

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

GCSE – **NEW**

3410U10-1



S18-3410U10-1

**CHEMISTRY – Unit 1:**  
**Chemical Substances, Reactions and**  
**Essential Resources**

**FOUNDATION TIER**

WEDNESDAY, 13 JUNE 2018 – MORNING

1 hour 45 minutes

**ADDITIONAL MATERIALS**

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

**INSTRUCTIONS TO CANDIDATES**

Use black ink or black ball-point pen. Do not use gel pen  
 or correction fluid.

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.  
 If you run out of space, use the additional page at the back  
 of the booklet, taking care to number the question(s) correctly.

**INFORMATION FOR CANDIDATES**

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

Question **8** is a quality of extended response (QER) question where your writing skills will be assessed.

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

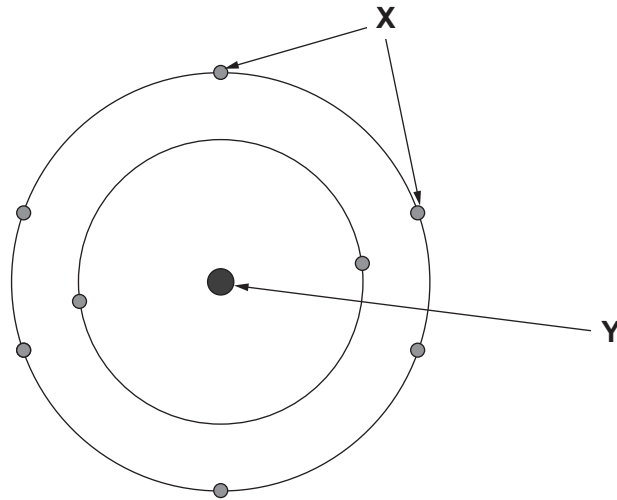
| For Examiner's use only |              |              |
|-------------------------|--------------|--------------|
| Question                | Maximum Mark | Mark Awarded |
| 1.                      | 9            |              |
| 2.                      | 6            |              |
| 3.                      | 7            |              |
| 4.                      | 8            |              |
| 5.                      | 10           |              |
| 6.                      | 9            |              |
| 7.                      | 5            |              |
| 8.                      | 6            |              |
| 9.                      | 6            |              |
| 10.                     | 9            |              |
| 11.                     | 5            |              |
| <b>Total</b>            | <b>80</b>    |              |

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Answer **all** questions.

1. (a) The following diagram shows the structure of an atom.



|           |         |        |          |         |
|-----------|---------|--------|----------|---------|
| electrons | protons | shells | neutrons | nucleus |
|-----------|---------|--------|----------|---------|

Complete the following sentences using words from the box.

[3]

The particles labelled **X** are called .....

The part of the atom labelled **Y** is called the .....

It contains particles called ..... and .....

- (b) Draw a line from each particle to the charge of that particle.

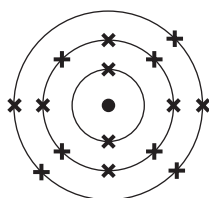
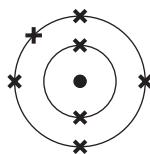
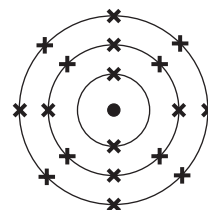
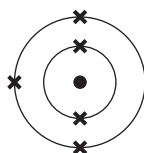
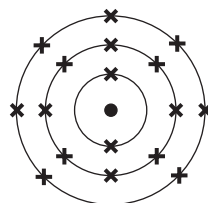
[2]

|          |    |
|----------|----|
| proton   | 0  |
| neutron  | +1 |
| electron | -1 |



(c) The diagrams below show five different atoms labelled **A-E**.

These letters are **not** the chemical symbols for the elements.

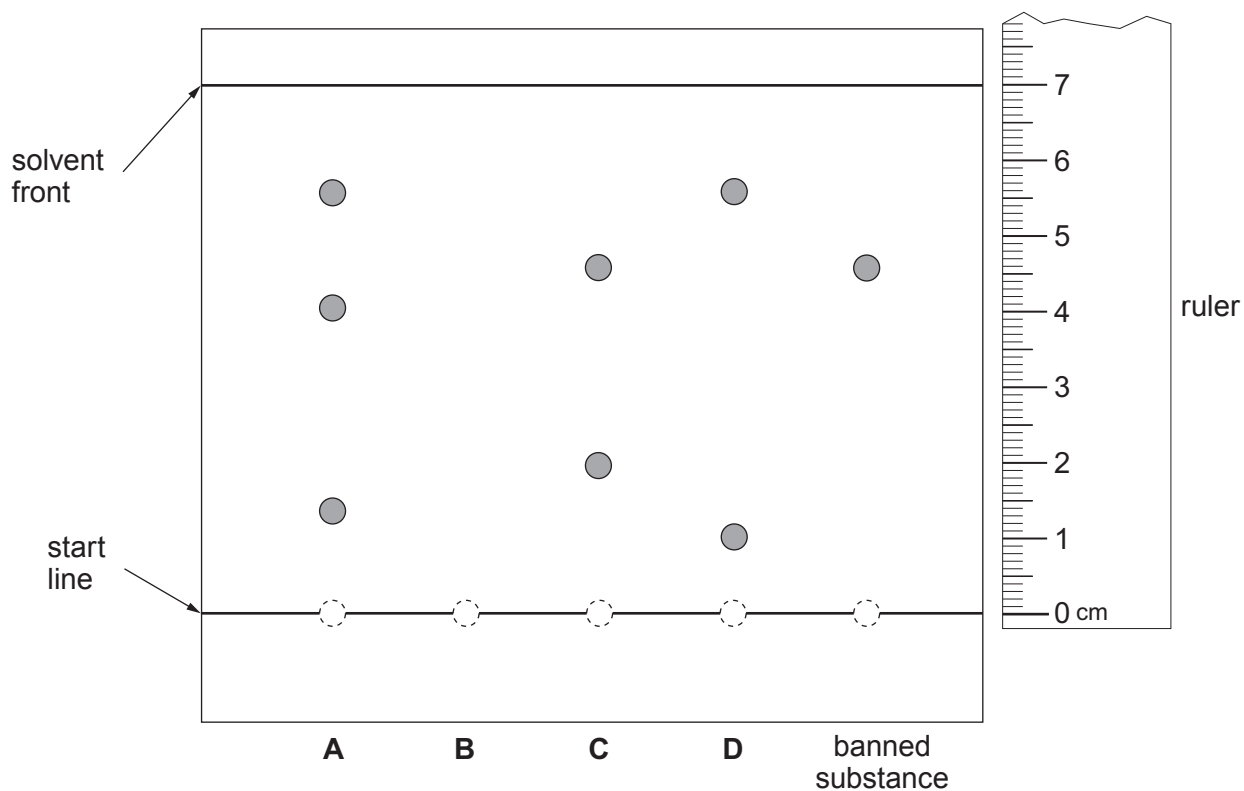
**A****B****C****D****E**

Use the letters **A-E** to complete the following sentences.

- (i) The atoms found in Group 5 are ..... and ..... [1]
- (ii) The atom with an atomic number of 7 is ..... [1]
- (iii) The atom that is an inert gas is ..... [1]
- (iv) The atoms found in Period 2 are ..... and ..... [1]



2. A food company was accused of using a banned substance in its sweets. Scientists tested four dyes, **A-D**, to find out if this was true or not. The results are shown below.



- (a) Name the method used.

[1]

.....

- (b) Dye **B** was found to have an  $R_f$  value of 0.428.

- (i) Use the following equation to calculate the distance moved by dye **B**.

[2]

$$\text{distance moved by dye B} = R_f \times \text{distance moved by solvent front}$$

Distance moved = ..... cm

- (ii) **Complete the diagram** above to show the position of dye **B**.

[1]



(c) Identify which dye, **A-D**, contains the banned substance. Give a reason for your answer. [2]

Dye .....

Reason .....

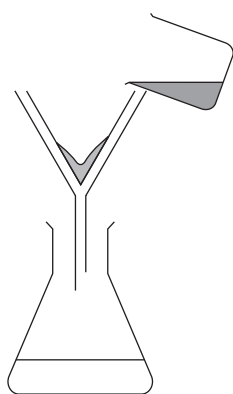
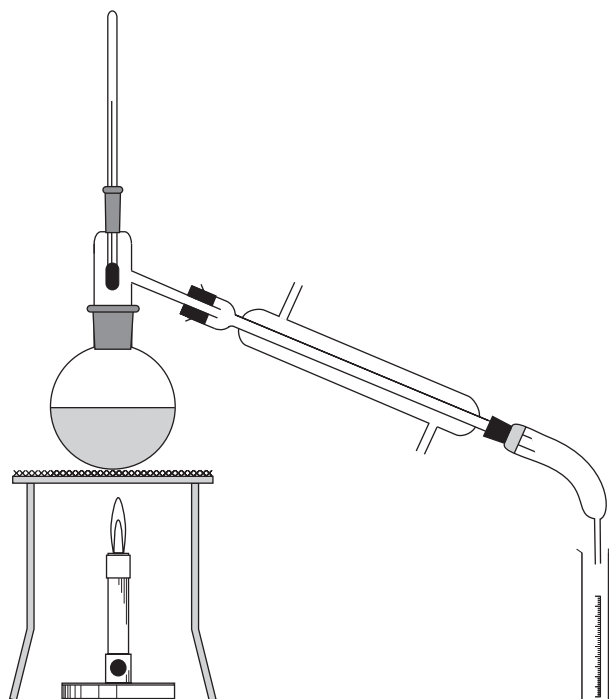
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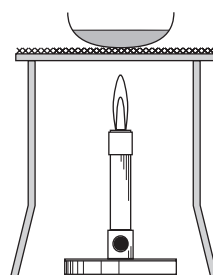
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3. (a) The diagrams below show three methods of separating mixtures.

Method A



Method B



Method C



- (i) A student was given a solution of sodium chloride. State which method, **A**, **B** or **C**, he could use in order to obtain a sample of pure water from the solution. Explain how the method works. [3]

Method .....

Explanation .....

- (ii) 500g of solution was found to contain 43g of sodium chloride. Calculate the percentage of sodium chloride in the solution. [2]

Percentage = ..... %

- (b) Group 7 ions, chloride, bromide and iodide, can be identified using silver nitrate solution.

Complete the following table to show the colours of the precipitates produced by these ions. [2]

| Group 7 ion | Colour of precipitate |
|-------------|-----------------------|
| chloride    | white                 |
| bromide     | .....                 |
| iodide      | .....                 |



4. The following table shows the composition of the atmosphere.

| Gas            | Chemical formula | Percentage found in the atmosphere (%) |
|----------------|------------------|----------------------------------------|
| argon          | Ar               | 0.93                                   |
| carbon dioxide | CO <sub>2</sub>  | 0.0360                                 |
| helium         | He               | 0.0005                                 |
| hydrogen       | H <sub>2</sub>   | 0.00005                                |
| methane        | CH <sub>4</sub>  | 0.00017                                |
| neon           | Ne               | 0.0018                                 |
| nitrogen       | N <sub>2</sub>   | 78.08                                  |
| nitrous oxide  | N <sub>2</sub> O | 0.00003                                |
| oxygen         | O <sub>2</sub>   | 20.95                                  |
| ozone          | O <sub>3</sub>   | 0.000004                               |

Use the table to answer parts (a) and (b).

(a) (i) Name **two** gases that occur as single atoms. [1]

.....

(ii) Name **two** elements that occur as molecules. [1]

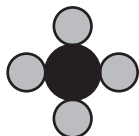
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(iii) Name the gas that has the **lowest** percentage. [1]

.....



- (b) (i) If  represents a carbon atom, name the gases from the table that can be represented by the following diagrams. [2]



.....

.....

- (ii) Use the information in part (i) to draw the diagram for oxygen gas. [1]

- (c) The atmosphere can become polluted by substances known as chlorofluorocarbons (CFCs). One example of a CFC is  $\text{CH}_2\text{ClF}$ .

- (i) State how many hydrogen atoms are present in  $\text{CH}_2\text{ClF}$ . [1]

.....

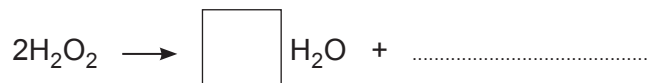
- (ii) Give the **total** number of atoms shown in the formula,  $\text{CH}_2\text{ClF}$ . [1]

.....

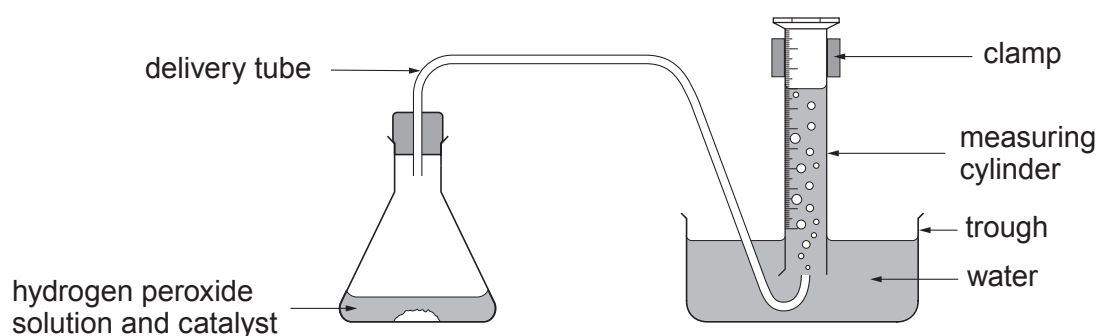


5. Hydrogen peroxide decomposes to give water and oxygen.

(a) Complete the symbol equation to show the reaction taking place. [2]



(b) The rate of decomposition of hydrogen peroxide can be measured using the following apparatus.



The rate was investigated using three different catalysts. The results are shown in the table.

| Time (s) | Volume of gas collected (cm <sup>3</sup> ) |            |            |
|----------|--------------------------------------------|------------|------------|
|          | Catalyst 1                                 | Catalyst 2 | Catalyst 3 |
| 0        | 0                                          | 0          | 0          |
| 20       | 2                                          | 20         | 8          |
| 40       | 4                                          | 34         | 15         |
| 60       | 6                                          | 38         | 23         |
| 80       | 8                                          | 40         | 30         |
| 100      | 10                                         | 40         | 36         |

(i) State which is the **least** effective catalyst. Give a reason for your answer. [1]

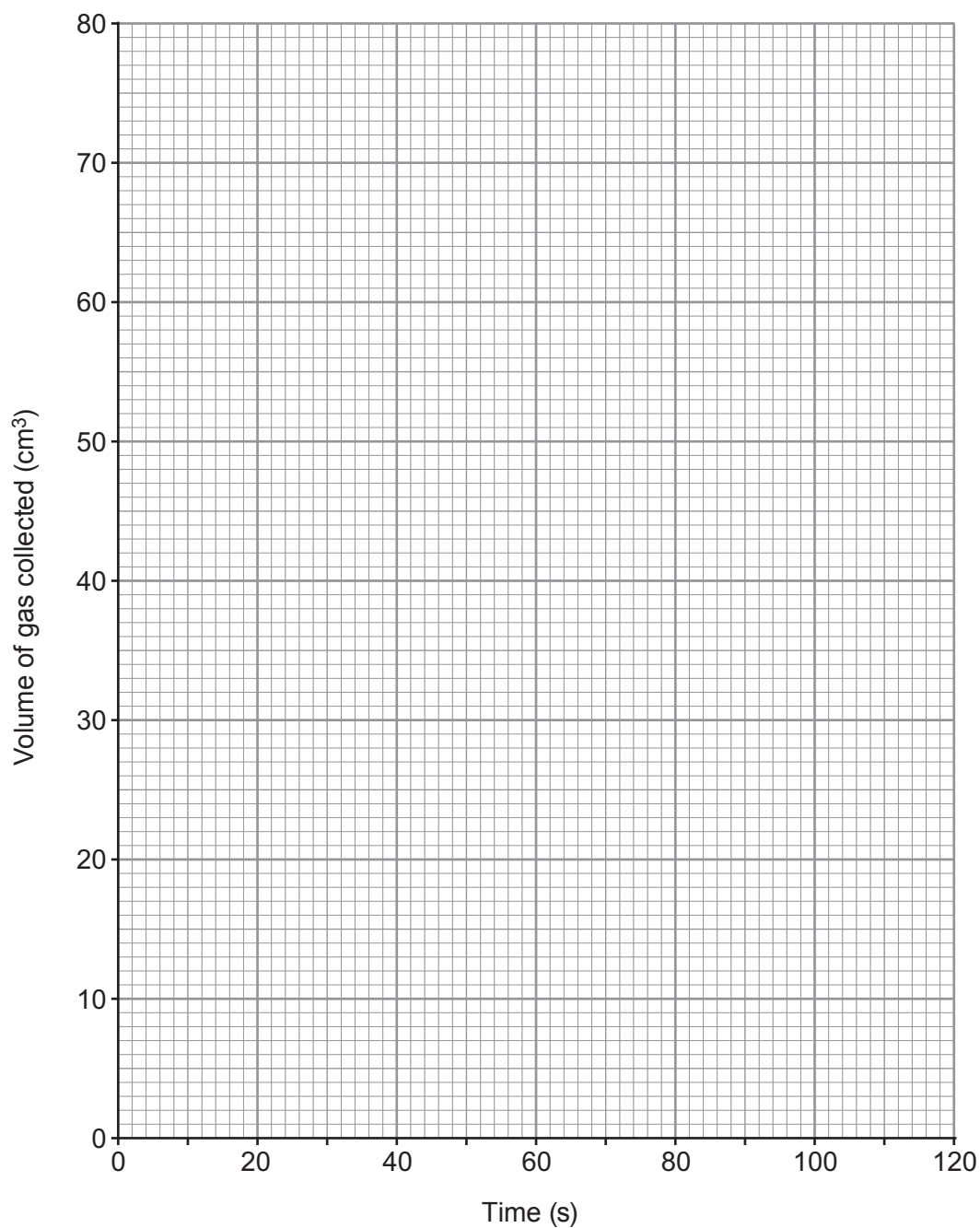
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- (ii) Plot a graph of the volume of gas collected using **catalyst 2**.  
Draw a suitable line.

[3]

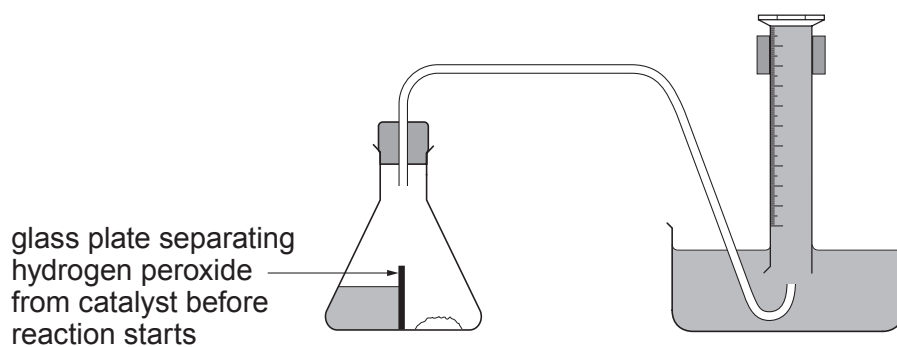


- (iii) **On the same grid**, sketch the graph you would expect to obtain if you added the same amount of catalyst 2 to the same volume of hydrogen peroxide of **twice** the concentration.

[2]



- (iv) Another student claimed that he could collect more accurate results using the following apparatus.



Suggest how this apparatus could improve the accuracy of the results.

[2]

.....

.....

.....

10



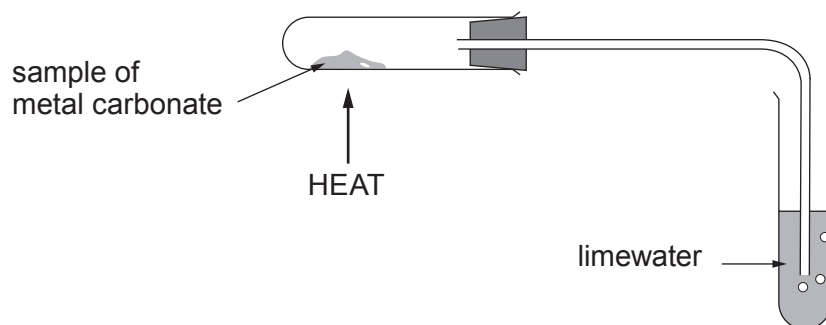
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6. (a) A student investigated the decomposition of three different metal carbonates.

She measured the time taken for limewater to turn milky using the following apparatus.



Three samples of each metal carbonate were tested. Her results are shown in the table.

| Metal carbonate      | Time taken for limewater to turn milky (s) |          |          |       |
|----------------------|--------------------------------------------|----------|----------|-------|
|                      | Sample 1                                   | Sample 2 | Sample 3 | Mean  |
| copper(II) carbonate | 15                                         | 25       | 17       | ..... |
| zinc carbonate       | 54                                         | 52       | 53       | 53    |
| calcium carbonate    | 195                                        | 200      | 190      | 195   |

- (i) Calculate the mean time taken for limewater to turn milky on heating copper(II) carbonate. **Show your working.** [2]

Mean time = ..... s



- (ii) I. Place the carbonates in order of stability giving a reason for your answer. [2]

Most stable .....

.....

Least stable .....

Reason .....

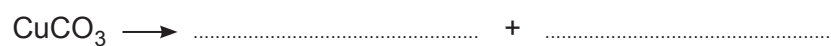
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- II. Explain the order of stability of the carbonates. [1]

.....

.....

- (iii) Complete the following symbol equation for the decomposition of copper(II) carbonate. [2]



- (b) Calculate the relative formula mass,  $M_r$ , of copper(II) carbonate,  $\text{CuCO}_3$ . [2]

$$A_r(\text{C}) = 12 \quad A_r(\text{O}) = 16 \quad A_r(\text{Cu}) = 63.5$$

$$M_r = \dots\dots\dots$$



7. The following information is taken from some articles about global warming.

Greenhouse gases such as carbon dioxide keep heat close to the Earth's surface making it a suitable temperature for life. Global warming is an increase of the Earth's mean surface temperature due to the overproduction of greenhouse gases by burning fossil fuels such as gas, petrol and oil. Deforestation also contributes to this. With the growth of industry in the 1900s, humans began burning more fossil fuels to run our cars, trucks and factories. There is more carbon dioxide in the atmosphere today than at any point in the last 800,000 years.

The following charts show the mean global temperature every decade since the 1880s, the amount of carbon dioxide in the atmosphere from 1750-2010 and the main sources of carbon dioxide production today.

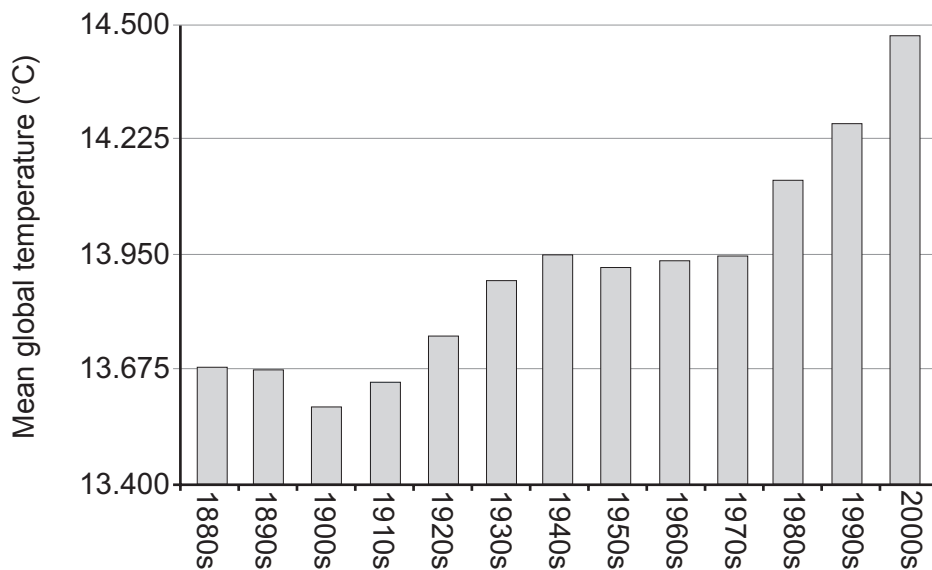


Figure 1

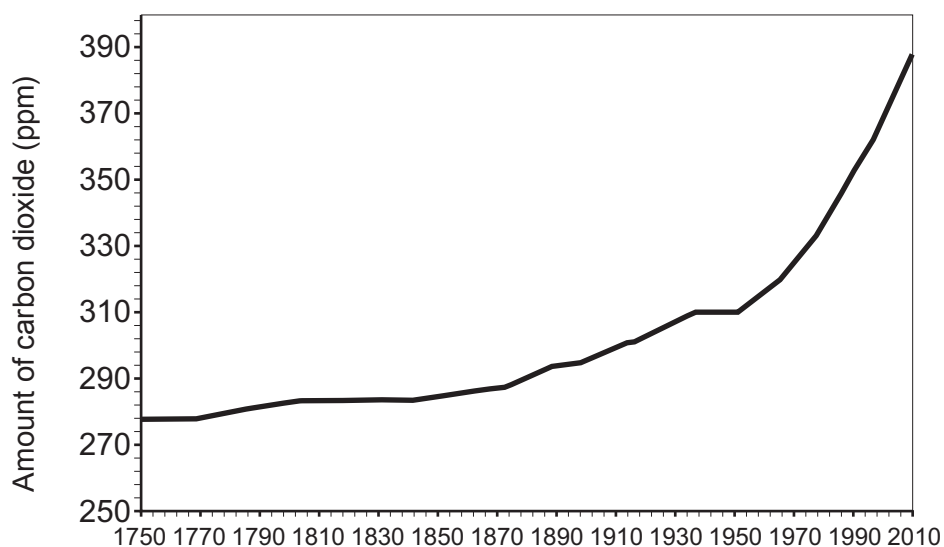


Figure 2



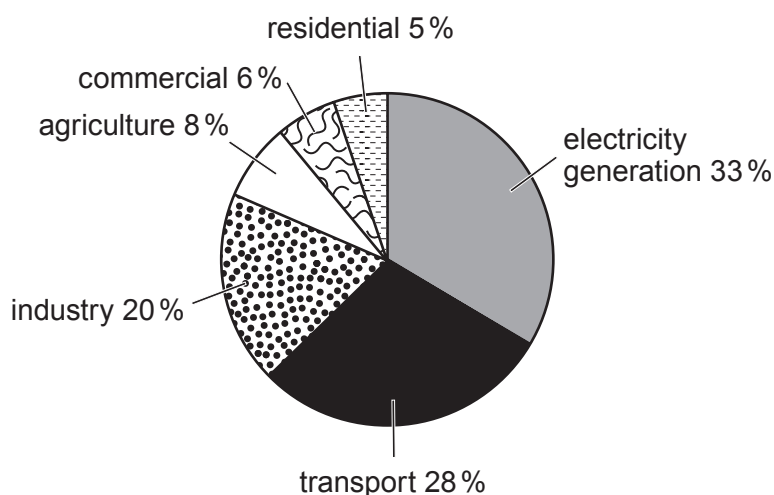


Figure 3

(a) Draw a trend line on **Figure 1**. [1]

(b) Suggest why there was a large rise in the amount of carbon dioxide in the atmosphere after around 1950. [2]

.....

.....

.....

(c) Give **one** way in which we are trying to reduce carbon dioxide emissions. [1]

.....

.....

(d) Some people say that changes in carbon dioxide levels are **not** responsible for global warming. Tick (✓) the statement that supports this opinion. [1]

Most carbon dioxide is produced by electricity generation

☐

Between 1900 and 2010 there was a massive increase in industry

☐

The mean global temperature remained constant between 1950 and 1980

☐

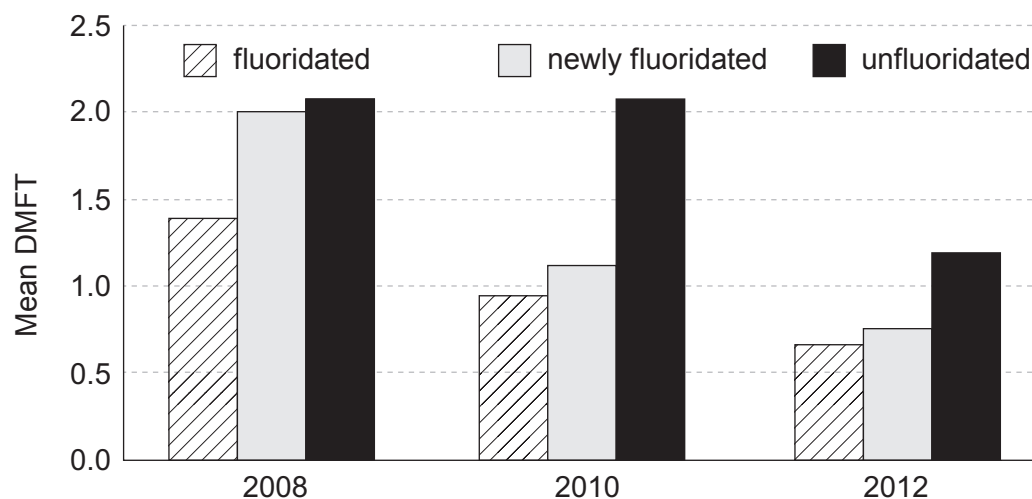
The average number of cars per home has increased steadily since the 1980s

☐

The use of energy efficient appliances has increased since 2000

☐


8. The following graph shows the mean numbers of decayed, missing and filled teeth (DMFT) in 12 year-olds in three areas of Australia in 2008, 2010 and 2012. One area has been fluoridated for 20 years, one is newly fluoridated and the other is unfluoridated.



Describe what the graph tells us. Use this information and your knowledge of fluoridation to explain why some people support fluoridation of water supplies but others oppose it. [6 QER]

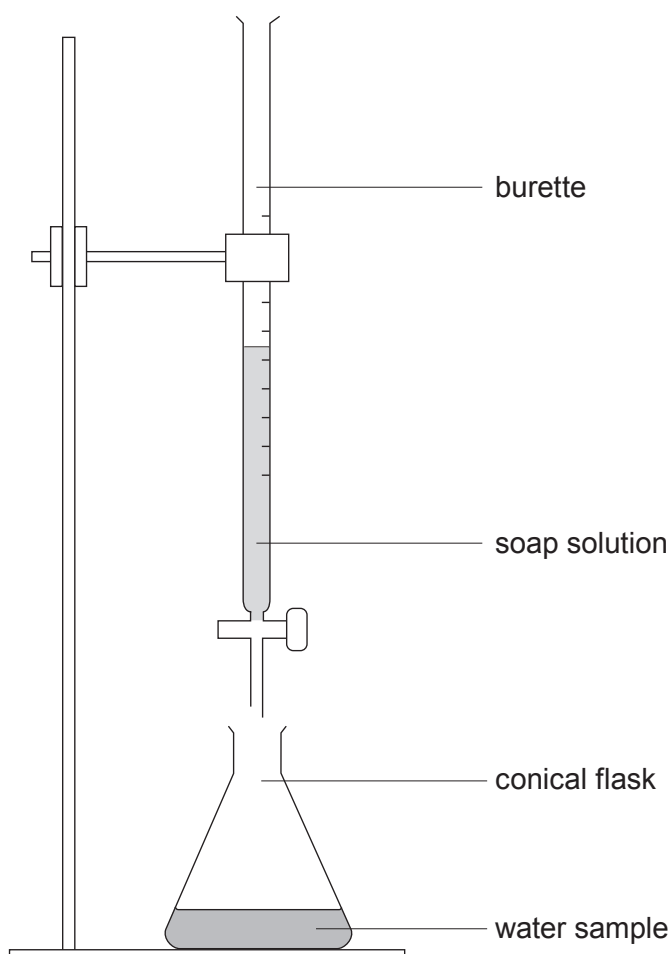


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9. Water samples **A**, **B**, **C** and **D** were tested for hardness using the apparatus shown.



Soap solution was added  $1\text{ cm}^3$  at a time to each sample and the volume required to produce a permanent lather on shaking was recorded. Each sample was tested before and after boiling. The results are shown in the table.

| Water sample | Volume of soap solution required ( $\text{cm}^3$ ) |               |
|--------------|----------------------------------------------------|---------------|
|              | Before boiling                                     | After boiling |
| <b>A</b>     | 1                                                  | 1             |
| <b>B</b>     | 10                                                 | 10            |
| <b>C</b>     | 15                                                 | 1             |
| <b>D</b>     | 15                                                 | 8             |



- (a) (i) State which water sample contains **only** temporary hardness. Explain your answer. [2]

Water sample .....

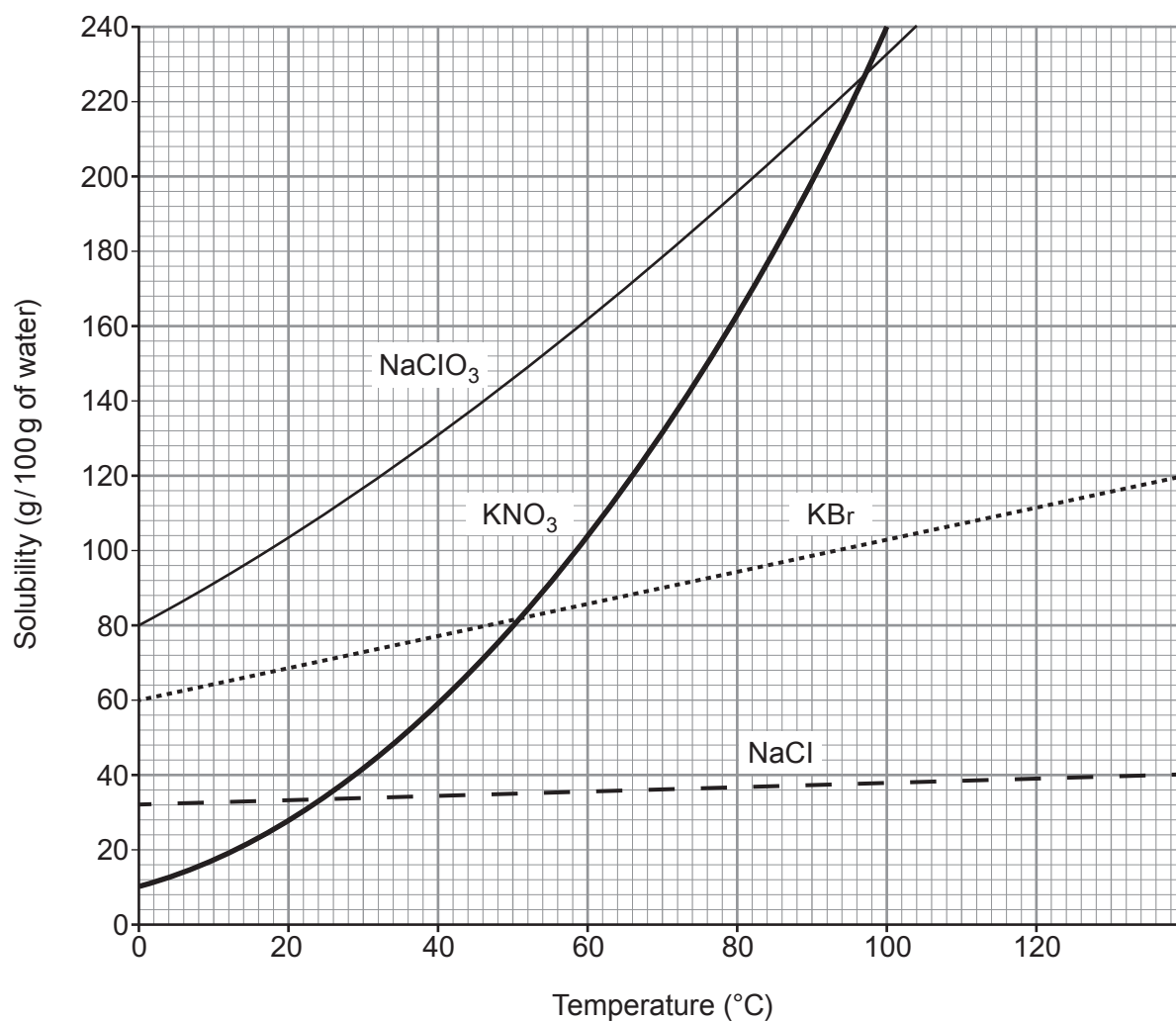
Explanation .....

- (ii) Give **one** similarity in the composition of temporary and permanent hard water. [1]

- (b) Discuss the benefits and drawbacks of living in a hard water area. [3]



10. The grid below shows the solubility curves for four ionic compounds.



|                    |                   |
|--------------------|-------------------|
| NaClO <sub>3</sub> | sodium chlorate   |
| KNO <sub>3</sub>   | potassium nitrate |
| KBr                | potassium bromide |
| NaCl               | sodium chloride   |



- (a) (i) Give the temperature at which the solubility of potassium nitrate and potassium bromide is the same. [1]

..... °C

- (ii) Calculate the mass of solid potassium nitrate that would form if a saturated solution in 200 g of water were cooled from 100 °C to 20 °C. [3]

Mass = ..... g

- (iii) Suggest why a student may be surprised at the temperature range shown on the solubility curves. [1]

.....  
.....

- (b) (i) Give the symbols of the **ions** of Group 1 elements present in the compounds shown on the grid. [1]

.....

- (ii) Explain how these ions are formed from their atoms. [2]

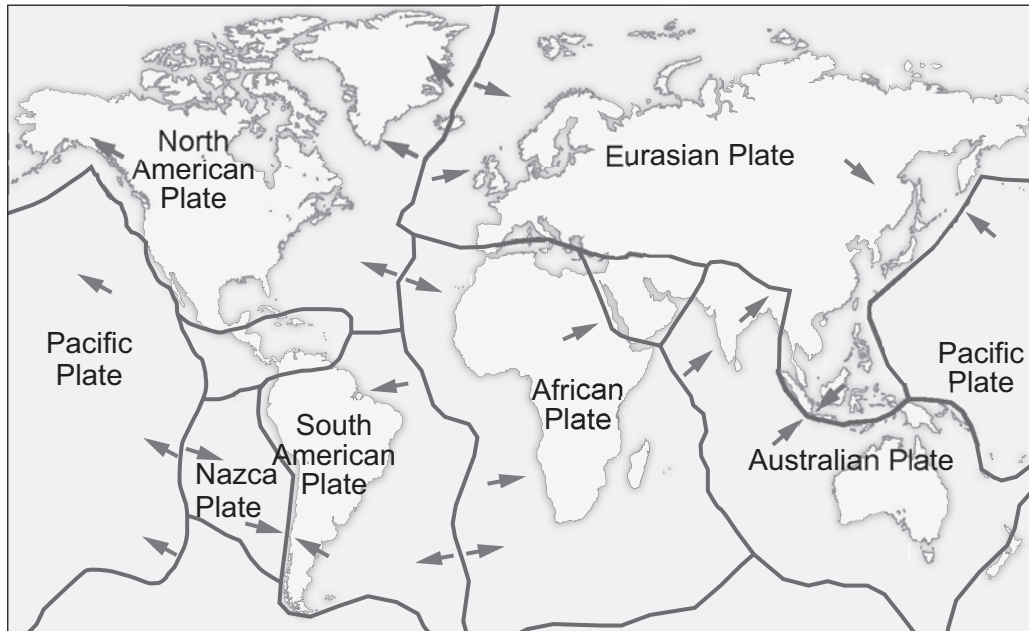
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- (c) Potassium nitrate reacts with aluminium hydroxide to produce aluminium nitrate and potassium hydroxide.

Balance the symbol equation for the reaction taking place. [1]



11. The following diagram shows some of the Earth's tectonic plates and the direction in which they move.



- (a) The boundary between the Nazca and South American plates is a destructive plate boundary. Describe what happens at a destructive boundary. [2]

.....

.....

.....

- (b) Draw a cross (✕) on the diagram to show a constructive plate boundary. Describe what happens at this boundary. [2]

.....

.....

.....

- (c) State **one** effect of plates sliding past each other. [1]

.....

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## FORMULAE FOR SOME COMMON IONS

| POSITIVE IONS |                  | NEGATIVE IONS |                    |
|---------------|------------------|---------------|--------------------|
| Name          | Formula          | Name          | Formula            |
| aluminium     | $\text{Al}^{3+}$ | bromide       | $\text{Br}^-$      |
| ammonium      | $\text{NH}_4^+$  | carbonate     | $\text{CO}_3^{2-}$ |
| barium        | $\text{Ba}^{2+}$ | chloride      | $\text{Cl}^-$      |
| calcium       | $\text{Ca}^{2+}$ | fluoride      | $\text{F}^-$       |
| copper(II)    | $\text{Cu}^{2+}$ | hydroxide     | $\text{OH}^-$      |
| hydrogen      | $\text{H}^+$     | iodide        | $\text{I}^-$       |
| iron(II)      | $\text{Fe}^{2+}$ | nitrate       | $\text{NO}_3^-$    |
| iron(III)     | $\text{Fe}^{3+}$ | oxide         | $\text{O}^{2-}$    |
| lithium       | $\text{Li}^+$    | sulfate       | $\text{SO}_4^{2-}$ |
| magnesium     | $\text{Mg}^{2+}$ |               |                    |
| nickel        | $\text{Ni}^{2+}$ |               |                    |
| potassium     | $\text{K}^+$     |               |                    |
| silver        | $\text{Ag}^+$    |               |                    |
| sodium        | $\text{Na}^+$    |               |                    |
| zinc          | $\text{Zn}^{2+}$ |               |                    |



# THE PERIODIC TABLE

Group 1 2 3 4 5 6 7 0



28

|                                                                                         |                             |                              |                             |                             |                              |                              |                              |
|-----------------------------------------------------------------------------------------|-----------------------------|------------------------------|-----------------------------|-----------------------------|------------------------------|------------------------------|------------------------------|
| <div> <div>1<br/>H<br/>Hydrogen<br/>1</div> <div>4<br/>He<br/>Helium<br/>2</div> </div> |                             | 28                           |                             |                             |                              |                              |                              |
| 7<br>Li<br>Lithium<br>3                                                                 | 9<br>Be<br>Beryllium<br>4   | 11<br>Na<br>Sodium<br>11     | 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       |
| 86<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 | 99<br>Tc<br>Technetium<br>43 | 101<br>Ru<br>Ruthenium<br>44 |
| 133<br>Cs<br>Caesium<br>55                                                              | 137<br>Ba<br>Barium<br>56   | 139<br>La<br>Lanthanum<br>57 | 179<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    |
| 223<br>Fr<br>Francium<br>87                                                             | 226<br>Ra<br>Radium<br>88   | 227<br>Ac<br>Actinium<br>89  | 201<br>Hg<br>Mercury<br>80  | 204<br>Pb<br>Lead<br>82     | 207<br>Bi<br>Bismuth<br>83   | 210<br>Po<br>Polonium<br>84  | 222<br>Rn<br>Radon<br>86     |
| 115<br>In<br>Indium<br>49                                                               | 112<br>Cd<br>Cadmium<br>48  | 106<br>Pd<br>Palladium<br>46 | 108<br>Ag<br>Silver<br>47   | 115<br>Ga<br>Gallium<br>31  | 119<br>Sn<br>Tin<br>50       | 127<br>I<br>Iodine<br>53     | 131<br>Xe<br>Xenon<br>54     |
| 70<br>Ga<br>Gallium<br>31                                                               | 65<br>Zn<br>Zinc<br>30      | 59<br>Ni<br>Nickel<br>28     | 63.5<br>Cu<br>Copper<br>29  | 73<br>Ge<br>Germanium<br>32 | 75<br>As<br>Arsenic<br>33    | 79<br>Se<br>Selenium<br>34   | 84<br>Kr<br>Krypton<br>36    |
| 115<br>In<br>Indium<br>49                                                               | 112<br>Cd<br>Cadmium<br>48  | 106<br>Pd<br>Palladium<br>46 | 108<br>Ag<br>Silver<br>47   | 115<br>Ga<br>Gallium<br>31  | 119<br>Sn<br>Tin<br>50       | 127<br>I<br>Iodine<br>53     | 131<br>Xe<br>Xenon<br>54     |
| 204<br>Pb<br>Lead<br>82                                                                 | 201<br>Hg<br>Mercury<br>80  | 195<br>Pt<br>Platinum<br>78  | 197<br>Au<br>Gold<br>79     | 207<br>Bi<br>Bismuth<br>83  | 210<br>Po<br>Polonium<br>84  | 210<br>At<br>Astatine<br>85  | 222<br>Rn<br>Radon<br>86     |

Key

relative atomic mass

|                |        |      |   |
|----------------|--------|------|---|
| A <sub>r</sub> | Symbol | Name | Z |
|----------------|--------|------|---|

atomic number