Surname	Centre Number	Candidate Number
Other Names		0

GCSE – NEW

C410U20-1

S18-C410U20-1

CHEMISTRY – Component 2
Applications in Chemistry

FOUNDATION TIER

WEDNESDAY, 13 JUNE 2018 – MORNING

1 hour 15 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**6**	
3.	**10**	
4.	**7**	
5.	**11**	
6.	**6**	
7.	**15**	
Total	**60**	

C410U201
01

ADDITIONAL MATERIALS

In addition to this examination paper you will need a:
- calculator and ruler;
- **Resource Booklet.**

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. If you run out of space, use the additional page(s) 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.

Examiner only

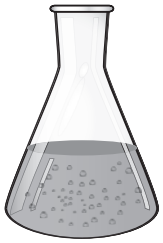
SECTION A

Answer **all** *questions.*

1. *(a)* Some common pieces of laboratory apparatus are shown below.

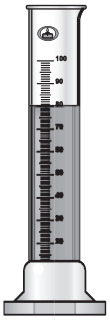
A

B



C

D



E

F

Give the letter, **A-F**, of the piece of apparatus that would be used to measure

reaction time .....

pH value .....

an exact volume of liquid ..... [2]

Examiner only

(b) The names of some separation methods used in chemistry are given in the box.

evaporation	**filtration**	**chromatography**
	distillation	**crystallisation**

A sample of sea water contains sand and salt solution.

Choose from the box the **most suitable** method to collect

sand from salt solution .....

water from salt solution .....

salt from salt solution .....

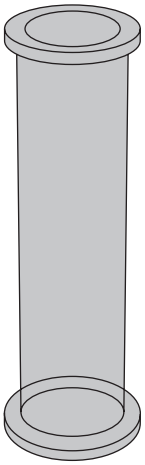
[3]

5

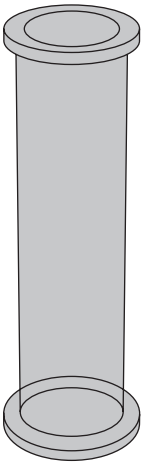
C410U201
03

Examiner only

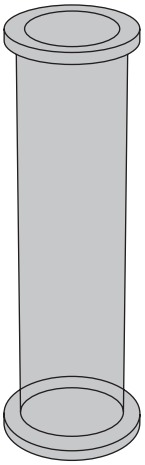
2. Kelsey and Eve were given three identical gas jars each containing a different gas. They carried out simple chemical tests to identify these gases. The results of these tests are given below.



gas **X**



gas **Y**



gas **Z**

Test	Observation		
	Gas **X**	Gas **Y**	Gas **Z**
put a glowing splint into the gas	relights	glowing stops	glowing stops
put a lit splint into the gas	burns more brightly	makes a squeaky pop	flame goes out

(a) Give the name of gas **X** and gas **Y**. [2]

Gas **X** .....

Gas **Y** .....

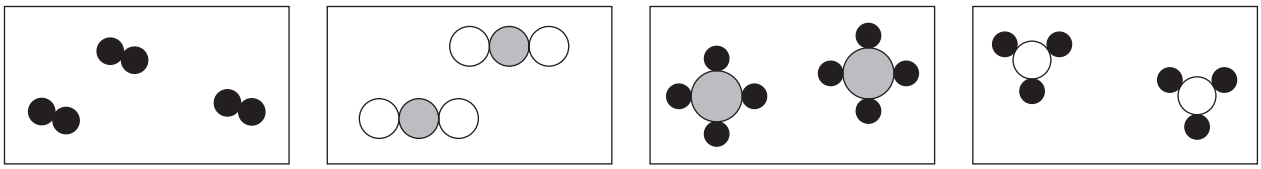
Examiner only

(b) They predict that gas **Z** is either carbon dioxide or ammonia.

(i) Complete the table to describe the additional tests they would need to carry out to identify each of these gases. [2]

Gas	Test they would carry out	Expected observation
carbon dioxide	.....	goes milky
ammonia	add damp red litmus paper	.....

(ii) The following diagrams show the arrangement of atoms in different gases.



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

Give the **letter** of the diagram that represents

carbon dioxide .....

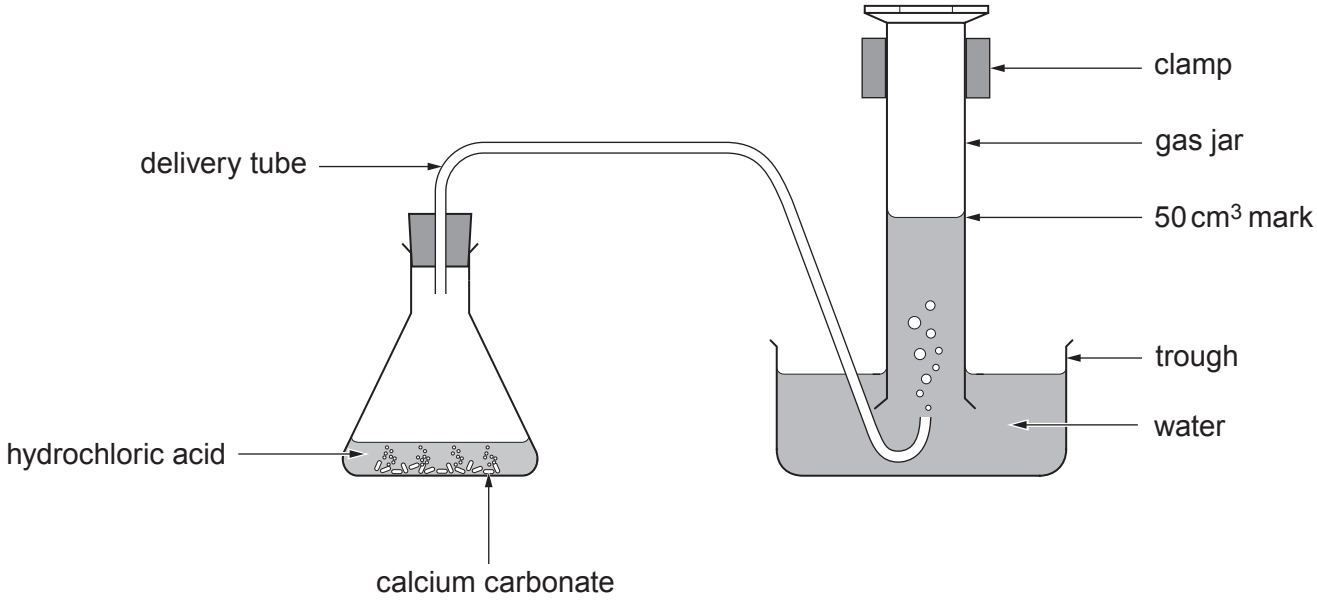
ammonia ..... [2]

6

C410U201
05

Examiner only

3. *(a)* A series of experiments was carried out to investigate the effect of different factors on the reaction between calcium carbonate and hydrochloric acid. The diagram shows the apparatus used to collect results.



The time taken to collect 50 cm^3 of carbon dioxide gas in each experiment is shown in the table.

Experiment	Temperature of hydrochloric acid (°C)	Concentration of hydrochloric acid (mol / dm^3)	Time taken to collect 50 cm^3 of gas (s)
1	40	1	92
2	40	0.5	185
3	60	1	38

(i) Give the numbers of the **two** experiments that should be compared to show the effect of changing concentration on the time taken. Describe what these results show. [2]

Experiments ..... and .....

.....

.....

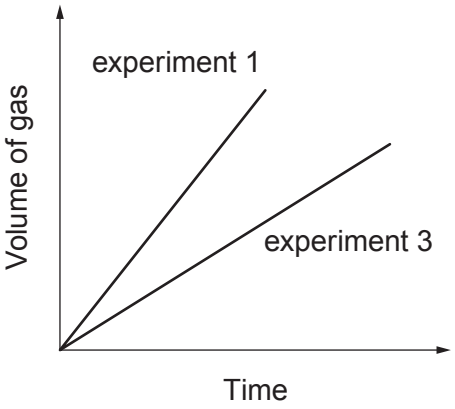
Examiner only

(ii) Give **two** factors relating to the calcium carbonate that should be kept the same to ensure a fair test. [2]

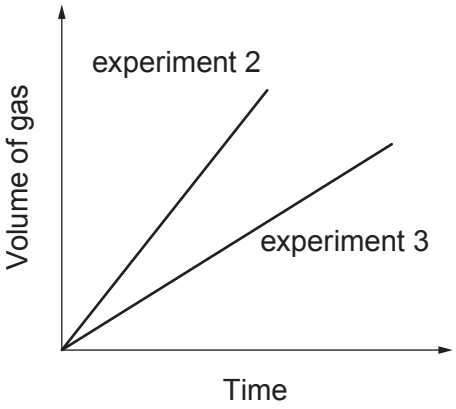
Factor 1 .....

Factor 2 .....

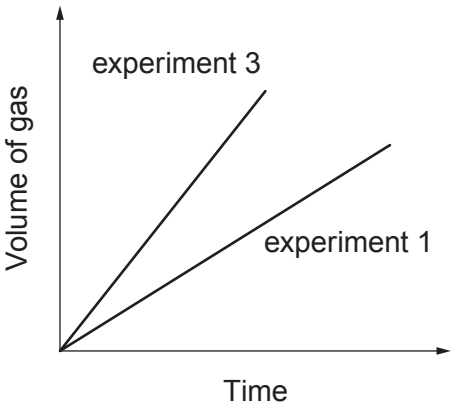
(iii) Assuming that a fair test was carried out, place a tick (✓) in the box of the graph that shows how temperature affects the volume of gas collected over time for this reaction. [1]



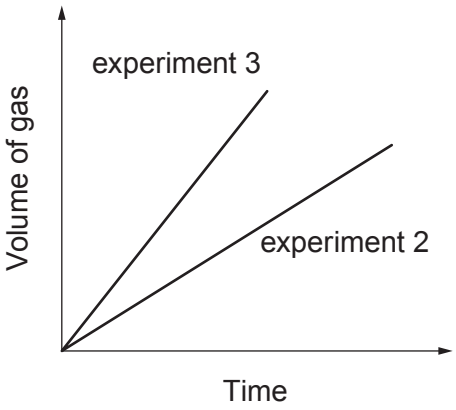
☐



☐



☐

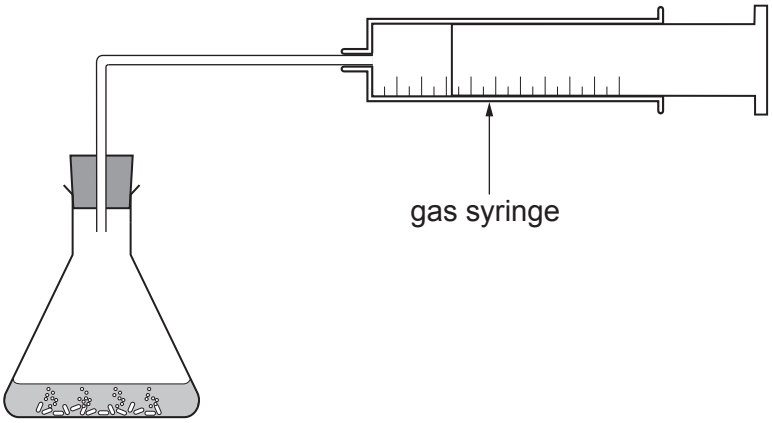


☐

C410U201
07

Examiner only

(b) An alternative method for collecting the gas is shown below.



Give **two** reasons why this method could improve the accuracy of the results. [2]

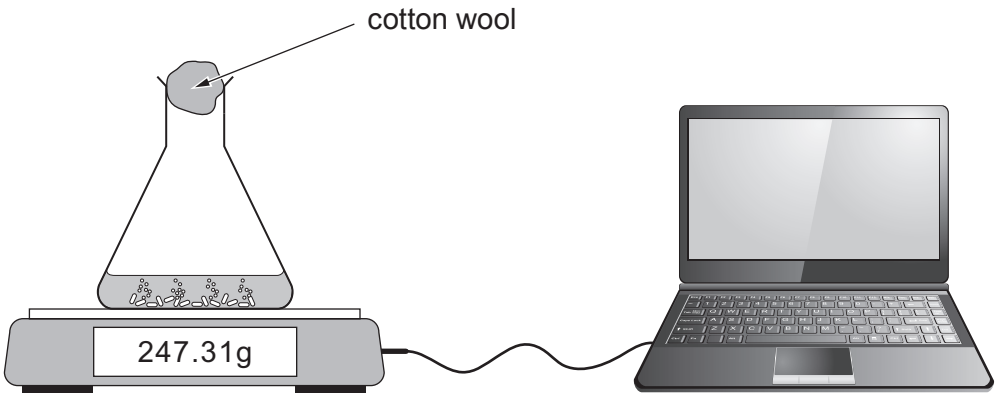
.....

.....

.....

Examiner only

(c) The reaction can also be investigated by recording the change in mass over time.



(i) State how the mass would change over time. Give a reason for your answer. [2]

.....

.....

.....

(ii) Give **one** benefit of connecting the balance to a laptop computer. [1]

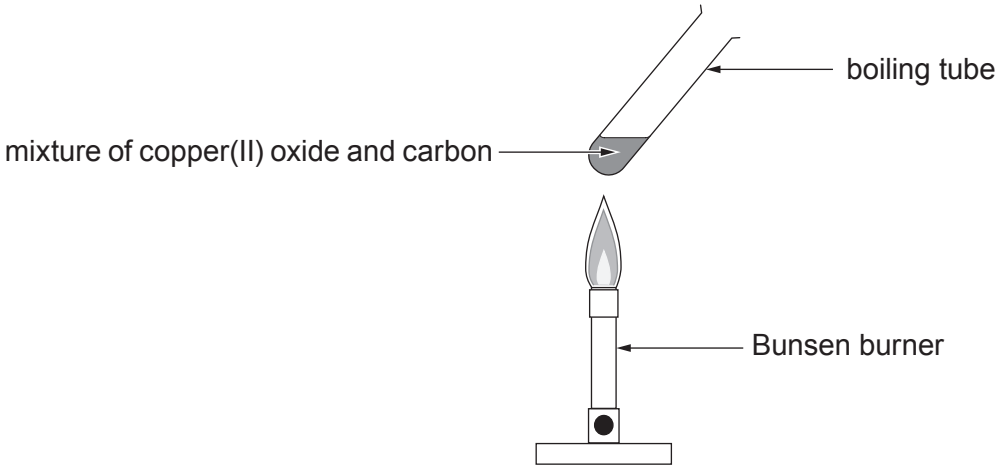
.....

.....

10

Examiner only

4. *(a)* In a class practical, Isobel demonstrated how copper can be extracted from copper(II) oxide using carbon. The apparatus used and equation for the reaction are shown below.



copper(II) oxide + carbon ⟶ carbon dioxide + copper

$2CuO(s) + C(s) \longrightarrow CO_2(g) + 2Cu(s)$

(i) State which substance is being reduced during Isobel's experiment. How does the equation show this? [2]

.....

.....

.....

(ii) Isobel was able to predict correctly which pairs of powders would react when heated strongly. Tick (✓) the box next to **each** pair that would react. [2]

copper and magnesium oxide	
carbon and aluminium oxide	
carbon and iron oxide	
gold and copper oxide	
magnesium and copper oxide	

Examiner only

(b) Metals are extracted from compounds found in their ores. These compounds are often oxides or sulfides of the metals. The percentage by mass of different metals in their compounds is given in the following table.

Name of ore	Formula of metal compound	Relative formula mass of compound	Percentage by mass of metal in compound (%)
haematite	Fe_2O_3	160	70.0
galena	PbS	239	86.6
sphalerite	ZnS	97	67.0
chalcocite	Cu_2S	?	?

Calculate the percentage by mass of copper in Cu_2S and compare this value to the percentage by mass of the other metals in their compounds. [3]

A_r(Cu) = 63.5 A_r(S) = 32

Percentage by mass = ... %

.....

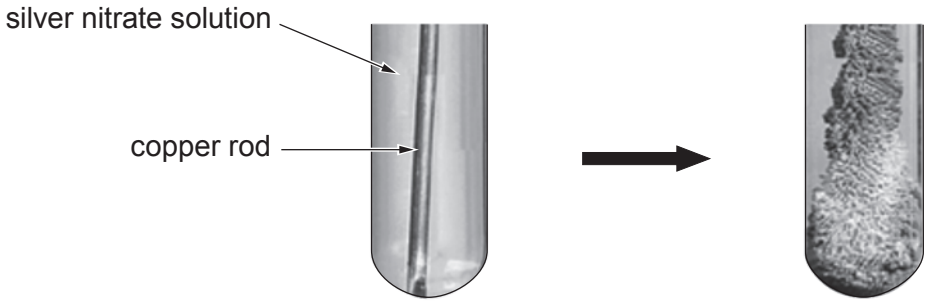
.....

.....

7

Examiner only

5. A student investigated the reaction between copper and silver nitrate solution.



(a) The student wanted to test the following hypothesis:

"the mass of silver that forms will increase as time increases"

The results below show the mass of silver formed when a 10 cm copper rod was placed in 25 cm^3 of silver nitrate solution for different amounts of time.

Time (minutes)	Mass of silver formed (g)			
	Result 1	Result 2	Result 3	Mean
1	0.08	0.10	0.06	0.08
2	0.14	0.15	0.16	0.15
3	0.25	0.23	0.27	0.25
4	0.39	0.31	0.33	0.32
5	0.40	0.38	0.33	0.39

(i) Circle the **two** results that were not used in calculating mean values. [1]

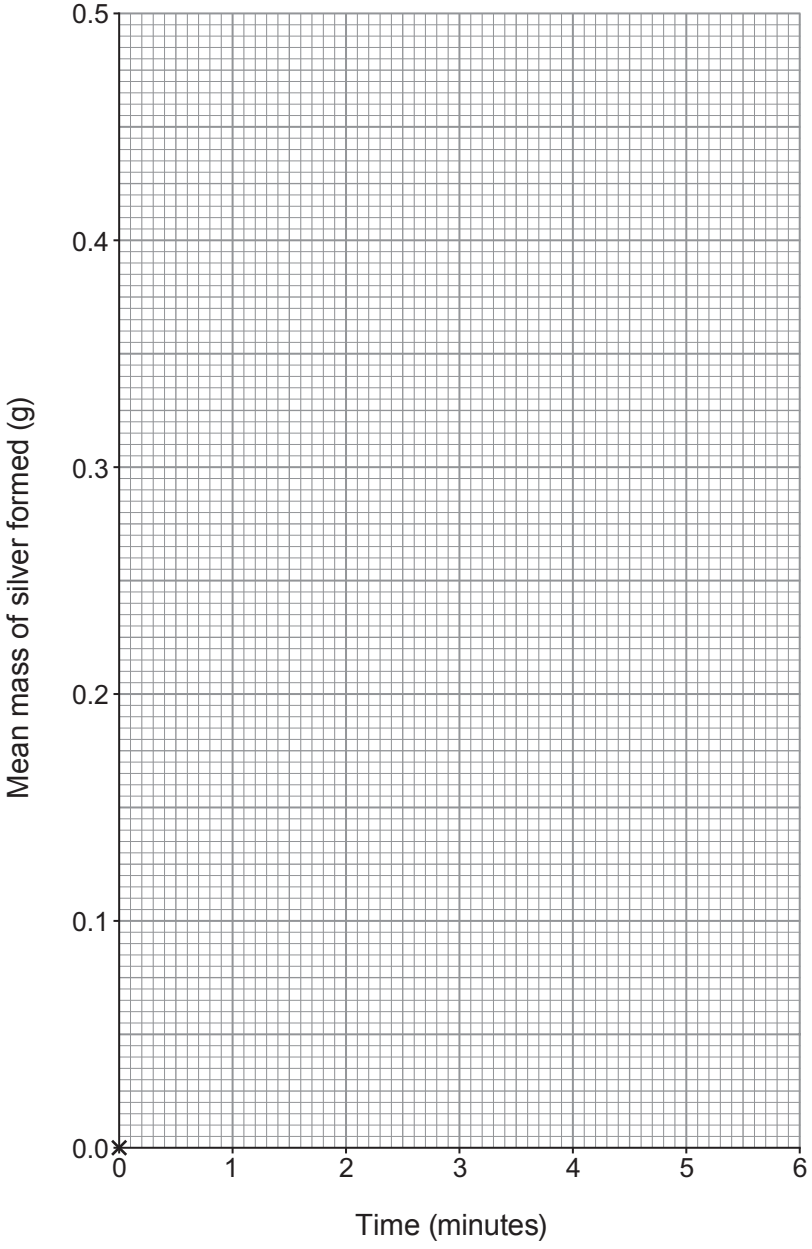
(ii) State how the results for 2 minutes show the best repeatability. [1]

.....

.....

Examiner only

(iii) Plot the mean results from the table on the grid below and draw a suitable line. [3]



(iv) Use the graph to:

I. Give the mass of silver that would form in 2.5 minutes. [1]

..... g

II. Predict the mass of silver that would form in 6 minutes. [1]

..... g

Examiner only

(b) The silver can be collected from the reaction mixture by carefully washing it from the copper rod. The mixture can then be filtered, washed and dried.

(i) Give **one** reason why this method could lead to the recorded mass being lower than the expected value. [1]

.....

.....

(ii) Give **one** reason why this method could lead to the recorded mass being higher than the expected value. [1]

.....

.....

(c) To extend the investigation, the student decided to test another hypothesis:

"as the length of the copper rod increases, the mass of silver deposited also increases"

(i) Complete the table to identify the independent and dependent variable to test this hypothesis. [1]

Variable	Description
independent variable	
dependent variable	

(ii) Give **one** control variable that would enable the students to collect valid data. [1]

.....

.....

11

Examiner only

6. Solutions of sodium sulfate, sodium bromide and sodium carbonate are all colourless.

How effective are the following tests in distinguishing between these compounds?

- flame test
- add hydrochloric acid
- add silver nitrate solution
- add sodium hydroxide solution

Include expected observations throughout your answer. [6 QER]

6

Examiner only

SECTION B

Read the article in the **Resource Booklet** *and answer* **all** *the questions that follow.*

7. *(a)* Refer to **Figure 1**. Identify the functional group common to all alcohols. [1]

.....

(b) Propanol is another alcohol. Draw its displayed formula and give its molecular formula. [2]

Displayed formula

Molecular formula .....

(c) Use the information to calculate how many million barrels of ethanol were produced in Brazil in 2010. [3]

..... million barrels

(d) Give the reason why the data collected using the equipment in **Figure 4** gives a smaller energy content value for ethanol than that shown in **Figure 5**. State how the experiment could be improved to give a value closer to the actual value. [2]

.....

.....

.....

.....

Examiner only

(e) Use **Figure 5** to describe the relationship between the carbon : hydrogen ratio and energy content for the fuels. [3]

(f) A student looked at **Figure 5** and concluded that "hydrogen is a better fuel than ethanol".

Discuss this statement using information from the table and your knowledge of fuels. Give advantages and disadvantages of both fuels. [4]

15

END OF PAPER

Examiner only

For continuation 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