| Surname | Centre Number | Candidate Number |
|---|---|---|
| Other Names | | 0 |

WJEC CBAC

# GCSE

4493/01

## CHEMISTRY

## CHEMISTRY 3
## FOUNDATION TIER

P.M. MONDAY, 20 May 2013

1 hour

| For Examiner's use only | | |
|---|---|---|
| **Question** | **Maximum Mark** | **Mark Awarded** |
| **1.** | **5** | |
| **2.** | **8** | |
| **3.** | **7** | |
| **4.** | **7** | |
| **5.** | **5** | |
| **6.** | **4** | |
| **7.** | **8** | |
| **8.** | **6** | |
| **9.** | **4** | |
| **10.** | **6** | |
| **Total** | **60** | |

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### ADDITIONAL MATERIALS

In addition to this paper you will need a calculator and a ruler.

### INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

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

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

### INFORMATION FOR CANDIDATES

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

You are reminded of the necessity for good English and orderly presentation in your answers.

Assessment will take into account the quality of written communication (QWC) used in your answer to question **10**.

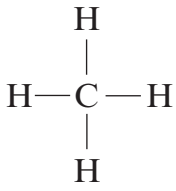
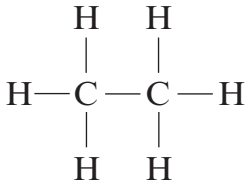
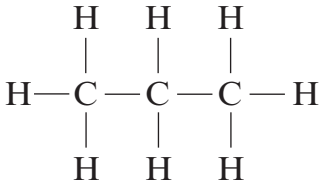
The Periodic Table is printed on the back cover of the examination paper and the formulae for some common ions on the inside of the back cover.

Examiner only

*Answer* **all** *questions.*

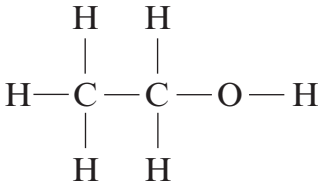
**1.** *(a)* The table below shows the names, molecular formulae and structural formulae of some alkanes.

Complete the table. [3]

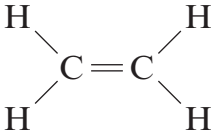
| Name | Molecular formula | Structural formula |
|---|---|---|
| | $CH_4$ |  |
| ethane | $C_2H_6$ |  |
| propane | |  |
| butane | $C_4H_{10}$ | |

Examiner only

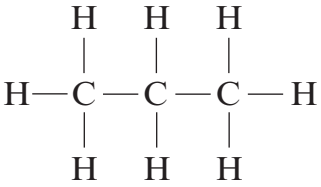
*(b)* The structural formulae of five carbon compounds are shown below.



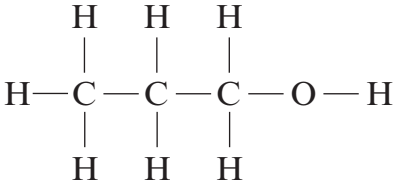
**A**



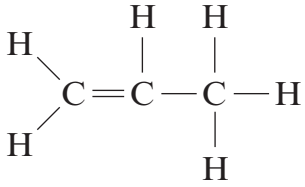
**B**



**C**



**D**



**E**

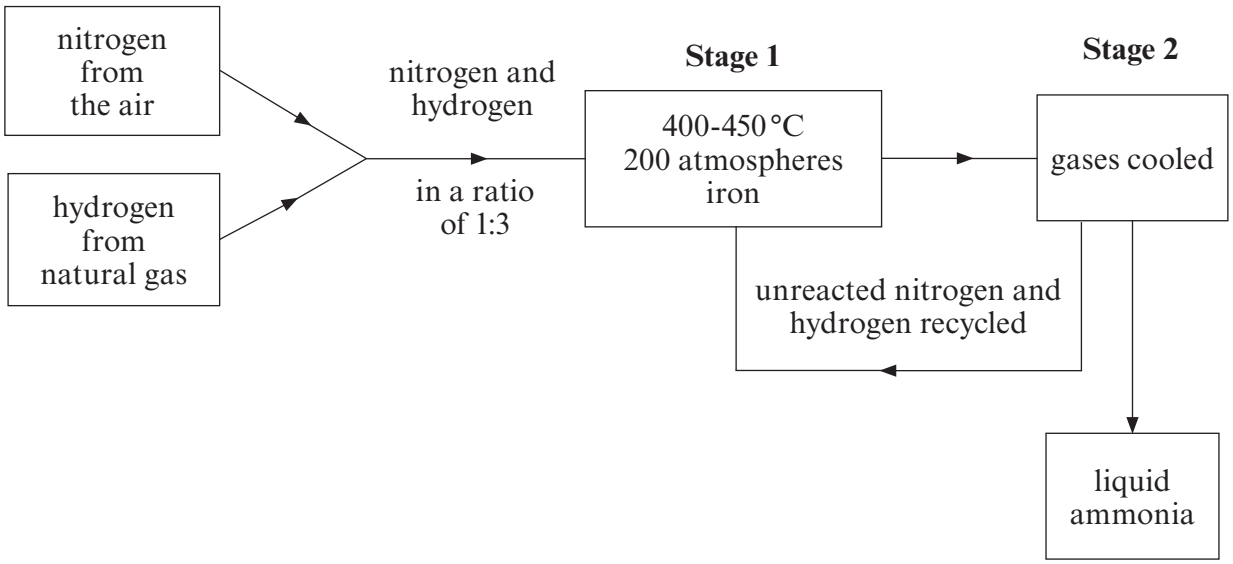
Give the letter **A-E** of the structure which shows

(i) ethanol, $C_2H_5OH$, ..... [1]

(ii) propene, $C_3H_6$. ..... [1]

Examiner only

**2.** *(a)* The flow diagram below outlines the manufacture of ammonia by the Haber process.




(i) Name the **two** *raw materials* used in the Haber process. [1]

..... and .....

(ii) Balance the **symbol** equation for the production of ammonia. [1]

$$N_2 + \square\ H_2 \rightleftharpoons \square\ NH_3$$

(iii) State why iron is added in **stage 1**. [1]

.....

(iv) Give the reason why gases are cooled in **stage 2**. [1]

.....

(v) Suggest a reason why recycling unreacted nitrogen and hydrogen saves money. [1]

.....

Examiner only

*(b)* One of the main uses of ammonia is in the production of nitrogenous fertilisers.

| | |
|---|---|
| **ammonium chloride** | **ammonium nitrate** |
| **ammonium phosphate** | **ammonium sulfate** |

Choose from the box above the fertiliser which is made by reacting ammonia with nitric acid. [1]

.....

*(c)* The box below contains some statements relating to the use of nitrogenous fertilisers.

| | | |
|---|---|---|
| **causes overgrowth of plants in canals** | **increases crop yield** | **pollutes water supplies** |
| **releases land for building houses** | **increases soil acidity** | |

Choose the **main** [2]

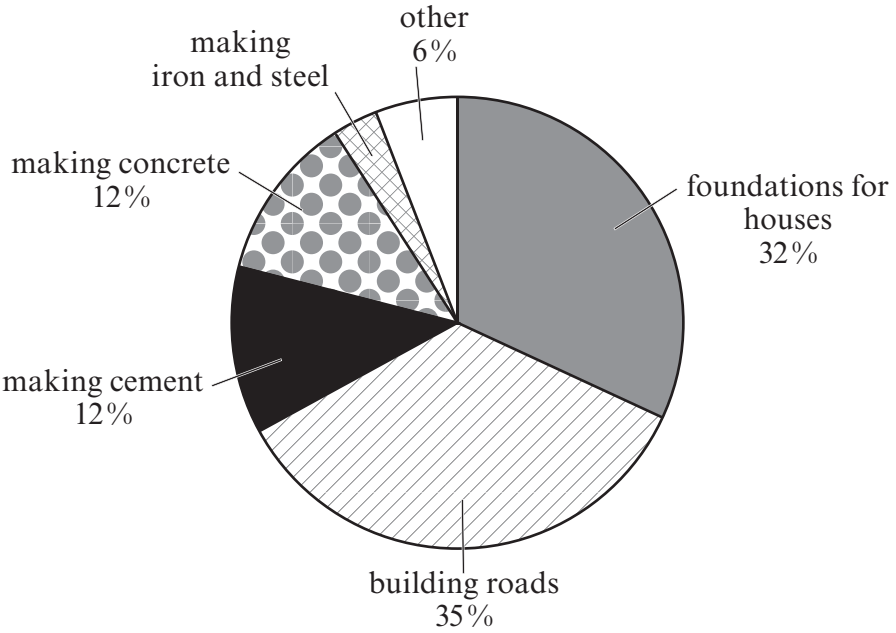
(i) benefit to farmers, .....

(ii) problem for farmers. .....

Examiner only

**3.** Limestone is an important raw material.

*(a)* The pie chart below shows some uses of limestone in the construction industry.




Calculate the percentage of limestone used for making iron and steel. [2]

*Percentage used for making iron and steel* = .....%

*(b)* The photograph below shows a limestone quarry.

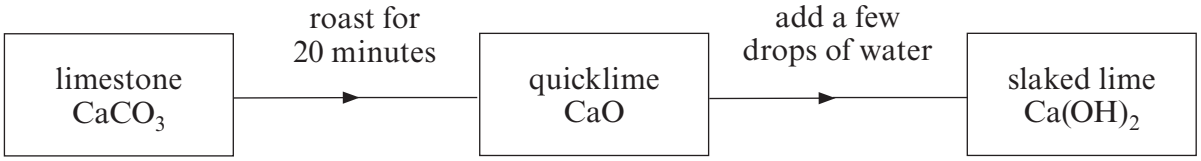
Give **two** environmental problems relating to limestone quarrying. [2]

*Problem 1* .....

*Problem 2* .....

Examiner only

*(c)* Limestone, $CaCO_3$, is the raw material for the production of slaked lime, $Ca(OH)_2$. The flow diagram below shows the steps involved.




(i) Using the **chemical names** write a **word** equation for the production of slaked lime from quicklime. [1]

..... + ..... ⟶ .....

(ii) The addition of water to quicklime is a very exothermic reaction. Describe what you **observe** during this reaction. [2]

.....

.....

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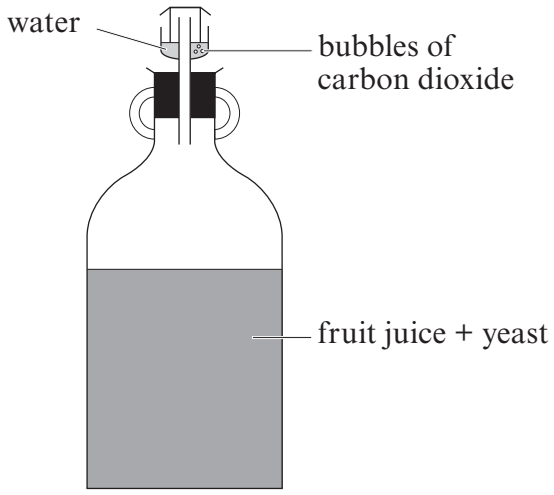
*Image: www.ebc-indevelopment.co.uk*

Examiner only

**4.** Home-made wine is made by adding yeast to fruit juice.




The equation below shows the reaction that occurs.

$$\underset{\text{glucose in fruit juice}}{C_6H_{12}O_6} \xrightarrow{\text{yeast}} \underset{\text{ethanol}}{2C_2H_5OH} + \underset{\text{carbon dioxide}}{2CO_2}$$

*(a)* Give the term for the process taking place when ethanol is formed from glucose. [1]

.....

*(b)* Yeast is needed for the process to occur. Give the reason why yeast is written above the arrow in the equation. [1]

.....

*(c)*

| | | | | |
|---|---|---|---|---|
| **0 °C** | **10 °C** | **30 °C** | **70 °C** | **100 °C** |

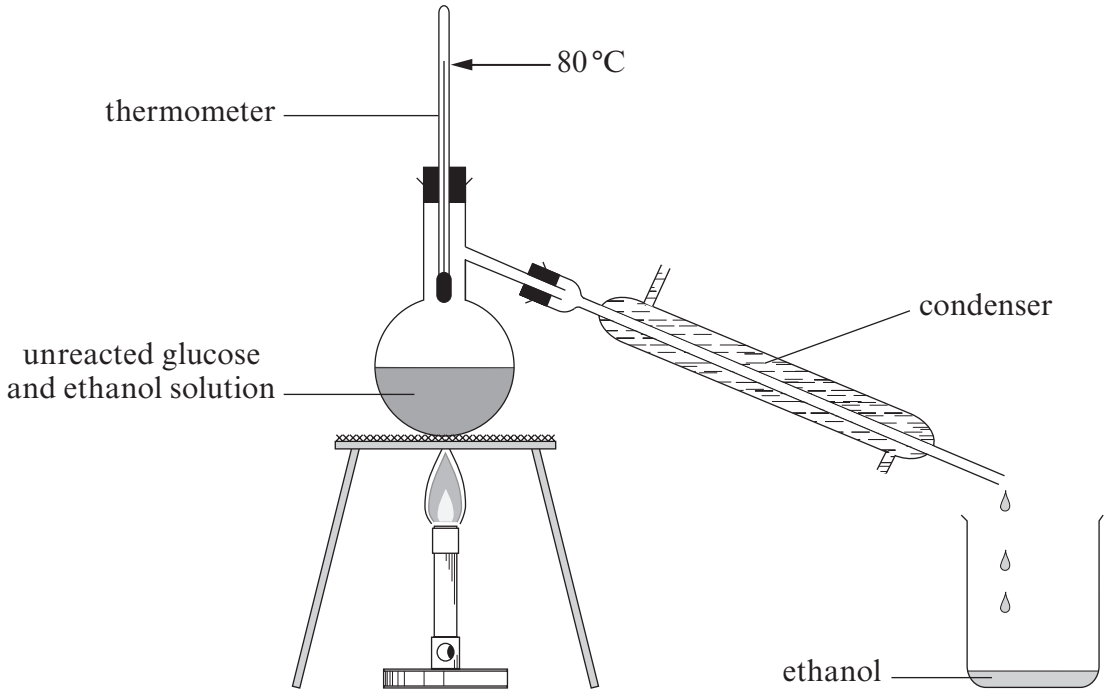
Choose from the box above a suitable temperature for the process to occur.

..... °C

[1]

Examiner only

*(d)* Once the reaction stops, the yeast can be removed by filtering to recover a mixture of unreacted glucose and ethanol. The apparatus below could be used to separate ethanol from the unreacted glucose in the solution.




(i) Give the name of the process which separates ethanol from the solution. [1]

.....

(ii) Explain how this process separates ethanol from the solution. [2]

.....

.....

.....

.....

*(e)* Give **one** anti-social behaviour caused by the excessive use of alcohol. [1]

.....

**5.** Indigestion is caused by excess acid in the stomach. Antacid tablets contain mainly calcium carbonate. The calcium carbonate in an antacid tablet neutralises the excess acid. A group of pupils was asked to carry out an investigation to find

*"Which brand of antacid tablet is the best?"*

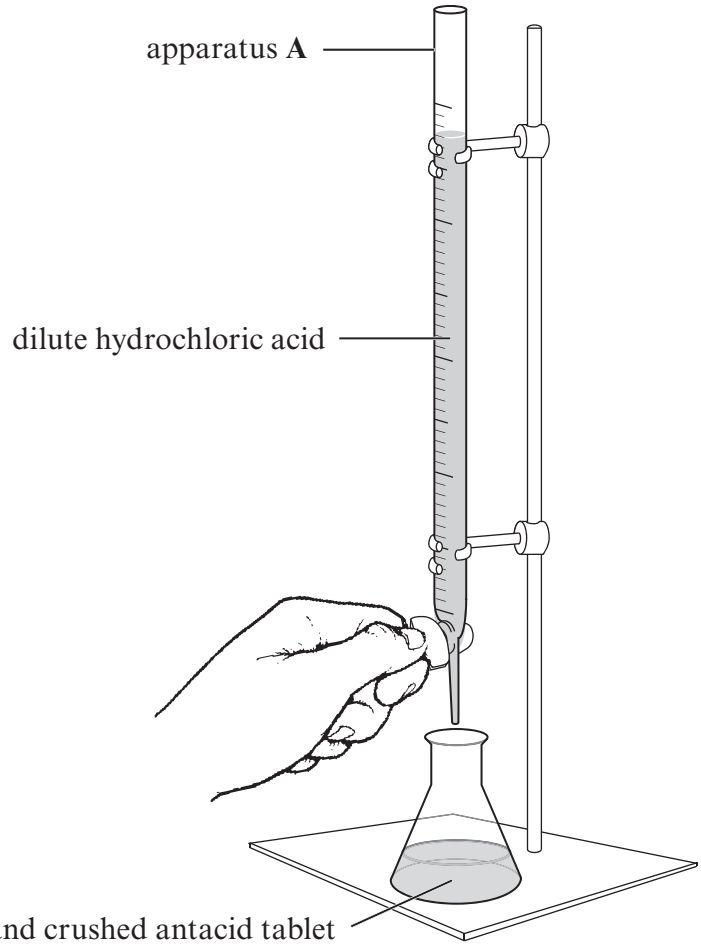
The group was provided with three different tablets, **A**, **B** and **C**, each of equal mass. The apparatus below was used to find out how much dilute hydrochloric acid was needed to react with all the calcium carbonate in each antacid tablet.

Tablet **A** was crushed and added to 50 $cm^3$ of water in a conical flask. Five drops of methyl orange were then added.

The mixture was titrated with dilute hydrochloric acid. The acid was added 0.5 $cm^3$ at a time until the methyl orange turned red.

The total volume of acid added was recorded.

This procedure was repeated using tablets **B** and **C**.




The results for each tablet are shown below.

| | Tablet | | |
|---|---|---|---|
| | **A** | **B** | **C** |
| Volume of acid needed to neutralise all the calcium carbonate in a single tablet ($cm^3$) | 12.5 | 13.5 | 11.0 |

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*(a)*

| burette | measuring cylinder | pipette | gas syringe | test tube |
|---|---|---|---|---|

Choose from the box above the name of apparatus **A** in the diagram.

.....

[1]

*(b)* Give the name for substances, such as methyl orange, which have one colour in acids and a different colour in alkalis.

..... [1]

*(c)* State, giving a reason, how the results could be made more accurate. [2]

.....

.....

*(d)* State, giving a reason, which brand of indigestion tablet is the best. [1]

.....

.....

Examiner only

**6.** *(a)* A Year 11 class investigated tests used to identify positive and negative ions. The results recorded by one pupil are shown below.

Put a **circle** around the **three** *incorrect* observations. [3]

**Flame tests**

| Metal ion | Flame colour |
|---|---|
| $Na^+$ | yellow |
| $K^+$ | lilac |
| $Cu^{2+}$ | brick-red |

**Adding sodium hydroxide to metal ions in solution**

| Metal ion solution | Colour of precipitate |
|---|---|
| $Cu^{2+}$ | blue |
| $Fe^{2+}$ | green |
| $Fe^{3+}$ | white |

**Testing negative ions**

| Ion | Test | Observation |
|---|---|---|
| $Cl^-$ | add dilute nitric acid followed by silver nitrate solution | yellow precipitate |
| $CO_3^{2-}$ | add dilute hydrochloric acid | bubbles formed |
| $SO_4^{2-}$ | add dilute hydrochloric acid followed by barium chloride solution | white precipitate |

*(b)* Compounds containing ammonium ions, $NH_4^+$, are identified by adding sodium hydroxide solution, warming and testing the gas formed with damp red litmus paper. The damp red litmus paper turns blue.

The symbol equation below shows the reaction between ammonium chloride and sodium hydroxide solution.

$$NH_4Cl + NaOH \longrightarrow NaCl + H_2O + NH_3$$

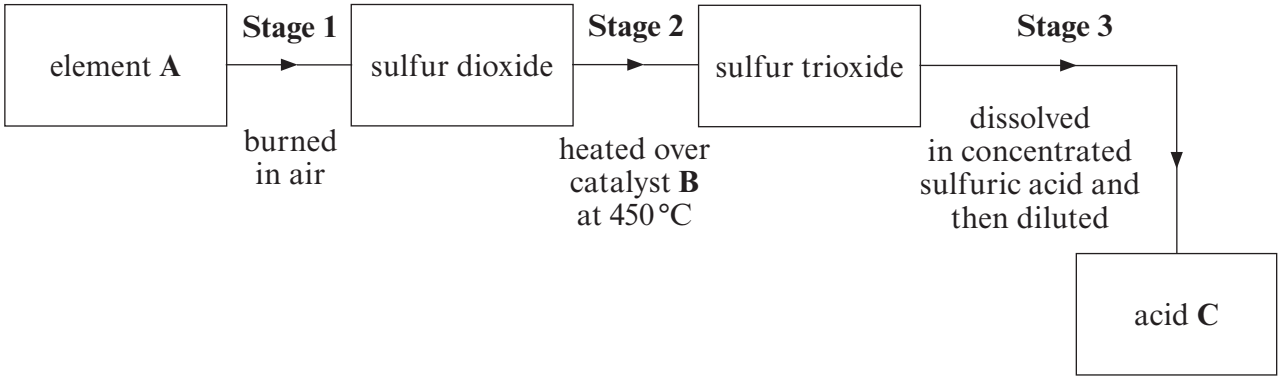
Name the **three** products of the reaction. [1]

.....

4

Examiner only

**7.** *(a)* The flow diagram below shows the stages in the Contact Process.




(i) Give the name of

I element **A**, ..... [1]

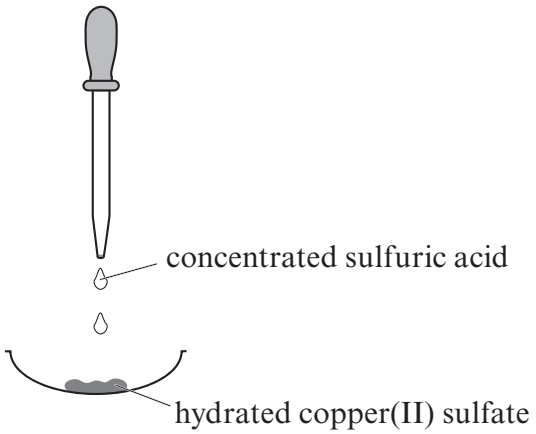
II catalyst **B**, ..... [1]

III acid **C**. ..... [1]

(ii) Write a **balanced symbol** equation for the formation of sulfur trioxide, in **stage 2**. [3]

..... + ..... ⇌ .....

*(b)* A few drops of concentrated sulfuric acid were added to some crystals of hydrated copper(II) sulfate, $CuSO_4.5H_2O$.




Describe **two** changes in the appearance of copper(II) sulfate as it is dehydrated. [2]

.....

.....

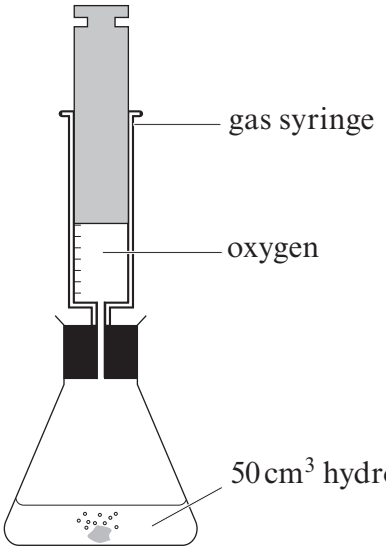
.....

**8.** Enzymes are catalysts produced by living cells. The enzyme catalase is found in both animal and plant cells. Catalase breaks down hydrogen peroxide into water and oxygen.

$$2H_2O_2 \longrightarrow 2H_2O + O_2$$

Some pupils were given samples of apple, carrot, potato and liver. They were asked to investigate the effect of these substances on hydrogen peroxide solution.

1 g of each substance was added separately to 50 $cm^3$ of hydrogen peroxide solution and the volume of oxygen formed was recorded every 10 seconds. The diagram below shows the apparatus used.

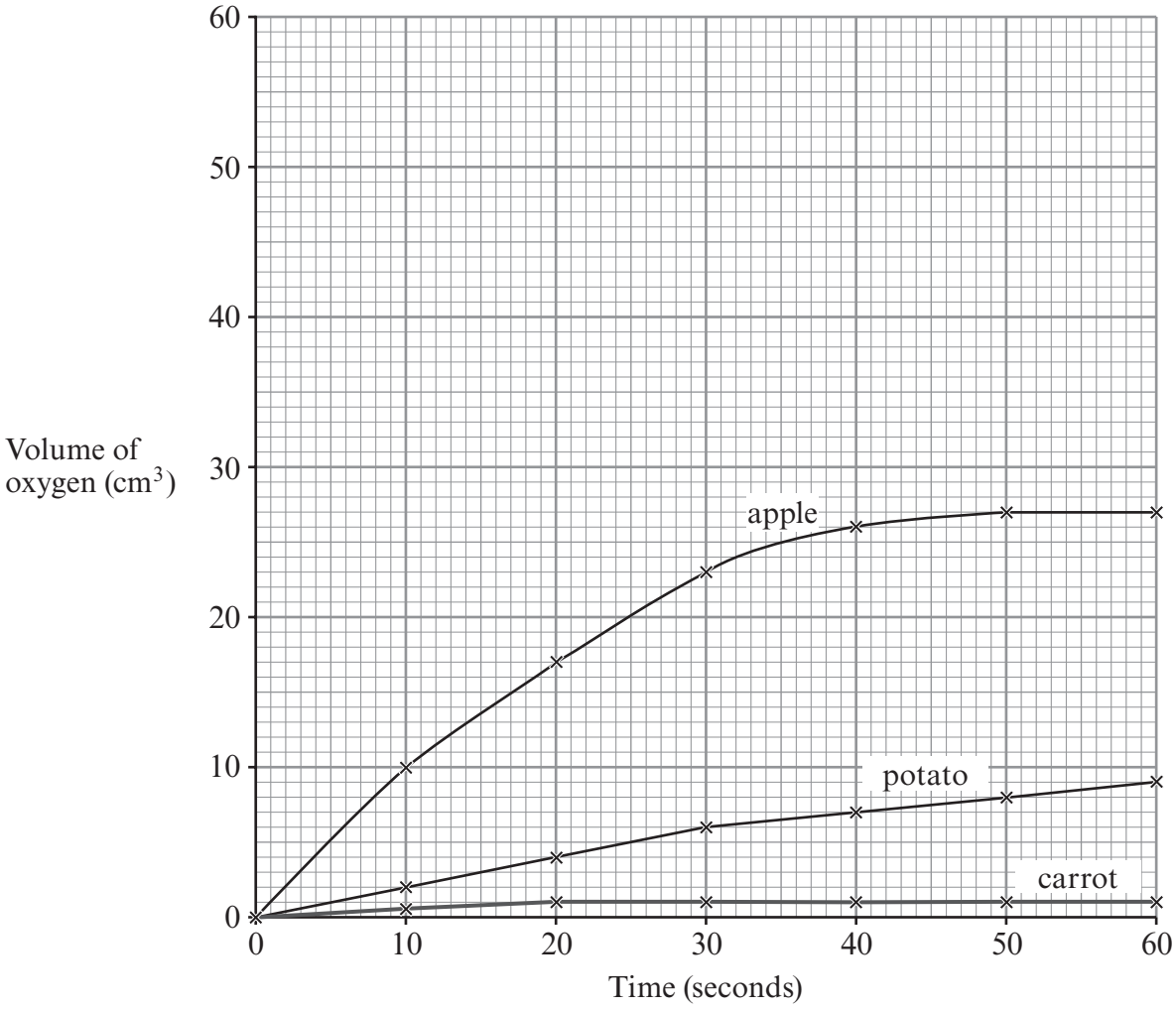



The table below shows the results recorded by the group.

| | Substance | Time (seconds) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 0 | 10 | 20 | 30 | 40 | 50 | 60 |
| Volume of oxygen formed ($cm^3$) | apple | 0 | 10 | 17 | 23 | 26 | 27 | 27 |
| | carrot | 0 | 0.5 | 1 | 1 | 1 | 1 | 1 |
| | potato | 0 | 2 | 4 | 6 | 7 | 8 | 9 |
| | liver | 0 | 29 | 43 | 49 | 50 | 50 | 50 |

The results for the apple, carrot and potato have been plotted on the graph opposite.

Examiner only




*(a)* Plot the results for liver on the grid and draw a suitable line. [3]

*(b)* Apart from using the same mass of each substance and the same volume of hydrogen peroxide solution, state **one** *other* way you would try to make the investigation a fair test. [1]

.....

*(c)* Assuming it is the presence of catalase that is responsible for the decomposition of hydrogen peroxide, give **one** conclusion that can be drawn from the results. [1]

.....

.....

*(d)* Describe the chemical test you would carry out to show that the gas formed is oxygen. [1]

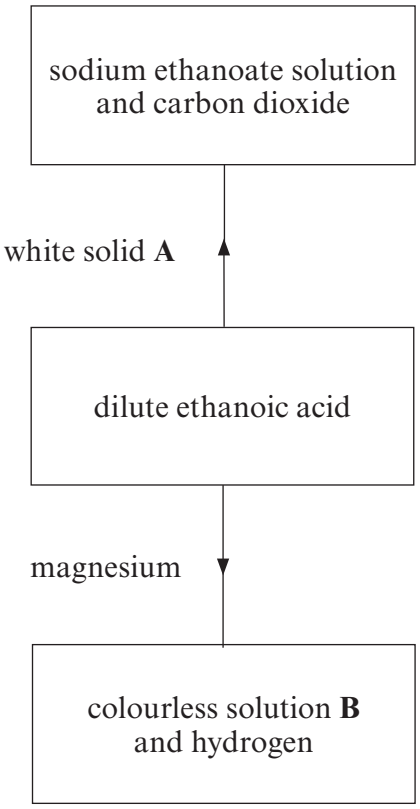
.....

.....

6

Examiner only

**9.** *(a)* The flow diagram below shows some reactions of ethanoic acid, $CH_3COOH$.




(i) Name white solid **A**. ..... [1]

(ii) Name colourless solution **B**. ..... [1]

*(b)* Dilute ethanoic acid reacts with magnesium less vigorously than dilute sulfuric acid of equal concentration.

Give the reason for this difference in behaviour. [1]

.....

*(c)* Ethanoic acid is formed when an alcoholic drink such as wine is left exposed to the air. Give the name of the compound in wine which turns into ethanoic acid. [1]

.....

4

Examiner only

**10.** Write an account of your understanding of the fire triangle and its use in fire fighting.

In your answer you should explain how the fire triangle gives rise to three different methods of fire fighting and give an example of each. [6 QWC]

.....

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.....

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**END OF PAPER**

6

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## FORMULAE FOR SOME COMMON IONS

| POSITIVE IONS | | NEGATIVE IONS | |
|---|---|---|---|
| **Name** | **Formula** | **Name** | **Formula** |
| Aluminium | $Al^{3+}$ | Bromide | $Br^{-}$ |
| Ammonium | $NH_4^{+}$ | Carbonate | $CO_3^{2-}$ |
| Barium | $Ba^{2+}$ | Chloride | $Cl^{-}$ |
| Calcium | $Ca^{2+}$ | Fluoride | $F^{-}$ |
| Copper(II) | $Cu^{2+}$ | Hydroxide | $OH^{-}$ |
| Hydrogen | $H^{+}$ | Iodide | $I^{-}$ |
| Iron(II) | $Fe^{2+}$ | Nitrate | $NO_3^{-}$ |
| Iron(III) | $Fe^{3+}$ | Oxide | $O^{2-}$ |
| Lithium | $Li^{+}$ | Sulfate | $SO_4^{2-}$ |
| Magnesium | $Mg^{2+}$ | | |
| Nickel | $Ni^{2+}$ | | |
| Potassium | $K^{+}$ | | |
| Silver | $Ag^{+}$ | | |
| Sodium | $Na^{+}$ | | |
| Zinc | $Zn^{2+}$ | | |

# PERIODIC TABLE OF ELEMENTS

| 1 | 2 | | | | | | | | | | | 3 | 4 | 5 | 6 | 7 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | $^{1}_{1}$H Hydrogen | | | | | | | | | $^{4}_{2}$He Helium |
| $^{7}_{3}$Li Lithium | $^{9}_{4}$Be Beryllium | | | | | | | | | | | $^{11}_{5}$B Boron | $^{12}_{6}$C Carbon | $^{14}_{7}$N Nitrogen | $^{16}_{8}$O Oxygen | $^{19}_{9}$F Fluorine | $^{20}_{10}$Ne Neon |
| $^{23}_{11}$Na Sodium | $^{24}_{12}$Mg Magnesium | | | | | | | | | | | $^{27}_{13}$Al Aluminium | $^{28}_{14}$Si Silicon | $^{31}_{15}$P Phosphorus | $^{32}_{16}$S Sulfur | $^{35}_{17}$Cl Chlorine | $^{40}_{18}$Ar Argon |
| $^{39}_{19}$K Potassium | $^{40}_{20}$Ca Calcium | $^{45}_{21}$Sc Scandium | $^{48}_{22}$Ti Titanium | $^{51}_{23}$V Vanadium | $^{52}_{24}$Cr Chromium | $^{55}_{25}$Mn Manganese | $^{56}_{26}$Fe Iron | $^{59}_{27}$Co Cobalt | $^{59}_{28}$Ni Nickel | $^{64}_{29}$Cu Copper | $^{65}_{30}$Zn Zinc | $^{70}_{31}$Ga Gallium | $^{73}_{32}$Ge Germanium | $^{75}_{33}$As Arsenic | $^{79}_{34}$Se Selenium | $^{80}_{35}$Br Bromine | $^{84}_{36}$Kr Krypton |
| $^{86}_{37}$Rb Rubidium | $^{88}_{38}$Sr Strontium | $^{89}_{39}$Y Yttrium | $^{91}_{40}$Zr Zirconium | $^{93}_{41}$Nb Niobium | $^{96}_{42}$Mo Molybdenum | $^{99}_{43}$Tc Technetium | $^{101}_{44}$Ru Ruthenium | $^{103}_{45}$Rh Rhodium | $^{106}_{46}$Pd Palladium | $^{108}_{47}$Ag Silver | $^{112}_{48}$Cd Cadmium | $^{115}_{49}$In Indium | $^{119}_{50}$Sn Tin | $^{122}_{51}$Sb Antimony | $^{128}_{52}$Te Tellurium | $^{127}_{53}$I Iodine | $^{131}_{54}$Xe Xenon |
| $^{133}_{55}$Cs Caesium | $^{137}_{56}$Ba Barium | $^{139}_{57}$La Lanthanum | $^{179}_{72}$Hf Hafnium | $^{181}_{73}$Ta Tantalum | $^{184}_{74}$W Tungsten | $^{186}_{75}$Re Rhenium | $^{190}_{76}$Os Osmium | $^{192}_{77}$Ir Iridium | $^{195}_{78}$Pt Platinum | $^{197}_{79}$Au Gold | $^{201}_{80}$Hg Mercury | $^{204}_{81}$Tl Thallium | $^{207}_{82}$Pb Lead | $^{209}_{83}$Bi Bismuth | $^{210}_{84}$Po Polonium | $^{210}_{85}$At Astatine | $^{222}_{86}$Rn Radon |
| $^{223}_{87}$Fr Francium | $^{226}_{88}$Ra Radium | $^{227}_{89}$Ac Actinium | | | | | | | | | | | | | | | |

Key: