Surname	Centre Number	Candidate Number
Other Names		0

wjec cbac

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

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**	
Total	**80**	

3410U101
01

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.

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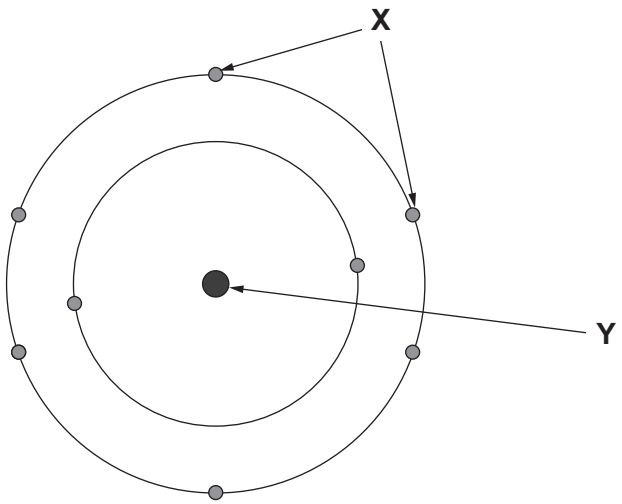
Answer **all** *questions*.

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**

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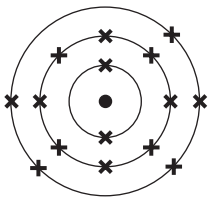
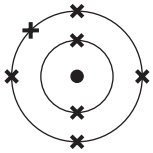
(c) The diagrams below show five different atoms labelled **A**-**E**.

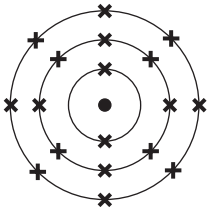
These letters are **not** the chemical symbols for the elements.



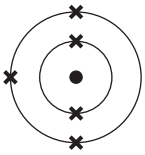
A



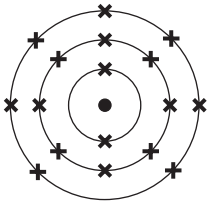
B



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]

9

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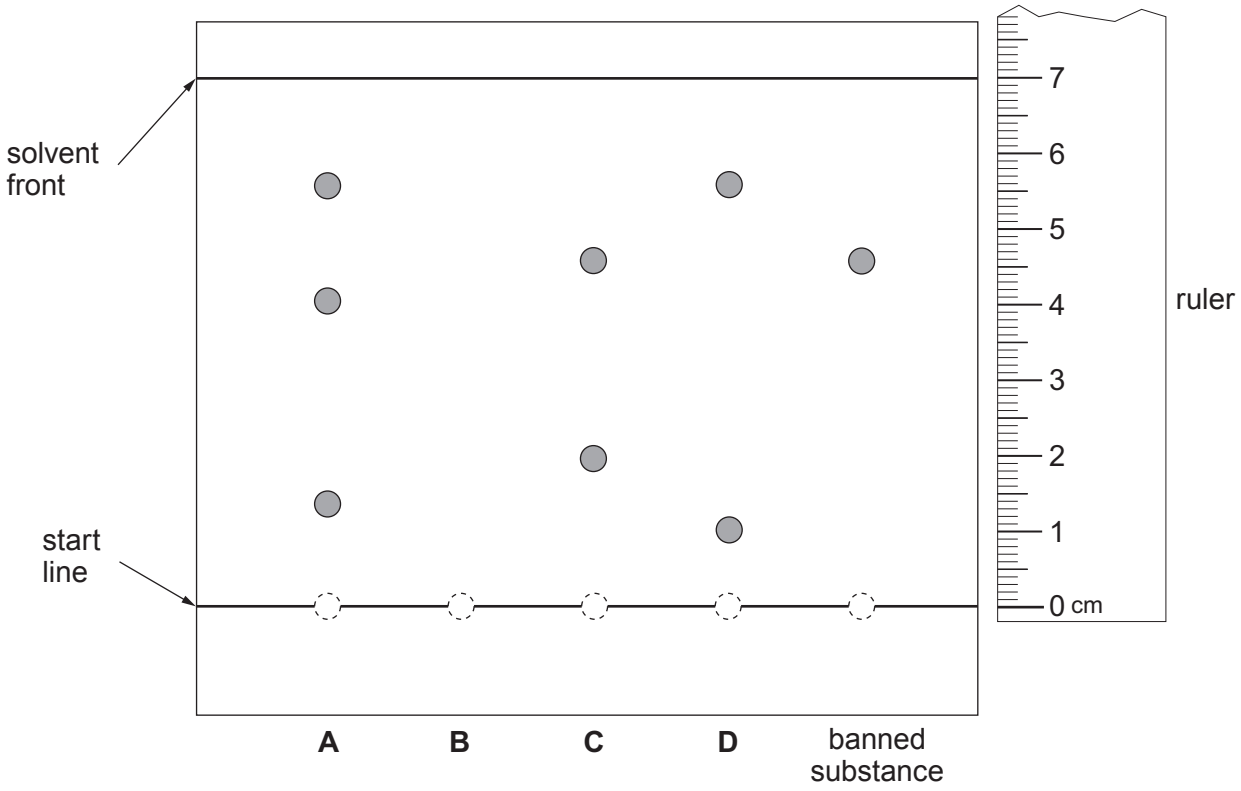
2. A food company was accused of using a banned substance in its sweets. Scientists tested four dyes, **A**-**D**, to find out if this was true or not. The results are shown below.



(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]

distance moved by dye **B** = R_f × distance moved by solvent front

Distance moved = ... cm

(ii) **Complete the diagram** above to show the position of dye **B**. [1]

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

Dye .....

Reason .....

.....

6

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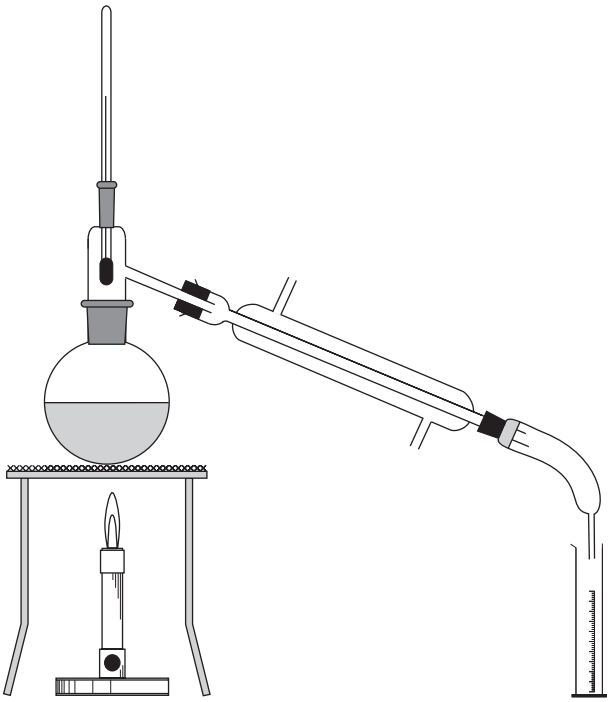
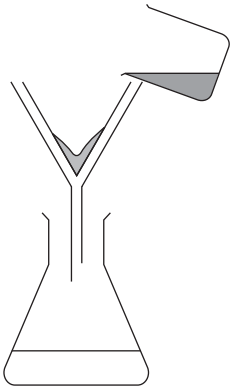
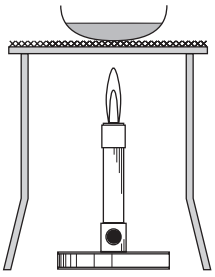
3. *(a)* The diagrams below show three methods of separating mixtures.

Method **A**





Method **B**



Method **C**

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(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) 500 g of solution was found to contain 43 g 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	.....

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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_2	0.0360
helium	He	0.0005
hydrogen	H_2	0.00005
methane	CH_4	0.00017
neon	Ne	0.0018
nitrogen	N_2	78.08
nitrous oxide	N_2O	0.00003
oxygen	O_2	20.95
ozone	O_3	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]

.....

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

.....

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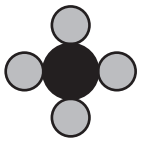
(b) (i) If ● represents a carbon atom, name the gases from the table that can be represented by the following diagrams. [2]



....

(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 CH_2ClF.

(i) State how many hydrogen atoms are present in CH_2ClF. [1]

.....

(ii) Give the **total** number of atoms shown in the formula, CH_2ClF. [1]

.....

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8

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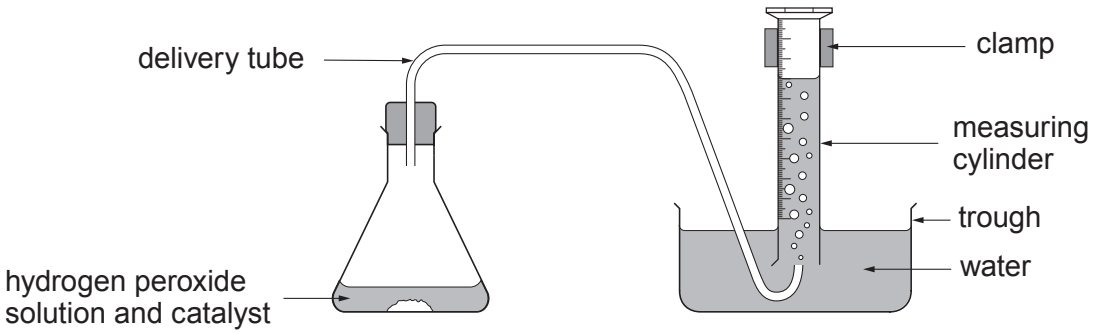
5. Hydrogen peroxide decomposes to give water and oxygen.

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

$$2H_2O_2 \longrightarrow \square\ H_2O + \ldots\ldots\ldots\ldots\ldots\ldots$$

(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^3)		
	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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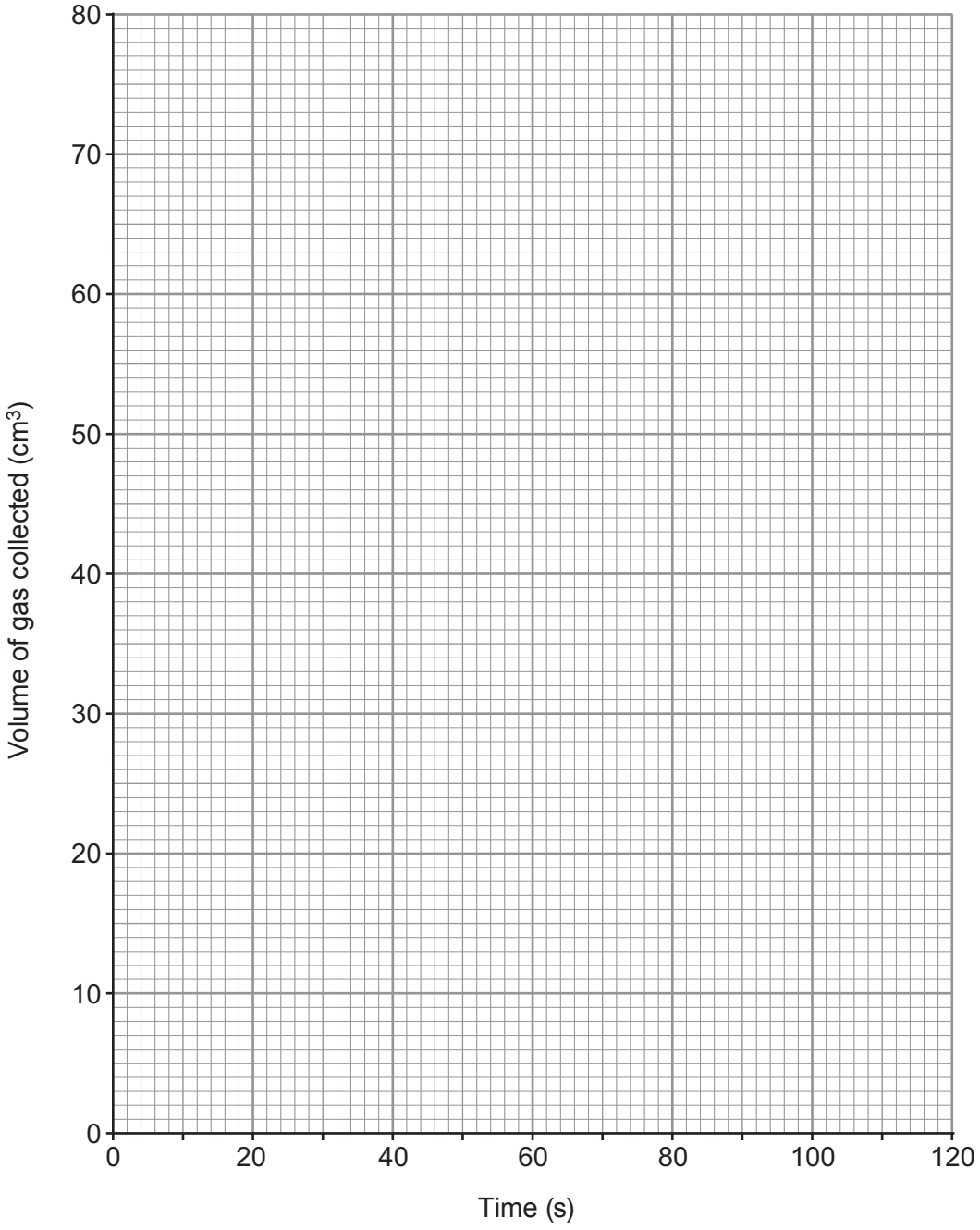
(ii) Plot a graph of the volume of gas collected using **catalyst 2**.
Draw a suitable line. [3]



(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]

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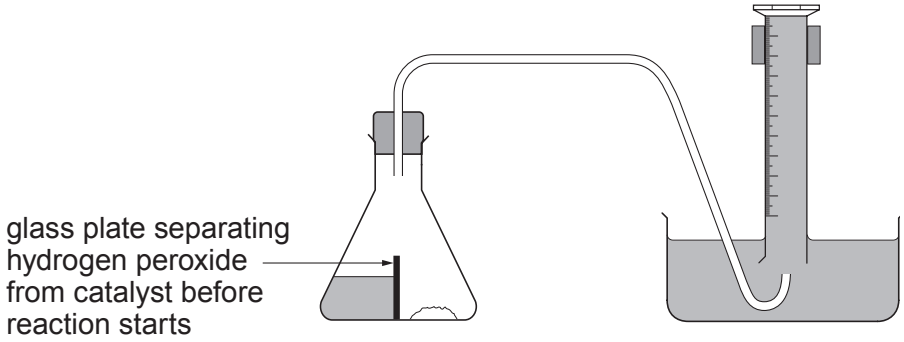
(iv) Another student claimed that he could collect more accurate results using the following apparatus.



Suggest how this apparatus could improve the accuracy of the results. [2]

.....

.....

.....

10

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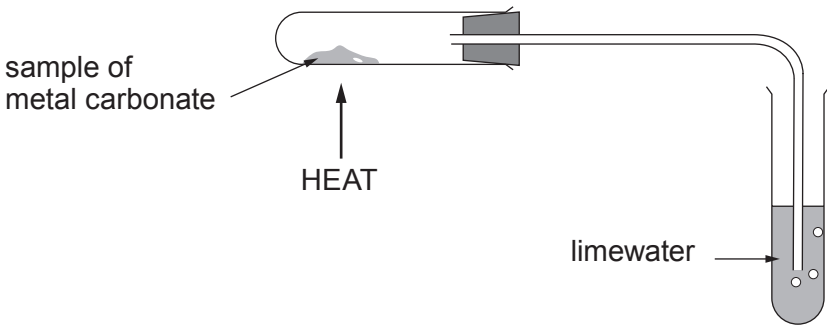
6. *(a)* A student investigated the decomposition of three different metal carbonates.

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

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

Most stable .....

.....

Least stable .....

Reason .....

.....

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

.....

.....

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

$CuCO_3 \longrightarrow$ ..... + ...

(b) Calculate the relative formula mass, M_r, of copper(II) carbonate, $CuCO_3$. [2]

$A_r(C) = 12$ $A_r(O) = 16$ $A_r(Cu) = 63.5$

M_r = ...

9

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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.

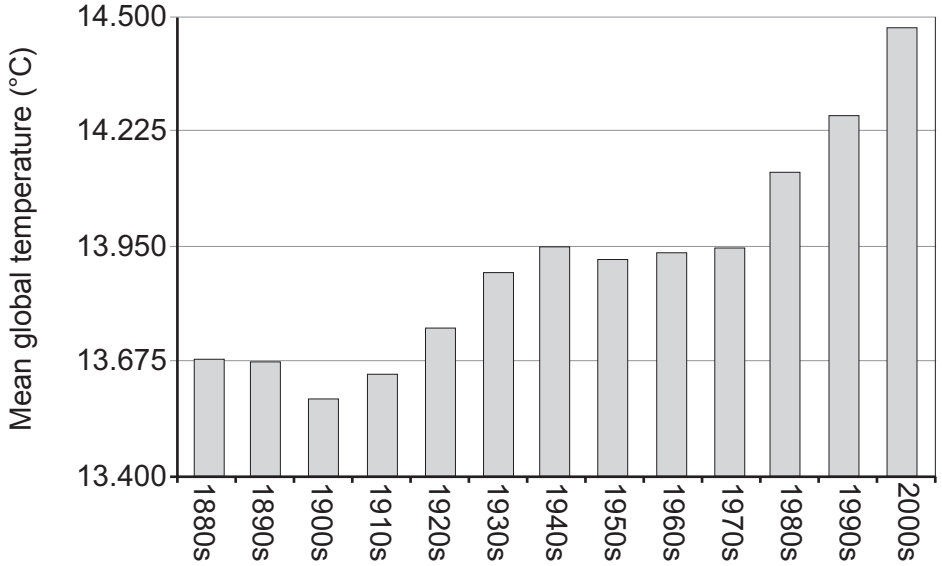

Figure 1

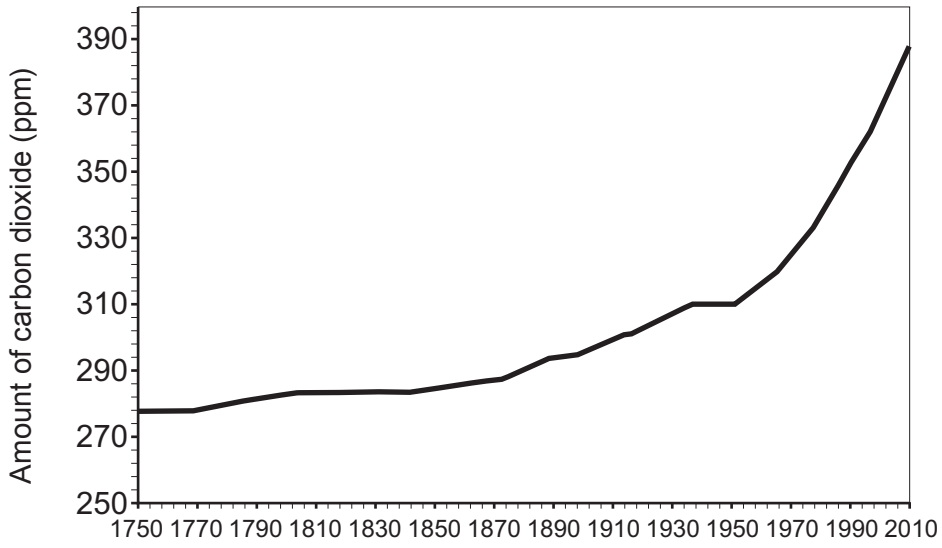

Figure 2

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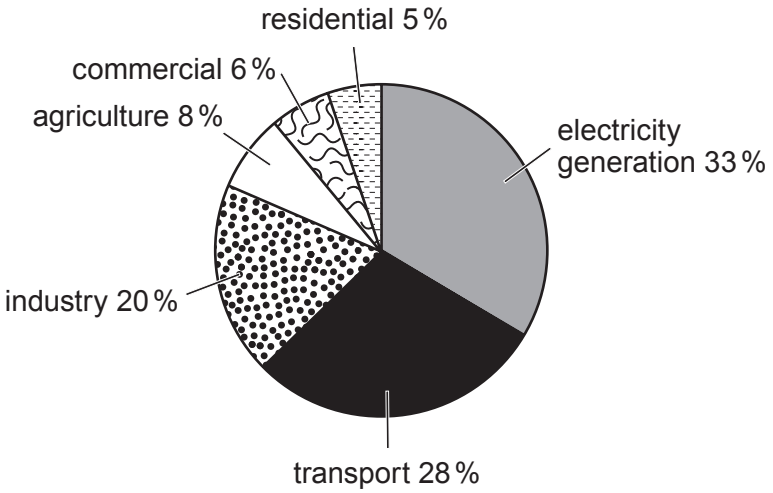

Figure 3

(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	☐

5

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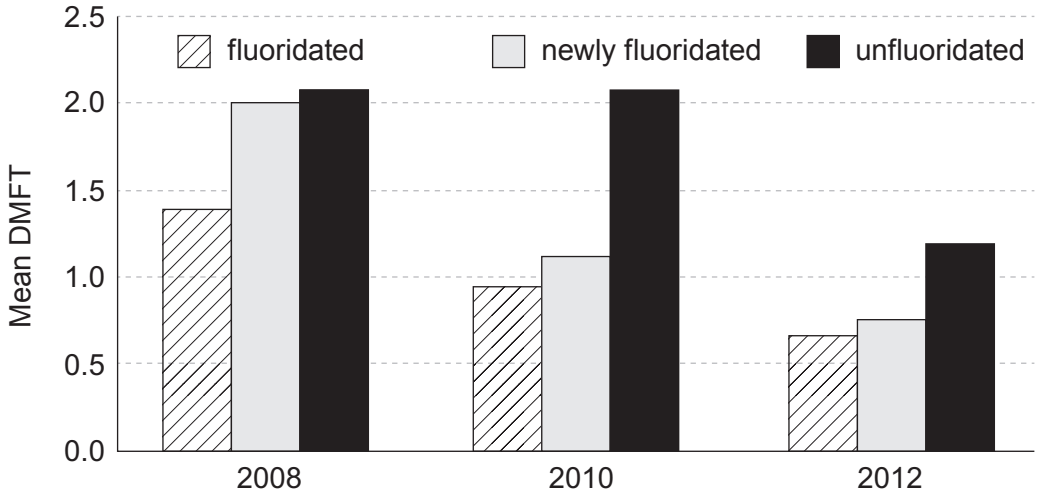
8. The following graph shows the mean numbers of decayed, missing and filled teeth (DMFT) in 12 year-olds in three areas of Australia in 2008, 2010 and 2012. One area has been fluoridated for 20 years, one is newly fluoridated and the other is unfluoridated.



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]

6

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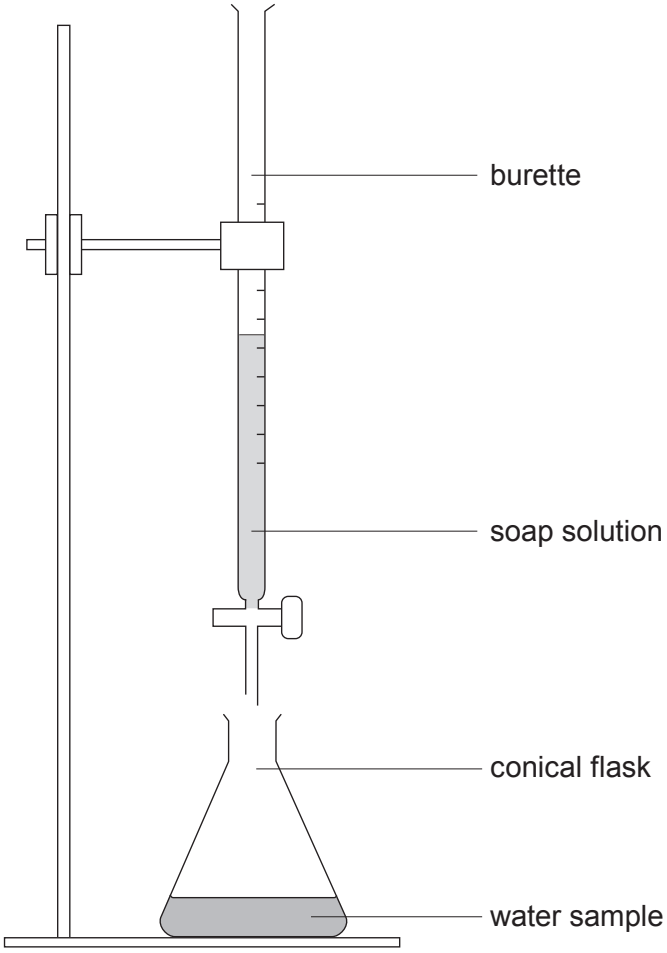
9. Water samples **A**, **B**, **C** and **D** were tested for hardness using the apparatus shown.



Soap solution was added 1 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 (cm^3)	
	Before boiling	After boiling
A	1	1
B	10	10
C	15	1
D	15	8

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(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]

.....

.....

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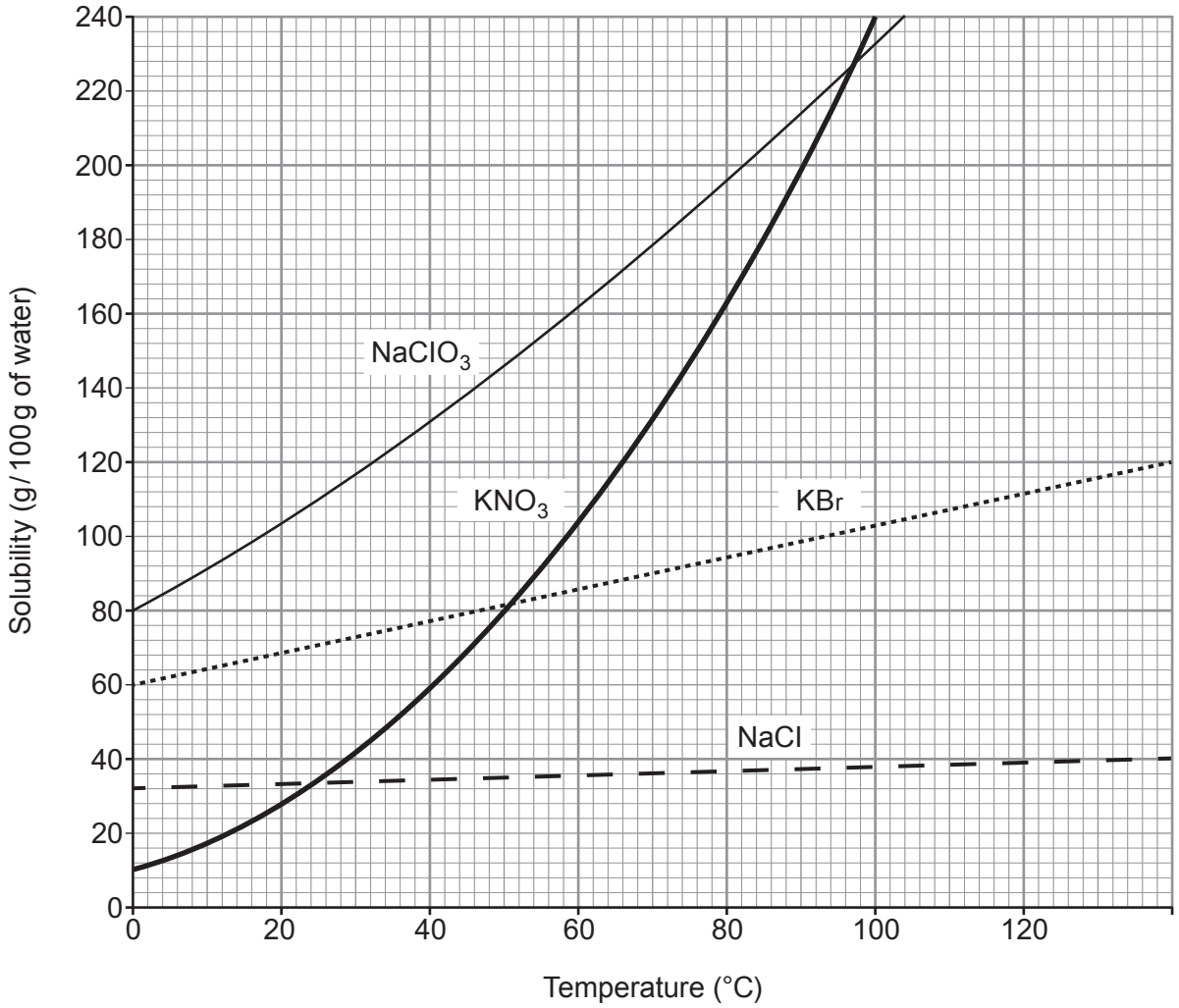
.....

6

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



$NaClO_3$	sodium chlorate
KNO_3	potassium nitrate
KBr	potassium bromide
NaCl	sodium chloride

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(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]

.....

.....

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

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

$\square\ KNO_3 + Al(OH)_3 \longrightarrow Al(NO_3)_3 + \square\ KOH$

9

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Question number	Additional page, if required. Write the question number(s) in the left-hand margin.

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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+}		

THE PERIODIC TABLE

1	2	Group										3	4	5	6	7	0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	63.5 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
86 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	179 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															

Key