Surname	Centre Number	Candidate Number
Other Names		0

wjec cbac

GCSE

3430UB0-1

S19-3430UB0-1

WEDNESDAY, 12 JUNE 2019 – MORNING

SCIENCE (Double Award)

Unit 2: CHEMISTRY 1
HIGHER TIER

1 hour 15 minutes

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

3430UB01
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. Do not use 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 **6** 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.

JUN193430UB0101

Examiner only

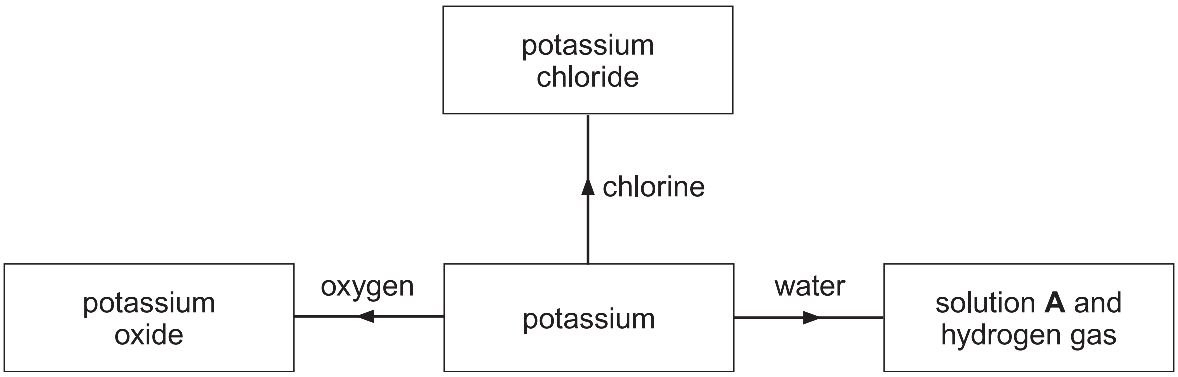
*Answer **all** questions.*

1. *(a)* The table gives information about some elements.

Element	Electronic structure	Group	Period
oxygen	2,6	6	2
chlorine	....	7	3
....	2,8,5	5	3
potassium	2,8,8,1	1	....

Complete the table. [3]

(b) The flow chart shows some of the reactions of potassium.



(i) State **one** observation you would make when potassium reacts with water. [1]

....

....

(ii) Apart from wearing gloves and safety goggles, give **one** safety precaution that should be taken when adding potassium to water. [1]

....

....

Examiner only

(iii) Give the formula of solution **A**. [1]

....

(iv) Suggest a value for the pH of solution **A**. [1]

....

(v) Name a Group 1 metal that is **more** reactive than potassium. [1]

....

8

3430UB01
03

Examiner only

2. *(a)* The Earth's early atmosphere around 4 000 million years ago contained mainly carbon dioxide and water vapour produced by volcanoes.

(i) Explain why the large percentage of water vapour in the Earth's atmosphere decreased over geological time. [2]

....

....

....

(ii) Give **two** reasons why the percentage of carbon dioxide in the Earth's atmosphere has decreased over geological time. [2]

....

....

....

(b) During the last 250 years the percentage of carbon dioxide in the Earth's atmosphere has increased from 0.03 % to 0.04 %. This has led to increased global warming. Give **one** reason for this increase and explain why global warming is a cause for concern. [2]

....

....

....

....

....

....

(c) Ammonia present in the Earth's early atmosphere reacted with oxygen to produce nitrogen and water vapour. Complete the balancing of the symbol equation for this reaction. [1]

$$\square\ NH_3 + 3O_2 \longrightarrow \square\ N_2 + 6H_2O$$

7

Examiner only

3. Some Year 10 students were given three unknown white solids – **A**, **B** and **C**.

They carried out a series of flame tests and silver nitrate tests to identify the solids.

Their results are shown in the table.

	Observations	
Solid	Flame test	Silver nitrate test
A	apple-green flame	cream precipitate
B	red flame	white precipitate
C	yellow flame	yellow precipitate

(a) Name solids **A**, **B** and **C**. [3]

A ....

B ....

C ....

3430UB01 05

(b) Complete and balance the symbol equation for the reaction between magnesium chloride and silver nitrate. [2]

$MgCl_2$ + ☐ $AgNO_3$ ⟶ ....

(c) 0.103 g of silver nitrate, $AgNO_3$, was used to make up a solution.

Calculate the number of moles of silver nitrate in this mass. Give your answer in **standard form**. [3]

A_r(Ag) = 108 A_r(N) = 14 A_r(O) = 16

Number of moles = ... mol

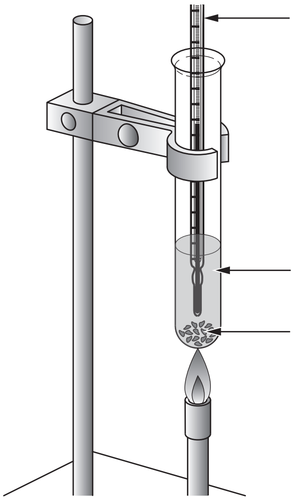
8

 (3430UB0-1) **Turn over.**

Examiner only

4. A student investigates the solubility of ammonium chloride by adding different masses to 10 g of water.

He uses the apparatus shown.



10 g of water is placed in a boiling tube and 3.0 g of ammonium chloride is added.

The tube is heated until all the solid dissolves.

The tube is allowed to cool.

The temperature at which solid ammonium chloride first appears is recorded.

The experiment is repeated using different masses of ammonium chloride.

The results are shown in the table.

Mass of ammonium chloride in 10 g of water (g)	3.0	3.3	4.1	5.2	5.9	6.6
Temperature at which solid ammonium chloride first appears (°C)	4	10	30	52	68	80

(a) What practical problem is the student likely to come across in finding the first two results? Suggest how this problem might be overcome. [2]

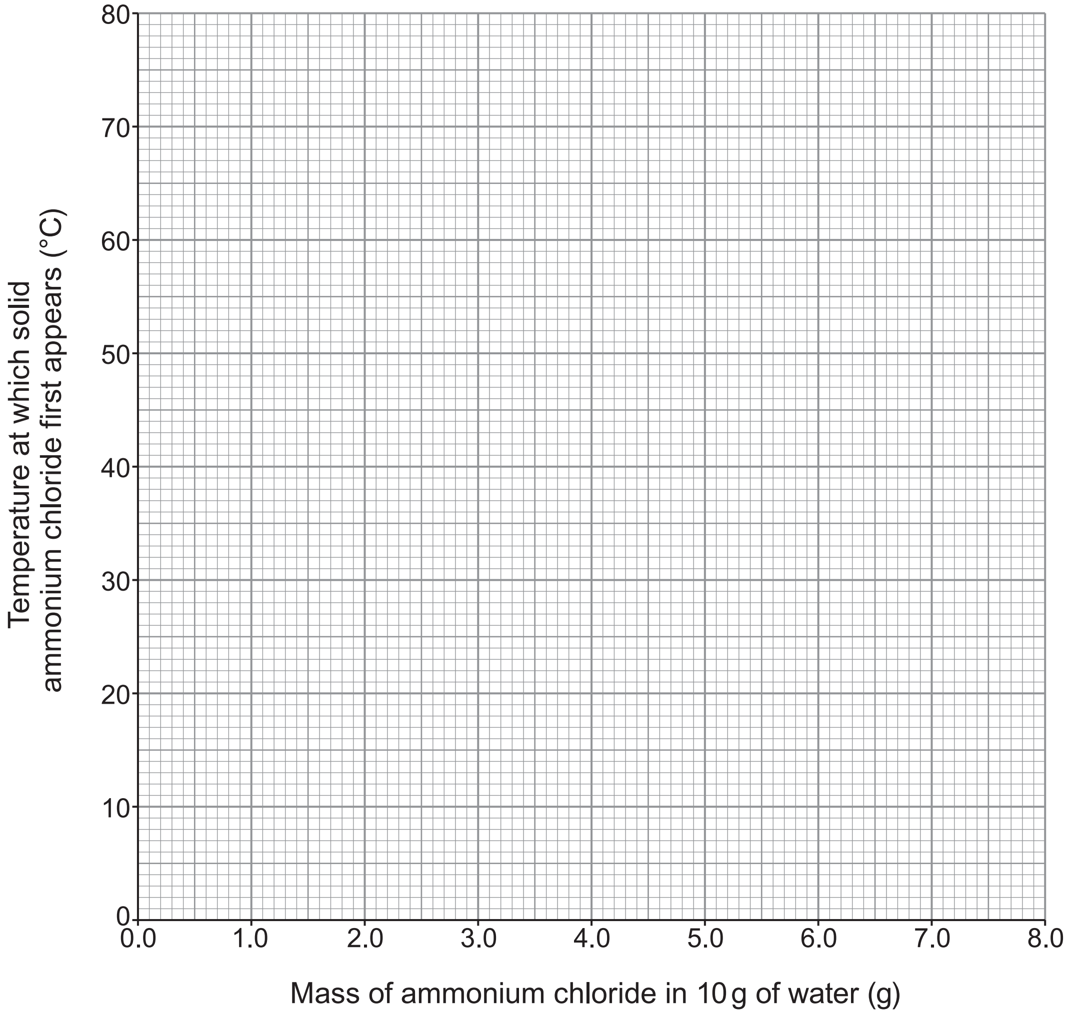
....

....

....

Examiner only

(b) (i) On the grid below, plot the temperature at which solid ammonium chloride first appears against the mass of ammonium chloride in 10 g of water. Draw a suitable line. [3]



(ii) The student is given a boiling tube containing 5.0 g of ammonium chloride in 10 g of water. He stirs the ammonium chloride in the water and heats it to a temperature of 45 °C.

State whether all the ammonium chloride dissolves. Give a reason for your answer. [1]

....

....

Examiner only

(c) The student is asked to use a **different** method to find the exact solubility of another compound in water at room temperature. He knows that it has a value of approximately 7 g per 100 g of water at this temperature.

He is given a 5.0 g sample of the compound and common laboratory equipment but **no heating apparatus**.

Describe how he would carry out his method and how he would find the solubility. [3]

....

....

....

....

....

....

....

....

9

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

Examiner only

5. *(a)* A bottle contains a mixture of liquids **E** and **F**. Liquid **E** has a boiling point of 57 °C and liquid **F** has a boiling point of 95 °C.

Describe the process of distillation and explain why it can be used to separate these liquids. [3]

....

....

....

....

....

....

(b) One molecule of liquid **E** contains **two** oxygen atoms. The percentage by mass of oxygen in liquid **E** is 43.2 %.

Use the following equation to calculate the relative molecular mass (M_r) of liquid **E**. [2]

$$\frac{\text{mass of oxygen}}{M_r} \times 100 = 43.2$$

$A_r(\text{O}) = 16$

M_r = ...

5

Examiner only

6. Explain how the processes of boiling and adding washing soda remove hardness from water. Include equations in your answer. [6 QER]

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

6

Examiner only

7. *(a)* (i) Chlorine is a non-metal found in Group 7 of the Periodic Table. When it is bubbled into a solution of potassium iodide there is a colour change from pale green to brown. Explain why this reaction occurs. [2]

....

....

....

....

(ii) Write the balanced symbol equation for the reaction between chlorine and potassium iodide. [2]

....

(b) The symbol equation for the reaction between iron and chlorine is as follows.

$$2Fe \quad + \quad 3Cl_2 \longrightarrow 2FeCl_3$$

Calculate the mass of chlorine needed to react with 1.32 g of iron. [3]

$A_r(Fe) = 56$ $\qquad$ $A_r(Cl) = 35.5$

Mass of chlorine = ... g

Examiner only

(c) (i) Under certain conditions, Group 7 elements will react with each other to produce new compounds.

When chlorine is reacted with bromine, chlorine tribromide is made.

Balance the symbol equation for this reaction. [1]

$$Cl_2 \; + \; \square \, Br_2 \longrightarrow \square \, ClBr_3$$

(ii) A chemist calculated that if she reacted 7.00 g of chlorine with an excess of bromine, the theoretical mass of chlorine tribromide produced is 27.55 g.

However, when she carried out the experiment using 7.00 g of chlorine the mass of chlorine tribromide obtained was 21.34 g.

Calculate the percentage yield of chlorine tribromide. [1]

Percentage yield = ... %

9

Examiner only

8. Hydrogen peroxide solution, H_2O_2, is used in commercial stain removers.

A GCSE class investigated how effective four stain removers are at removing stains. Stain removers **A**, **B**, **C** and **D** contain different concentrations of hydrogen peroxide.

The students tested how effective each one is at removing an identical oil stain from four towels.

Their findings are outlined below.

Stain remover **A**	
Working temperature	= 50 °C
Cost per 100 cm^3	= 99p
Time to remove stain	= 40 min
Volume needed	= 20 cm^3

Stain remover **B**	
Working temperature	= 30 °C
Cost per 100 cm^3	= £1.99
Time to remove stain	= 40 min
Volume needed	= 10 cm^3

Stain remover **C**	
Working temperature	= 20 °C
Cost per 100 cm^3	= £2.49
Time to remove stain	= 20 min
Volume needed	= 5 cm^3

Stain remover **D**	
Working temperature	= 30 °C
Cost per 100 cm^3	= £1.49
Time to remove stain	= 30 min
Volume needed	= 10 cm^3

(a) In carrying out this investigation, which variables were kept the same in order to get valid results? Tick (✓) the correct answer. [1]

type of oil used, towel material and volume of hydrogen peroxide ☐

type of oil used, towel material and temperature of stain remover ☐

type of oil used and towel material ☐

type of oil used, towel material and cost of stain remover ☐

Examiner only

(b) Tick (✓) **all** of the statements which **could** explain why stain remover **A** has to be heated to 50 °C before it removes the stain. [1]

it is the cheapest stain remover ☐

it is heat resistant ☐

it has a low concentration of hydrogen peroxide ☐

it takes a long time to work ☐

(c) The students found that stain removers **B** and **D** used the same volume and worked best at the same temperature.

Assuming that they have the same hydrogen peroxide concentration, suggest a possible reason why **D** removes the stain more quickly than **B**. [1]

....

....

(d) One student went on to investigate the decomposition of hydrogen peroxide.

The equation for the reaction is as follows.

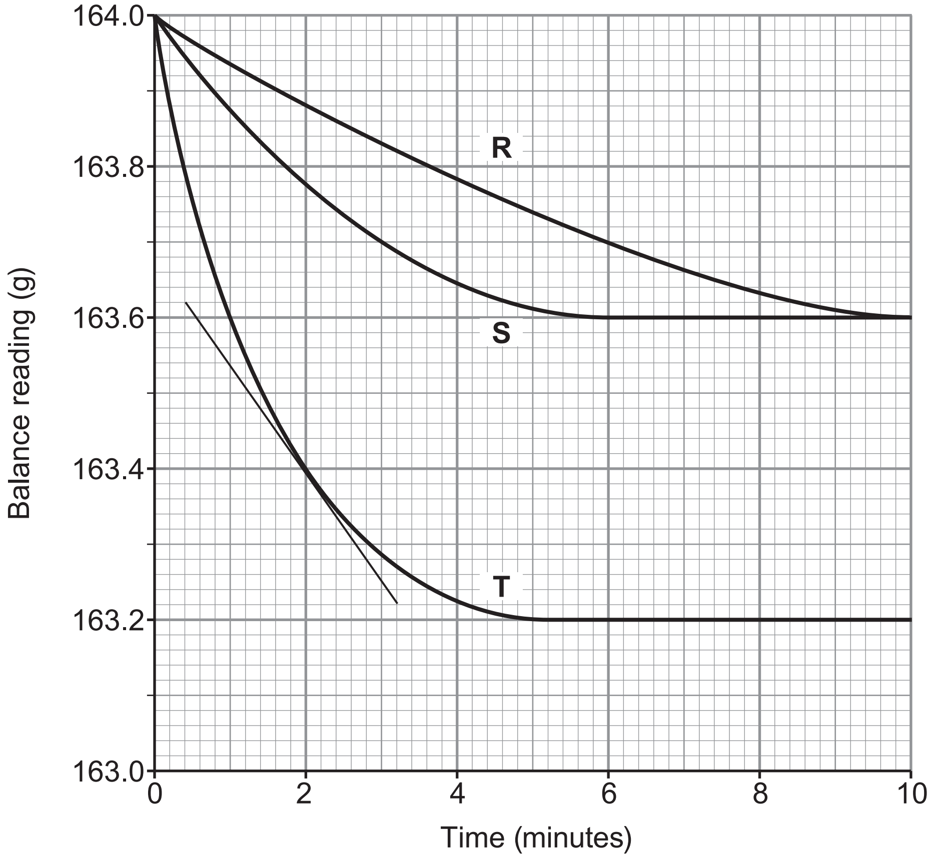
$$2H_2O_2 \longrightarrow 2H_2O + O_2$$

The student investigated the effect of changing the concentration of the hydrogen peroxide solution on the rate of the reaction. She used manganese dioxide as a catalyst in each experiment.

This is the method she used.

- Pour 50 cm^3 of hydrogen peroxide solution of concentration **R** into a conical flask on a digital balance.
- Add 1 g of catalyst and place some cotton wool loosely in the neck of the flask. Record the balance reading and immediately start a stopwatch.
- Record the balance reading every minute until the mass no longer changes.
- Carry out the experiment twice more using hydrogen peroxide of different concentrations, **S** and **T**.

Her results are plotted on the grid below.



Examiner only

(i) Using the tangent shown on the graph, calculate the rate of reaction for concentration **T** at 2 minutes. Show your working. [2]

Rate at 2 minutes = ... g/minute

(ii) The initial rate for concentration **S** is half the initial rate for concentration **T**. Explain this difference in rate in terms of the particle theory. [3]

....

....

....

....

....

8

END OF PAPER

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

Examiner only

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

Group

1	2											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

A_r — relative atomic mass
Symbol
Name
Z — atomic number