

**GENERAL CERTIFICATE OF SECONDARY EDUCATION**  
**GATEWAY SCIENCE**  
**CHEMISTRY B**

**B642/01**

Unit 2 Modules C4 C5 C6 (Foundation Tier)

Candidates answer on the question paper.  
A calculator may be used for this paper.

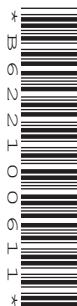
**OCR supplied materials:**  
None

**Other materials required:**

- Pencil
- Ruler (cm/mm)

**Wednesday 15 June 2011**  
**Morning**

**Duration: 1 hour**



|                       |  |                      |  |
|-----------------------|--|----------------------|--|
| Candidate<br>forename |  | Candidate<br>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. Pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Answer **all** the questions.
- Do **not** write in the bar codes.

**INFORMATION FOR CANDIDATES**

- 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 **60**.
- The Periodic Table is printed on the back page.
- This document consists of **28** pages. Any blank pages are indicated.

2

Answer **all** the questions.**Section A – Module C4**

- 1** Washing powder is used to clean clothes.

Look at the label on a box of biological washing powder.

|                           |
|---------------------------|
| <b>Ingredients</b>        |
| <b>water softener</b>     |
| <b>bleach</b>             |
| <b>optical brightener</b> |
| <b>detergent</b>          |
| <b>enzyme</b>             |

- (a) (i)** One ingredient helps to give clothes a 'whiter than white' appearance.

Which ingredient?

..... [1]

- (ii)** What is the job of the bleach in the washing powder?

..... [1]

3

(b) Milly investigates a biological washing powder.

Milly does several experiments.

Each time she adds washing powder to  $1000\text{ cm}^3$  of water.

She puts a tea-towel with a food stain into the water.

She times how long it takes for the food stain to be removed.

Milly then changes the temperature of the water and the mass of washing powder she uses.

Look at her table of results.

|                      |       | mass of washing powder used |        |        |
|----------------------|-------|-----------------------------|--------|--------|
|                      |       | 10 g                        | 30 g   | 50 g   |
| temperature of water | 15 °C | 25 min                      | 20 min | 15 min |
|                      | 35 °C | 10 min                      | 8 min  | 4 min  |
|                      | 55 °C | 15 min                      | 10 min | 6 min  |

Write down **two** conclusions Milly can make from these results.

.....

.....

.....

..... [2]

(c) Write down one **advantage** of using a low temperature wash.

.....

..... [1]

[Total: 5]

## 2 Sea water contains many useful chemicals.

Ed uses the internet to find out the ions found in sea water.

Look at the table of information that Ed finds.

| name of ion | formula of ion     | percentage of dissolved ion in sea water |
|-------------|--------------------|------------------------------------------|
| bromide     | $\text{Br}^-$      | 0.2 %                                    |
| calcium     | $\text{Ca}^{2+}$   | 1.2 %                                    |
| chloride    | $\text{Cl}^-$      | 55.0 %                                   |
| magnesium   | $\text{Mg}^{2+}$   | 3.7 %                                    |
| potassium   | $\text{K}^+$       | 1.1 %                                    |
| sodium      | $\text{Na}^+$      | 30.6 %                                   |
| sulfate     | $\text{SO}_4^{2-}$ | 7.7 %                                    |

(a) Which **positive** ion is present in the **greatest** amount in sea water?

Choose from the table.

..... [1]

(b) Which solution is used to test for chloride ions in sea water?

Choose from the list.

**ammonium sulfate**

**hydrochloric acid**

**potassium nitrate**

**silver nitrate**

answer ..... [1]

5

- (c) Barium chloride solution reacts with the sulfate ions in sea water.

A precipitate is made.

What is the colour of the precipitate?

Choose from the list.

blue

green

pale yellow

white

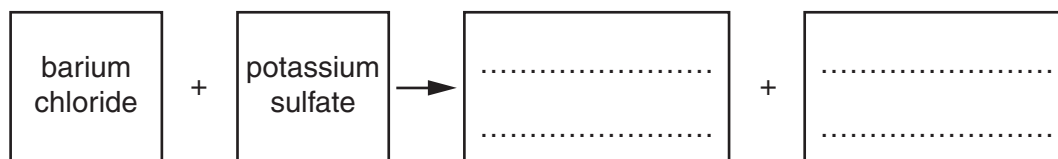
answer ..... [1]

- (d) Barium chloride solution reacts with potassium sulfate solution.

This is a precipitation reaction.

Look at the word equation for this precipitation reaction.

Finish the word equation.



[1]

- (e) In some parts of the world sea water is used to make clean water for drinking.

It is important that people in all parts of the world have a supply of clean water.

Explain why.

.....

..... [1]

[Total: 5]

3 Stowmarket Synthetics own a chemical factory.

They want to make hydrogen peroxide.

Hydrogen peroxide can be made by two methods.

One method is a **batch** process and one is a **continuous** process.

(a) What is the difference between a batch process and a continuous process?

.....

.....

..... [1]

(b) Look at the table.

It gives some information about the two methods used to make hydrogen peroxide.

|                           | method 1                          | method 2               |
|---------------------------|-----------------------------------|------------------------|
| <b>starting materials</b> | barium peroxide and sulfuric acid | hydrogen and oxygen    |
| <b>temperature</b>        | 5 °C                              | 45 °C                  |
| <b>catalyst</b>           | none needed                       | catalyst needed        |
| <b>percentage yield</b>   | 70%                               | 95 %                   |
| <b>pollution problems</b> | poisonous waste product made      | no waste products made |

There are many costs involved in making hydrogen peroxide.

One of these is the cost of energy.

Write down two **other** costs of making hydrogen peroxide.

1 .....

.....

2.....

..... [2]

7

(c) Stowmarket Synthetics also make medicines.

They extract chemicals from the leaves of a plant.

They use these chemicals as the starting material.



Write about how chemicals can be extracted from plants.

.....

.....

.....

..... [2]

[Total: 5]

4 Dylan is a farmer.

He uses fertilisers to make his plants grow faster and bigger.

Fertilisers contain one or more of the three **essential elements**.

These essential elements are nitrogen, phosphorus and potassium.

Look at the diagram. It shows the bags of fertiliser that Dylan has bought.



(a) How many of the **essential elements** are there in this fertiliser?

..... [1]

(b) Dylan puts this fertiliser on his fields.

How does this fertiliser enter the plants?

..... [1]

(c) Ammonium phosphate is a fertiliser made from ammonia.

(i) Which one of these fertilisers is also made from ammonia?

Choose from the list.

**ammonium sulfate**

**phosphorus(V) oxide**

**potassium phosphate**

**potassium sulfate**

answer..... [1]

(ii) A solution of ammonium phosphate has a pH of 5.5.

What does this tell you about ammonium phosphate solution?

..... [1]

9

(d) Urea is another fertiliser that can be made from ammonia.

Urea has the formula  $(\text{NH}_2)_2\text{CO}$ .

What is the relative formula mass,  $M_r$ , for urea?

The relative atomic mass,  $A_r$ , of N is 14, of H is 1, of C is 12 and of O is 16.

.....

.....

.....

relative formula mass = ..... [1]

[Total: 5]

10

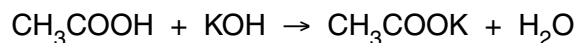
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## Section B – Module C5

5 Kim investigates the neutralisation reaction between ethanoic acid and potassium hydroxide.

(a) Look at the symbol equation for this reaction.



(i) Write down the formula of the **salt** in this reaction.

..... [1]

(ii) Kim uses a solution of potassium hydroxide, KOH, in water.

What is the correct state symbol for a solution of KOH in water?

Choose from the list.

(aq)

(g)

(l)

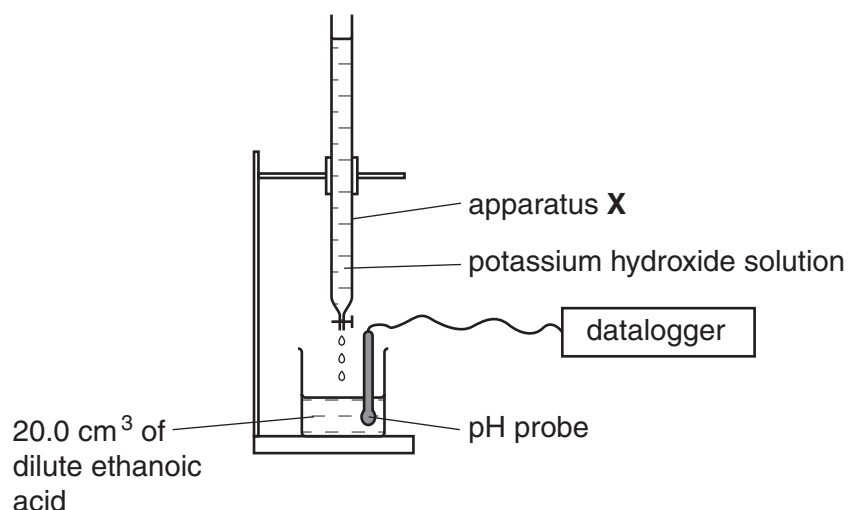
(s)

answer .....

[1]

(b) Kim slowly adds potassium hydroxide solution to the dilute ethanoic acid.

Look at the diagram. It shows the apparatus she uses.



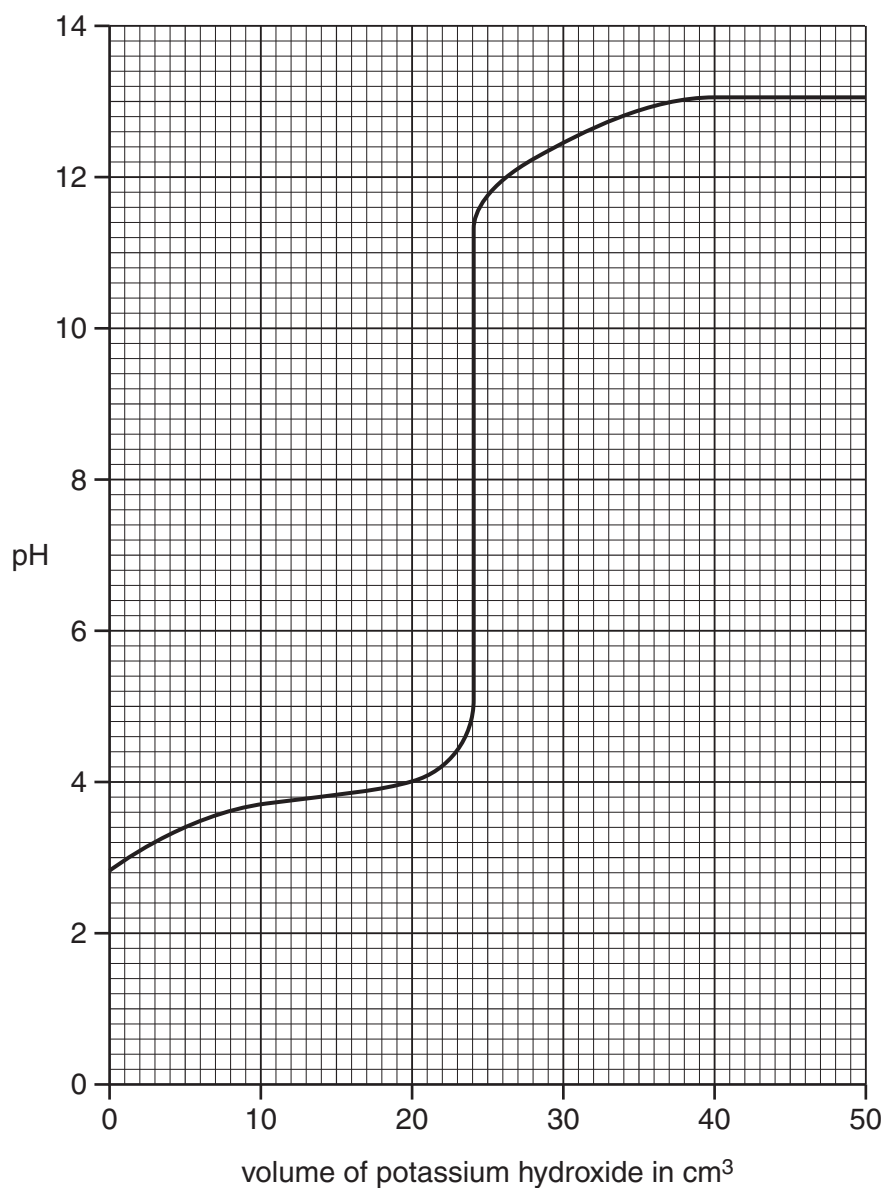
What is the name of apparatus **X**?

..... [1]

12

(c) Kim uses a pH probe (pH meter) to find the pH of the solution in the beaker.

Look at the graph. It shows how the pH of the solution in the beaker changes as more potassium hydroxide solution is added.



(i) Kim adds 10.0 cm³ of potassium hydroxide solution.

What is the pH of the solution in the beaker?

..... [1]

(ii) What volume of potassium hydroxide must be added to just neutralise the ethanoic acid?

..... cm³ [1]

13

(d) Kim repeats the investigation.

This time she uses phenolphthalein to tell when the ethanoic acid has been neutralised.

Phenolphthalein is an indicator.

Finish the sentences about phenolphthalein.

Choose words from the list.

**blue**

**colourless**

**green**

**pink**

**yellow**

In acid, phenolphthalein is .....

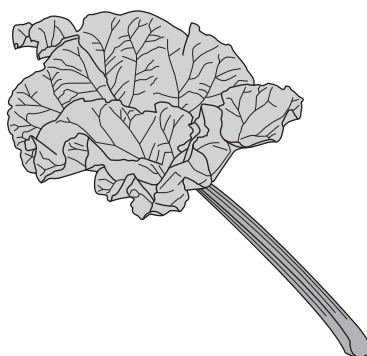
In alkali, phenolphthalein is .....

**[2]**

**[Total: 7]**

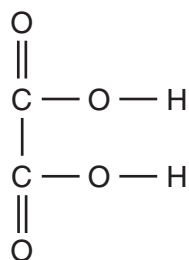
6 Chen is a research chemist.

He extracts a poisonous acid from rhubarb leaves.



The name of the acid is oxalic acid.

Look at the displayed formula for oxalic acid.



(a) What is the molecular formula for oxalic acid?

.....

[1]

(b) Oxalic acid is a weak acid.

Oxalic acid ionises in water.

Which one of these ions is made?

Choose from the list.



answer .....

[1]

15

- (c) Suggest **one** property of hydrochloric acid which is different from oxalic acid.

..... [1]

- (d) Ethanoic acid is another weak acid.

Dilute ethanoic acid can be used to descale kettles.

This is because ethanoic acid reacts with the calcium carbonate (limescale).

- (i) A gas is made when ethanoic acid reacts with calcium carbonate.

Which gas?

..... [1]

- (ii) Hydrochloric acid is not used to descale kettles.

Explain why.

.....  
..... [1]

[Total: 5]

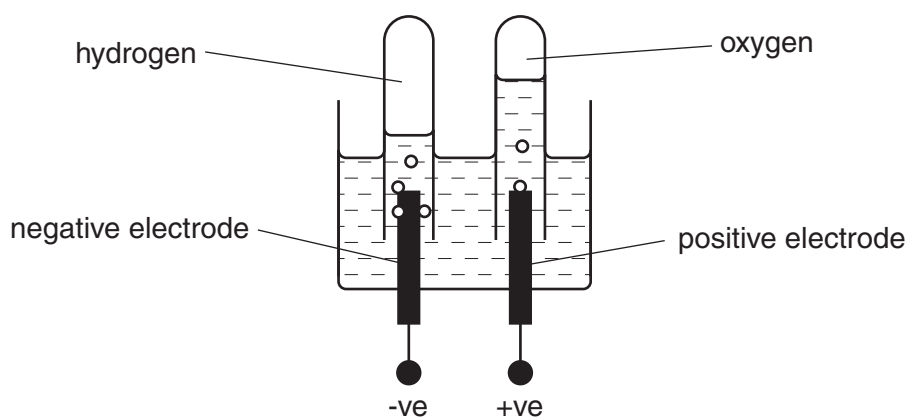
**7** Electrolysis is a type of chemical reaction.

During electrolysis, an electric current is passed through a liquid.

The liquid is broken down (decomposed).

**(a)** Cameron investigates the electrolysis of potassium sulfate solution.

Look at the apparatus he uses.



**(i)** The positive electrode is called the anode.

What is the negative electrode called?

..... [1]

**(ii)** Potassium sulfate solution contains the following particles.



One ion reacts (is discharged) at the positive electrode.

Which ion?

Choose from the list.

answer .....

[1]

(b) Cameron uses the internet to find out about the electrolysis of melted solids.

Look at the table. It shows some of the information he finds.

| melted solid       | product made at the negative electrode | product made at the positive electrode |
|--------------------|----------------------------------------|----------------------------------------|
| aluminium oxide    | aluminium                              | oxygen                                 |
| lead bromide       | lead                                   | bromine                                |
| potassium chloride | .....                                  | .....                                  |

What are the products of the electrolysis of melted potassium chloride?

Write your answers in the table.

[2]

[Total: 4]

18

- 8 Sulfuric acid,  $\text{H}_2\text{SO}_4$ , is made by the Contact Process.

Write about the Contact Process.

You may include

- the names of the raw materials used
- the chemical reactions that happen
- the conditions used.

.....

.....

.....

..... [2]

[Total: 2]

19

- 9 Potassium superoxide is used to provide emergency supplies of oxygen in submarines.

Look at the word equation.

It shows the reaction of potassium superoxide that makes oxygen.



Anthony reacts 71 g of potassium superoxide with 22 g of carbon dioxide.

He finds that 69 g of potassium carbonate is made.

What mass of oxygen is made at the same time?

.....

.....

.....

mass of oxygen = ..... g

[2]

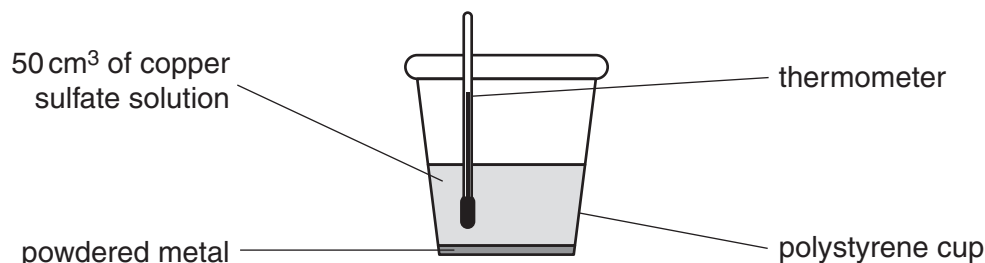
[Total: 2]

## Section C – Module C6

10 This question is about the reactivity of metals.

(a) Amanda and Ken investigate the reactivity of iron, magnesium, tin and zinc.

Look at the diagram. It shows the apparatus they use.



Look at their table of results.

| metal     | starting temperature<br>in °C | highest temperature<br>in °C | temperature rise<br>in °C |
|-----------|-------------------------------|------------------------------|---------------------------|
| iron      | 20                            | 52                           | 32                        |
| magnesium | 21                            | 71                           | 50                        |
| tin       | 22                            | 41                           |                           |
| zinc      | 19                            | 60                           | 41                        |

(i) Calculate the temperature rise for tin.

Write your answer in the table.

[1]

(ii) Zinc reacts with copper sulfate solution to make copper.

A solution of zinc sulfate is also made.

Write down the **word** equation for this reaction.

..... [1]

21

(b) Write down iron, magnesium, tin and zinc in order of reactivity.

**most** reactive metal .....

.....

.....

**least** reactive metal .....

[1]

(c) Oil and grease are used to prevent rusting of iron.

Write down **two** other ways that can be used to prevent iron rusting.

1 .....

.....

2 .....

..... [2]

[Total: 5]

11 This question is about oils and fats.

(a) Look at the pictures.



butter, a fat



olive oil, an oil

Fats and oils are the same type of chemical.

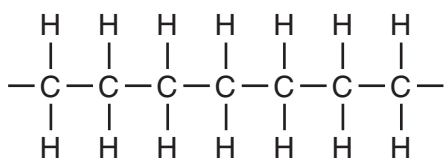
What is the difference between fats and oils at room temperature?

.....  
 ..... [1]

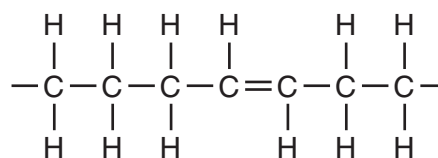
(b) (i) Butter contains saturated and unsaturated fats.

Fats **A** and **B** are both found in butter.

Look at parts of the structures of fats **A** and **B**.



fat **A**



fat **B**

Fat **B** is unsaturated.

How can you tell from its structure?

..... [1]

23

(ii) Jill wants to find out if olive oil is unsaturated.

Write about the experiment she does.

Your answer should include

- the chemical she uses
- any colour change.

.....

.....

.....

..... [2]

(c) Adam shakes olive oil with water. The oil does not dissolve in the water.

The tiny droplets of oil spread throughout the water.

What is the name of this type of mixture?

Choose from the list.

**alloy**

**emulsion**

**precipitate**

**resin**

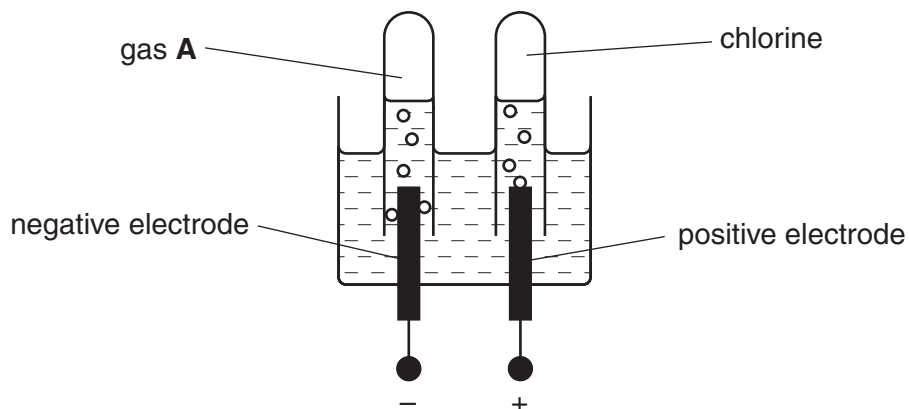
**solution**

answer ..... [1]

[Total: 5]

12 (a) Sarah investigates the electrolysis of concentrated sodium chloride solution.

Look at the apparatus she uses.



Bubbles of gas are made at both electrodes.

Sarah tests the gases.

Look at her results.

| name of gas       | test                            | observations   |
|-------------------|---------------------------------|----------------|
| gas A is<br>..... | light gas with a lighted splint | squeaky pop    |
| chlorine          | hold moist litmus paper in gas  | .....<br>..... |

Complete the table by

- writing in the name of gas A
- describing what happens to the moist litmus paper.

[2]

(b) Sodium chloride is an important raw material.

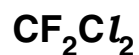
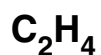
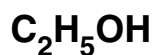
The electrolysis of molten sodium chloride makes chlorine gas.

Write down one large-scale use of chlorine gas.

answer ..... [1]

[Total: 3]

13 Look at the molecular formulas of some compounds.



(a) (i) The compound  $\text{CF}_2\text{Cl}_2$  is an example of a chlorofluorocarbon.

Write down the **names** of the elements in this compound.

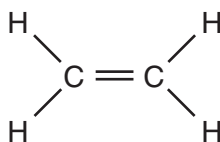
The Periodic Table may help you.

..... [1]

(ii) Write down the total number of **atoms** in a molecule of  $\text{C}_2\text{H}_5\text{OH}$ .

answer ..... [1]

(iii) Look at the **displayed** formula of ethene,  $\text{C}_2\text{H}_4$ .



Draw the **displayed** formula of ethanol,  $\text{C}_2\text{H}_5\text{OH}$ .

[1]

(b) Ethanol is made from ethene.



Write down the name of this **type** of reaction.

Choose from the list.

**dehydration**

**electrolysis**

**fermentation**

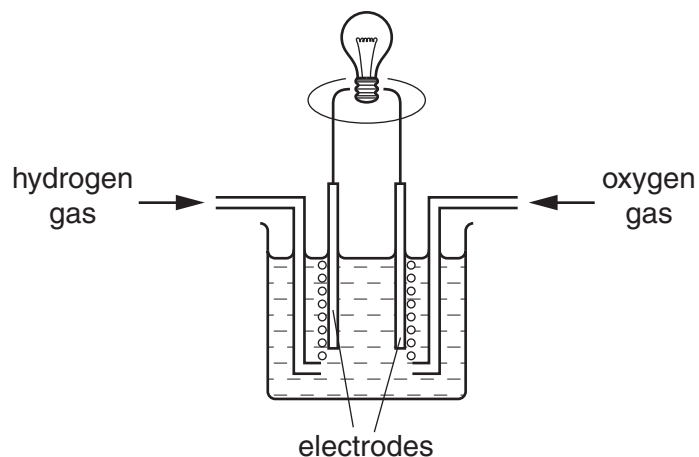
**hydration**

answer ..... [1]

[Total: 4]

14 This question is about fuel cells.

The diagram shows how a fuel cell works.



(a) Fuel cells produce energy.

Look at the list. It shows different types of energy.

**electrical**

**heat**

**kinetic**

**sound**

Write down the name of the **main** type of energy made in a fuel cell.

Choose from the list.

answer ..... [1]

(b) Look at the word equation for the reaction in this fuel cell.



Petrol and fuel cells can both be used to power cars.

Burning petrol makes carbon dioxide and water.

Write down **one** reason why using a fuel cell is better for the environment than burning petrol.

.....  
 ..... [1]

- (c) Fuel cells are used in spacecraft instead of batteries.

Write down **one** advantage of using fuel cells instead of batteries.

.....  
..... [1]

[Total: 3]

**END OF QUESTION PAPER**



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# The Periodic Table of the Elements

|                               |                             |                                                                         |                                     |                               |                                  |                                |                               |                                  |                                    |                                   |                                                                                     |                             |                             |                             |                               |                               |                            |                             |  |                           |                             |                         |                              |                         |
|-------------------------------|-----------------------------|-------------------------------------------------------------------------|-------------------------------------|-------------------------------|----------------------------------|--------------------------------|-------------------------------|----------------------------------|------------------------------------|-----------------------------------|-------------------------------------------------------------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------------|-------------------------------|----------------------------|-----------------------------|--|---------------------------|-----------------------------|-------------------------|------------------------------|-------------------------|
| 1                             | 2                           | Key                                                                     |                                     |                               |                                  |                                |                               |                                  |                                    |                                   |                                                                                     | 3                           | 4                           | 5                           | 6                             | 7                             | 0                          |                             |  |                           |                             |                         |                              |                         |
|                               |                             | relative atomic mass<br>atomic symbol<br>name<br>atomic (proton) number |                                     |                               |                                  |                                |                               |                                  |                                    |                                   |                                                                                     |                             |                             |                             |                               |                               |                            | 1<br>H<br>hydrogen<br>1     |  | 4<br>He<br>helium<br>2    |                             |                         |                              |                         |
| 7<br>Li<br>lithium<br>3       | 9<br>Be<br>beryllium<br>4   |                                                                         |                                     |                               |                                  |                                |                               |                                  |                                    |                                   |                                                                                     |                             |                             |                             |                               |                               |                            | 11<br>B<br>boron<br>5       |  | 12<br>C<br>carbon<br>6    | 14<br>N<br>nitrogen<br>7    | 16<br>O<br>oxygen<br>8  | 19<br>F<br>fluorine<br>9     | 20<br>Ne<br>neon<br>10  |
| 23<br>Na<br>sodium<br>11      | 24<br>Mg<br>magnesium<br>12 |                                                                         |                                     |                               |                                  |                                |                               |                                  |                                    |                                   |                                                                                     |                             |                             |                             |                               |                               |                            | 27<br>Al<br>aluminium<br>13 |  | 28<br>Si<br>silicon<br>14 | 31<br>P<br>phosphorus<br>15 | 32<br>S<br>sulfur<br>16 | 35.5<br>Cl<br>chlorine<br>17 | 40<br>Ar<br>argon<br>18 |
| 39<br>K<br>potassium<br>19    | 40<br>Ca<br>calcium<br>20   | 45<br>Sc<br>scandium<br>21                                              | 48<br>Ti<br>titanium<br>22          | 51<br>V<br>vanadium<br>23     | 52<br>Cr<br>chromium<br>24       | 55<br>Mn<br>manganese<br>25    | 56<br>Fe<br>iron<br>26        | 59<br>Co<br>cobalt<br>27         | 59<br>Ni<br>nickel<br>28           | 63.5<br>Cu<br>copper<br>29        | 65<br>Zn<br>zinc<br>30                                                              | 70<br>Ga<br>gallium<br>31   | 73<br>Ge<br>germanium<br>32 | 75<br>As<br>arsenic<br>33   | 79<br>Se<br>selenium<br>34    | 80<br>Br<br>bromine<br>35     | 84<br>Kr<br>krypton<br>36  |                             |  |                           |                             |                         |                              |                         |
| 85<br>Rb<br>rubidium<br>37    | 88<br>Sr<br>strontium<br>38 | 89<br>Y<br>yttrium<br>39                                                | 91<br>Zr<br>zirconium<br>40         | 93<br>Nb<br>niobium<br>41     | 96<br>Mo<br>molybdenum<br>42     | [98]<br>Tc<br>technetium<br>43 | 101<br>Ru<br>ruthenium<br>44  | 103<br>Rh<br>rhodium<br>45       | 106<br>Pd<br>palladium<br>46       | 108<br>Ag<br>silver<br>47         | 112<br>Cd<br>cadmium<br>48                                                          | 115<br>In<br>indium<br>49   | 119<br>Sn<br>tin<br>50      | 122<br>Sb<br>antimony<br>51 | 128<br>Te<br>tellurium<br>52  | 127<br>I<br>iodine<br>53      | 131<br>Xe<br>xenon<br>54   |                             |  |                           |                             |                         |                              |                         |
| 133<br>Cs<br>caesium<br>55    | 137<br>Ba<br>barium<br>56   | 139<br>La*<br>lanthanum<br>57                                           | 178<br>Hf<br>hafnium<br>72          | 181<br>Ta<br>tantalum<br>73   | 184<br>W<br>tungsten<br>74       | 186<br>Re<br>rhenium<br>75     | 190<br>Os<br>osmium<br>76     | 192<br>Ir<br>iridium<br>77       | 195<br>Pt<br>platinum<br>78        | 197<br>Au<br>gold<br>79           | 201<br>Hg<br>mercury<br>80                                                          | 204<br>Tl<br>thallium<br>81 | 207<br>Pb<br>lead<br>82     | 209<br>Bi<br>bismuth<br>83  | [209]<br>Po<br>polonium<br>84 | [210]<br>At<br>astatine<br>85 | [222]<br>Rn<br>radon<br>86 |                             |  |                           |                             |                         |                              |                         |
| [223]<br>Fr<br>francium<br>87 | [226]<br>Ra<br>radium<br>88 | [227]<br>Ac*<br>actinium<br>89                                          | [261]<br>Rf<br>rutherfordium<br>104 | [262]<br>Db<br>dubnium<br>105 | [266]<br>Sg<br>seaborgium<br>106 | [264]<br>Bh<br>bohrium<br>107  | [277]<br>Hs<br>hassium<br>108 | [268]<br>Mt<br>meitnerium<br>109 | [271]<br>Ds<br>darmstadtium<br>110 | [272]<br>Rg<br>roentgenium<br>111 | Elements with atomic numbers 112-116 have been reported but not fully authenticated |                             |                             |                             |                               |                               |                            |                             |  |                           |                             |                         |                              |                         |

Key

relative atomic mass  
atomic symbol  
name  
atomic (proton) number

\* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.