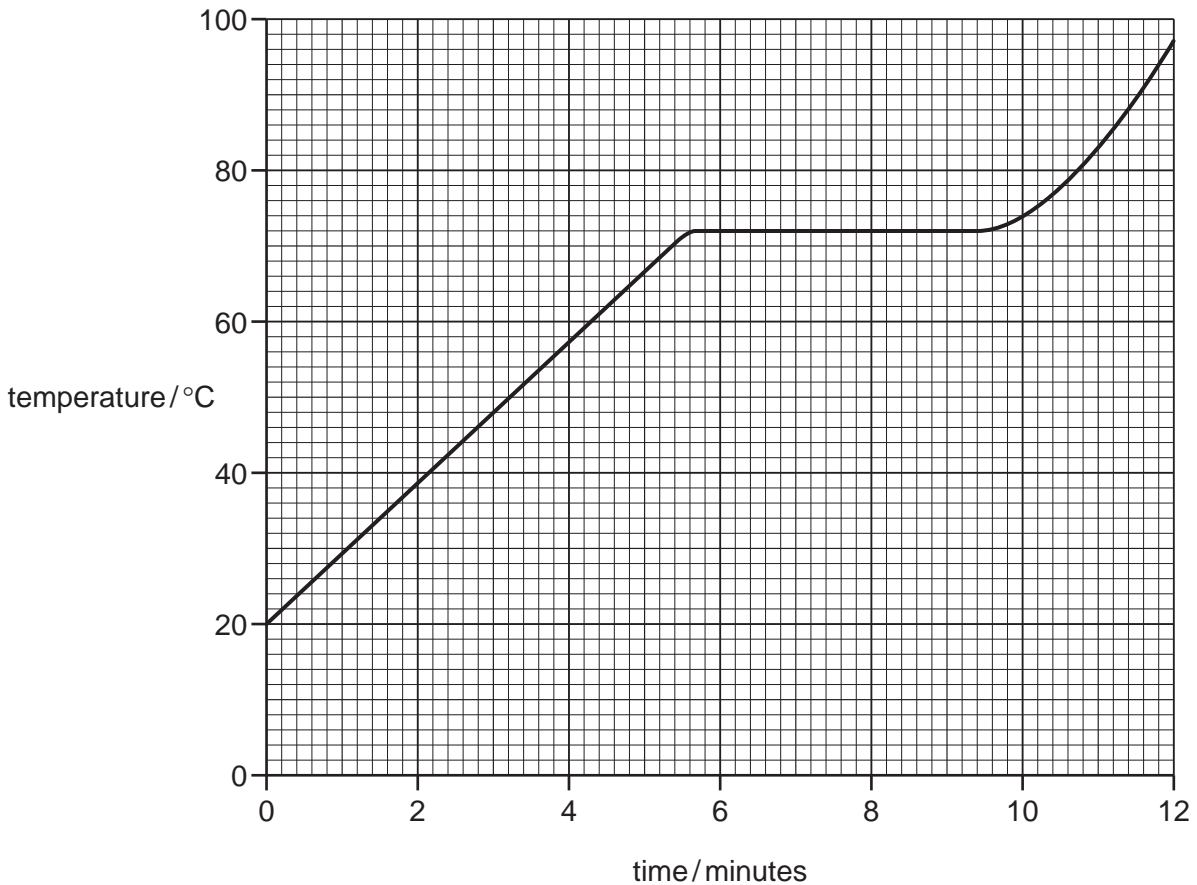
..... [1]

- (ii) Describe a chemical test for water.

test

result [2]

(c) A graph of temperature of stearic acid against time of heating is shown below.



(i) What was the temperature of the stearic acid after 3 minutes heating?

..... [1]

(ii) Use the information on the graph to determine the melting point of stearic acid.

..... [1]

(d) Describe the arrangement and motion of the particles in liquid stearic acid.

arrangement

motion [2]

(e) A sample of stearic acid contained 1% of another compound with a higher relative molecular mass.

(i) Which one of the following statements about this sample of stearic acid is correct?
Tick **one** box.

Its density is exactly the same as that of pure stearic acid.

Its boiling point is the same as that of pure stearic acid.

Its melting point is different from pure stearic acid.

Its melting point is the same as that of pure stearic acid.

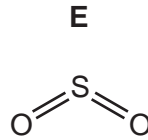
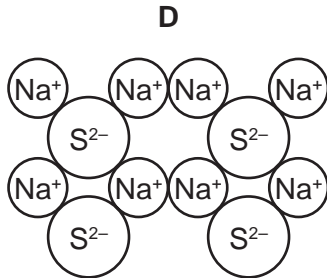
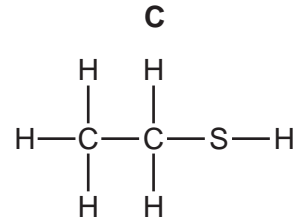
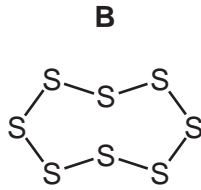
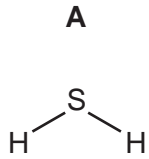
[1]

(ii) Describe **one** area of everyday life where the purity of substances is important.

..... [1]

[Total: 11]

2 The diagram below shows the structure of some substances, **A**, **B**, **C**, **D** and **E**.



(a) (i) Which **one** of these substances, **A**, **B**, **C**, **D** or **E**, is an element?

..... [1]

(ii) What do you understand by the term *element*?

..... [1]

(b) Calculate the relative molecular mass of **E**.

[1]

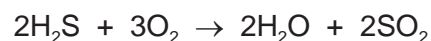
(c) Write the simplest formula for **D**.

..... [1]

(d) Which substance, **A**, **B**, **C**, **D** or **E**, conducts electricity when it is molten?
Explain your answer.

..... [2]

(e) The equation for the combustion of substance **A** is shown below.



What type of chemical reaction is this?
Put a ring around the correct answer.

decomposition **neutralisation** **oxidation** **reversible**

[1]

[Total: 7]

3 Hydrochloric acid and ethanoic acid are both acidic in nature.

(a) Which **one** of the following is a pH value for an acidic solution.
Put a ring around the correct answer.

pH3

pH7

pH9

pH13

[1]

(b) Describe how you would use litmus to test if a solution is acidic.

.....

 [3]

(c) Acids react with metal carbonates.

(i) Write a word equation for the reaction of calcium carbonate with hydrochloric acid.

[3]

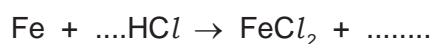
(ii) Calcium carbonate can be used to treat acidic soil.
State **one** other use of calcium carbonate.

..... [1]

(iii) Name **one** other compound that can be used to treat acidic soil.

..... [1]

(d) Hydrochloric acid reacts with iron to form iron(II) chloride and hydrogen.
Complete the equation for this reaction.



[2]

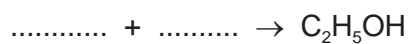
(e) (i) Complete the table below to show:

- the molecular formula for ethanoic acid
- the full structural formula for ethanol.

| | ethanoic acid | ethanol |
|-------------------------|--|--------------------------------|
| full structural formula | $ \begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{C} \\ \quad // \\ \text{H} \quad \text{O} \\ \quad \quad \backslash \\ \quad \quad \text{O}-\text{H} \end{array} $ | |
| molecular formula | | $\text{C}_2\text{H}_6\text{O}$ |

[2]

(ii) Ethanol can be manufactured by the catalytic addition of steam to ethene. Complete the equation for this reaction.



[1]

[Total: 14]

- 4 Fractional distillation is used to separate petroleum into different fractions. Each fraction has a particular use.

- (a) Match the fractions on the left with their uses on the right. The first one has been done for you.

| | |
|----------------------|--------------------|
| gas oil | heating |
| bitumen | fuel for ships |
| lubricating fraction | surfacing roads |
| refinery gases | waxes and polishes |
| naphtha | making chemicals |

[4]

- (b) Petroleum fractions contain hydrocarbons. What do you understand by the term *hydrocarbon*?

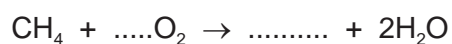
..... [1]

- (c) Methane, CH₄, is a hydrocarbon.

- (i) Draw the structure of methane, showing all atoms and bonds.

[1]

- (ii) Complete the following equation for the burning of methane in excess oxygen.



[2]

- (iii) Methane belongs to a homologous series called the alkanes.
What do you understand by the term *homologous series*?

.....

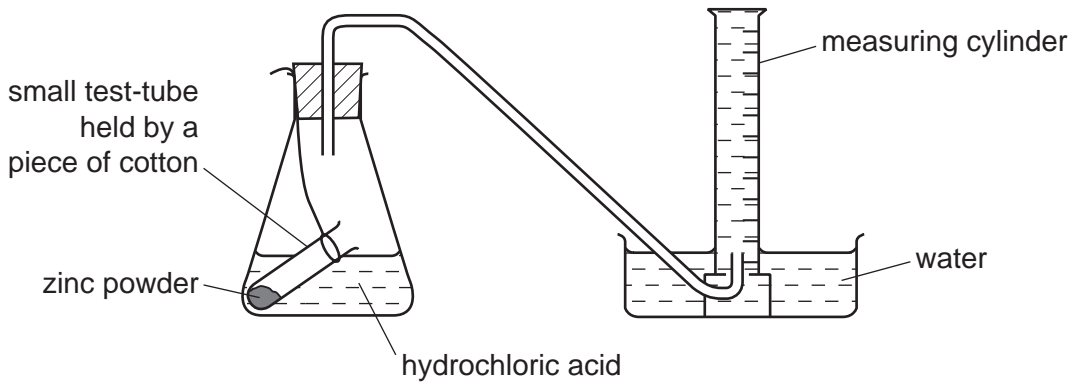
..... [2]

- (iv) Name the second member of the alkane homologous series.

..... [1]

[Total: 11]

- 5 A student investigated the reaction between zinc and hydrochloric acid using the apparatus shown below. The zinc was in excess.



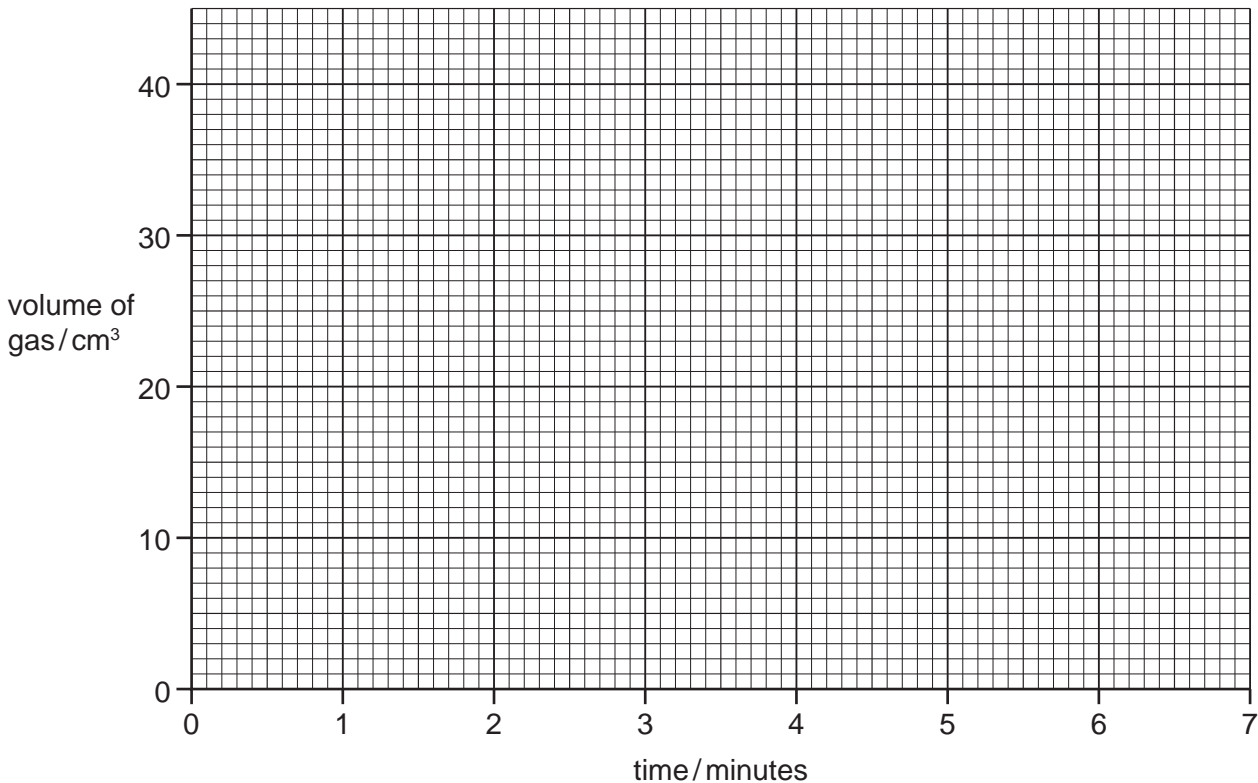
- (a) What should the student do to start the reaction?

..... [1]

- (b) The student measured the volume of gas in the measuring cylinder at minute intervals. The results are shown in the table.

| | | | | | | | | |
|-------------------------------|---|----|----|----|----|----|----|----|
| time/minutes | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| volume of gas/cm ³ | 0 | 15 | 23 | 30 | 33 | 35 | 35 | 35 |

- (i) Plot the results on the grid below and draw the best curve through the points.



[3]

(ii) Explain why the volume of gas stays the same after 5 minutes.

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

(c) Complete the following sentences about this reaction using words or phrases from the list below.

- | | | |
|----------------------|-----------------------|------------------|
| concentration | decreases | increases |
| speed | stays the same | volume |

When the of hydrochloric acid is increased, the volume of gas given off in the first two minutes Decreasing the temperature of the reaction mixture the of the reaction. [4]

(d) When the reaction is complete, the flask contains a mixture of zinc and aqueous zinc chloride. Describe how you can obtain pure dry crystals of zinc chloride from this reaction mixture.

.....
.....
.....
..... [3]

[Total: 13]

6 Lithium, sodium and potassium are in Group I of the Periodic Table.

(a) The equation for the reaction of lithium with water is



(i) Write a word equation for this reaction.

..... [2]

(ii) Sodium reacts with water in a similar way to lithium.
Write a symbol equation for the reaction of sodium with water.

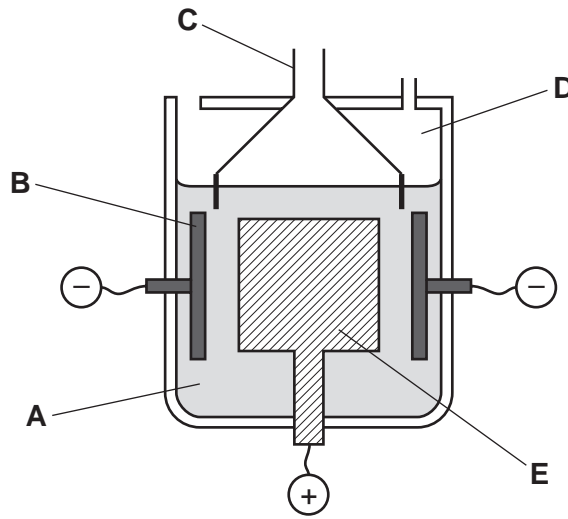
[1]

(b) Describe the reactions of lithium, sodium and potassium with water.
In your description, write about:

- the difference in the reactivity of the metals
- the observations you would make when these metals react with water.

.....
.....
.....
.....
.....
.....
..... [5]

(c) The diagram below shows an electrolysis cell used to manufacture sodium from molten sodium chloride.



(i) Which letter in the diagram above represents
the anode?

the electrolyte? [2]

(ii) State the name of the product formed
at the positive electrode,

at the negative electrode. [2]

(iii) Which one of the following substances is most likely to be used for the anode?
Put a ring around the correct answer.

graphite **iodine** **magnesium** **sodium** [1]

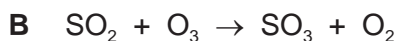
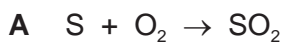
(d) Lithium, sodium and potassium are metals with a low density.
State **two** other physical properties of these metals.

1.

2. [2]

[Total: 15]

7 (a) The equations **A** and **B** below show two reactions which lead to the formation of acid rain.



(i) Write a word equation for reaction **A**.

..... [2]

(ii) Which two of the following statements about reaction **B** are correct?
Tick **two** boxes.

SO₂ is oxidised to SO₃

SO₂ is reduced to SO₃

O₃ is reduced to O₂

O₃ is oxidised to O₂

[2]

(iii) Complete the equation to show how an aqueous solution of sulfuric acid, H₂SO₄, is formed from SO₃.



[1]

(b) Describe and explain the effect of sulfuric acid on buildings made from limestone (calcium carbonate).

.....

 [3]

(c) State **one** effect of acid rain other than on buildings.

..... [1]

[Total: 9]

