Surname	Centre Number	Candidate Number
Other Names		0

GCSE – NEW

C410UB0-1

S18-C410UB0-1

CHEMISTRY – Component 2
Applications in Chemistry

HIGHER TIER

WEDNESDAY, 13 JUNE 2018 – MORNING

1 hour 15 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**15**	
2.	**7**	
3.	**6**	
4.	**6**	
5.	**7**	
6.	**7**	
7.	**12**	
Total	**60**	

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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 **7**(*a*) 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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SECTION A

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

1. *(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]

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(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]

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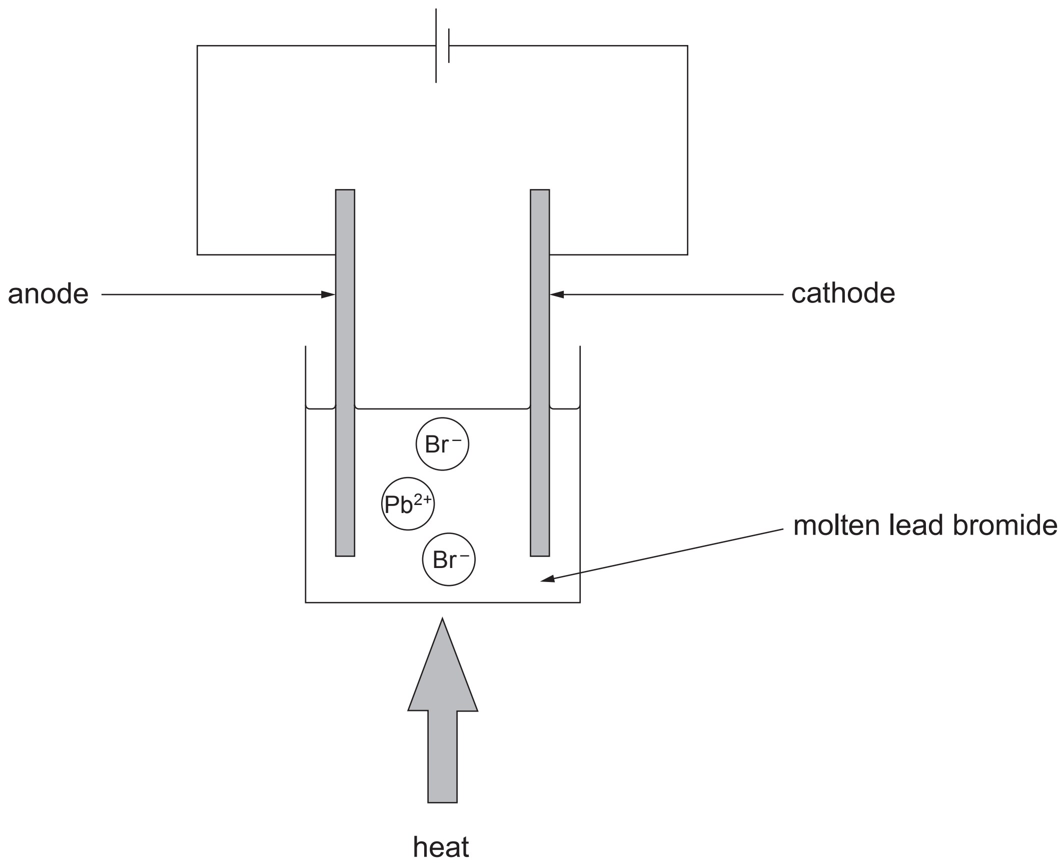
SECTION B

Answer **all** *questions.*

2. *(a)* The diagram shows how the electrolysis of lead bromide can be carried out in the laboratory.



(i) Give the reason why the lead bromide must be molten for electrolysis to take place. [1]

....

(ii) **Draw arrows on the diagram** to show the movement of the lead and bromide ions during electrolysis. [1]

(iii) Balance the following electrode equation to show what happens to the bromide ions during the process. [1]

$$\square \, Br^- \; - \; \square \, e^- \longrightarrow Br_2$$

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(b) Taylor wanted to find out how the amount of lead produced during the process varied with time. He recorded the mass of lead formed after six different times. His results are shown in the table.

Time (s)	Mass of lead formed (g)
30	0.14
60	0.29
90	0.45
120	0.59
150	0.76
180	0.90

(i) Describe the trend in the results. [2]

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(ii) Assuming that **all** of the lead was deposited on the electrode, suggest how Taylor was able to determine the mass of lead formed after a given time. [2]

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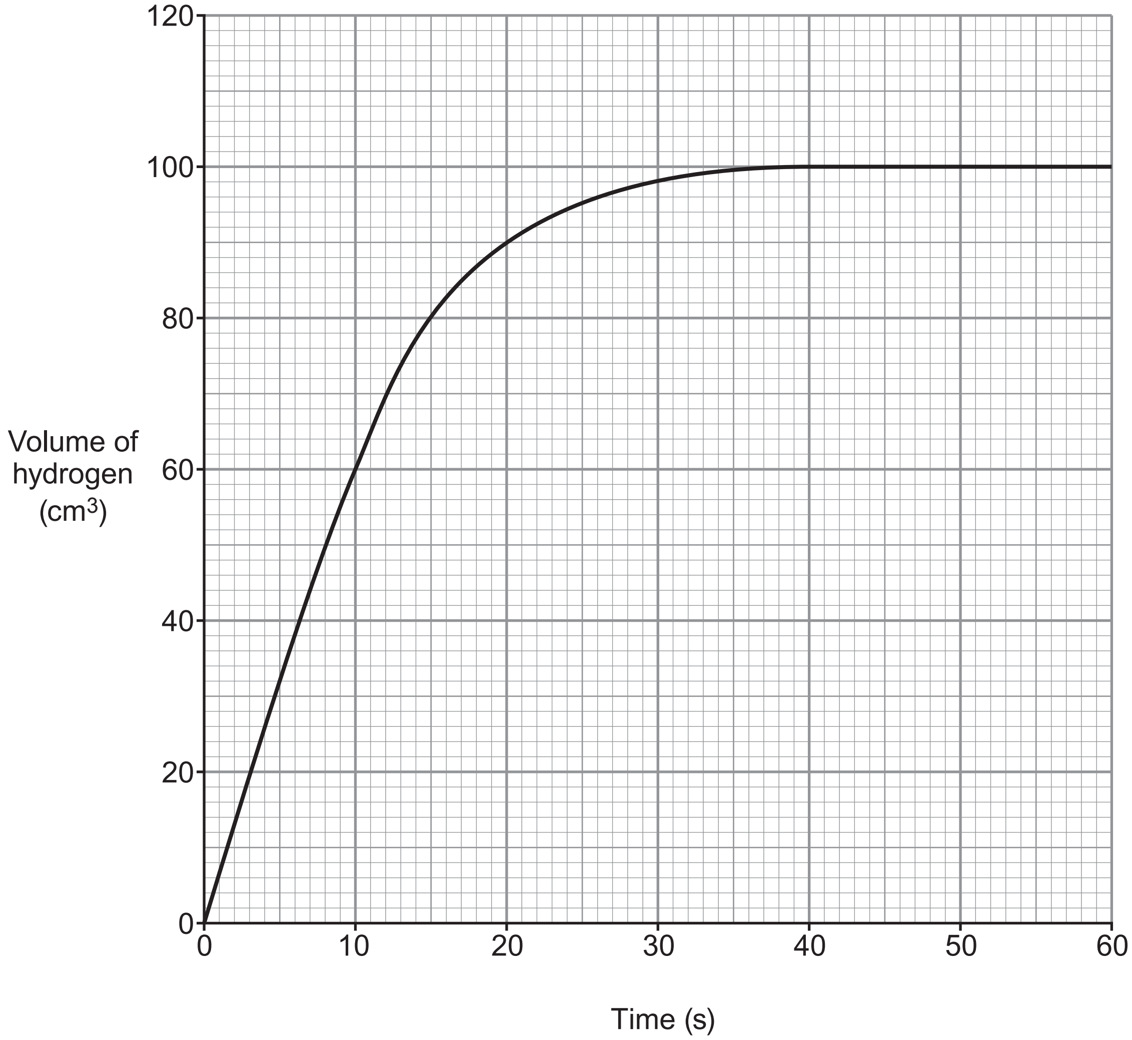
3. The reaction between magnesium and dilute hydrochloric acid produces hydrogen gas and a solution of magnesium chloride.

magnesium + hydrochloric acid ⟶ magnesium chloride + hydrogen

The graph shows the volume of hydrogen formed when Casey carried out this reaction using magnesium ribbon and excess dilute hydrochloric acid at 40 °C.



(a) **Sketch on the grid**, the graph that would be obtained if Casey repeated the experiment using the same length of magnesium ribbon with the dilute hydrochloric acid still in excess but at 20 °C. Explain your graph using particle theory. [3]

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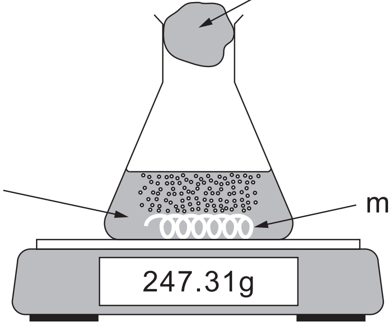
(b) Reactions that produce a gas can also be investigated by recording the loss of mass over time.



balance resolution = 0.01 g

Calculate the mass of hydrogen gas produced in the initial experiment. Use this answer to evaluate the suitability of the above apparatus for investigating this reaction.

The volume of 1 mol of hydrogen gas is 24 000 cm^3 at room temperature and pressure. [3]

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Mass of hydrogen = ... g

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4. A teacher wanted her class to investigate the reactivity of the halogens. She gave each group of students the following chemicals.

chlorine water	**bromine water**	**iodine water**
sodium iodide solution	**sodium chloride solution**	**sodium bromide solution**

(a) Explain how the students would use these chemicals to show the order of reactivity of the halogens. Include the expected results in your answer. [4]

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(b) Explain, in terms of their electronic structures, the trend in reactivity of the halogens. [2]

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5. You have been given an unlabelled bottle thought to contain iron(III) sulfate solution.

(a) Describe how you would identify the iron(III) ions in the solution. Give the ionic equation for the reaction. [4]

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(b) Describe how you could test for the presence of sulfate ions in the solution. Include the names of **both** products formed. [3]

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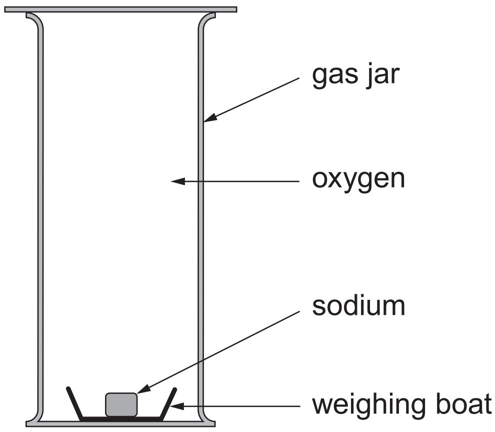
6. Sodium oxidises when left exposed to the air. The equation for the reaction is shown.

$$4Na + O_2 \longrightarrow 2Na_2O$$

(a) Cain and James wanted to show experimentally that the formula of sodium oxide is Na_2O. They left a piece of sodium in a gas jar of pure oxygen for one week.



They recorded the mass of the weighing boat and its contents at the start of the experiment and then again after one week.

Mass of weighing boat	5.90 g
Mass of weighing boat and sodium at the start	7.51 g
Mass of weighing boat and contents after one week	7.88 g

(i) Using the results from the experiment, calculate the simplest formula of sodium oxide. **Show your working.** [3]

Simplest formula ....

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(ii) Describe what Cain and James would need to do to show whether the experiment is reproducible. [2]

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(b) The correct formula for sodium oxide is Na_2O. If all weighings were correct and no product was lost, suggest **two** reasons that could explain the difference between the correct formula of sodium oxide and the formula calculated in part *(a)*(i). [2]

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7. *(a)* Describe and explain the similarities and differences seen when ethanoic acid and hydrochloric acid of equal concentration react with sodium carbonate. Include relevant equations in your answer. [6 QER]

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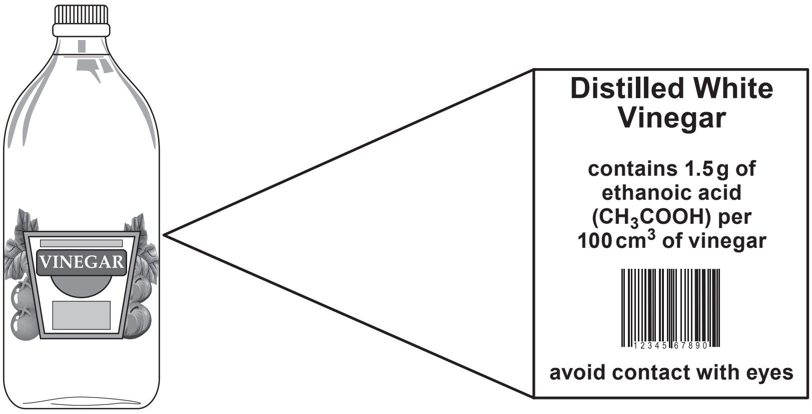
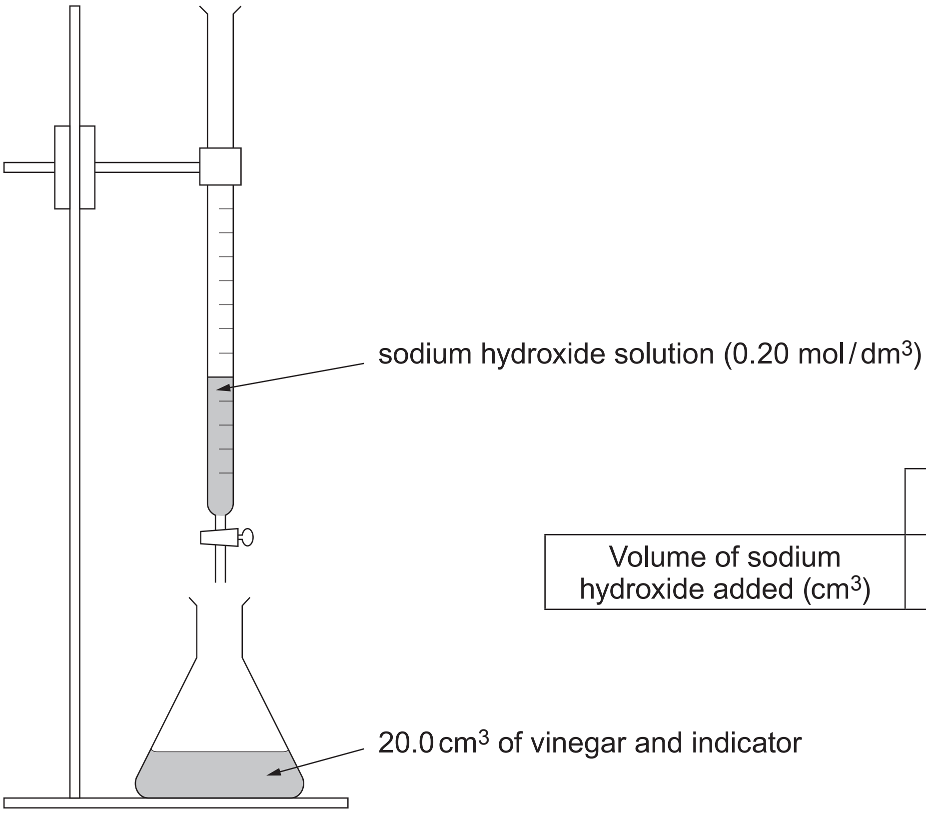
(b) A group of students were asked to investigate the concentration of the ethanoic acid, CH_3COOH, in a bottle of white vinegar.



They added sodium hydroxide solution of concentration 0.20 mol/dm^3 a little at a time to 20.0 cm^3 of the vinegar and a few drops of indicator until the indicator just changed colour.

The apparatus used and the results collected are shown below.



	Trial	Run 2	Run 3
Volume of sodium hydroxide added (cm^3)	26.4	24.9	25.1

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Ethanoic acid in the vinegar reacts with sodium hydroxide solution as shown in the following equation.

$$CH_3COOH \quad + \quad NaOH \longrightarrow CH_3COONa \quad + \quad H_2O$$

(i) Use this information, together with the results collected, to calculate the concentration of the ethanoic acid in mol/dm^3. [4]

Concentration = ... mol/dm^3

(ii) Use your answer to part (i) to show whether or not the information on the label is correct. [2]

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END OF PAPER

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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

Key	
A_r	relative atomic mass
Symbol	
Name	
Z	atomic number