

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.

SECTION A

Answer all questions.

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



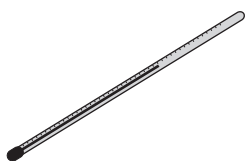
A



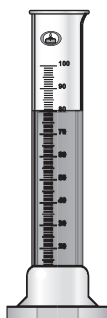
B



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]

- (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

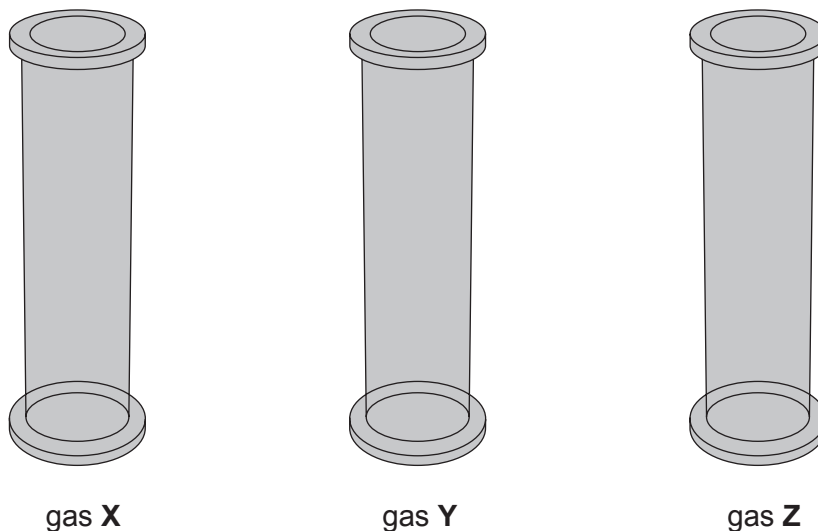
water from salt solution

salt from salt solution

[3]

5

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.



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

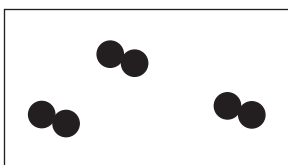
Gas Y

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

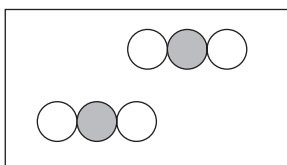
(i) Complete the table to describe the additional tests they would need to carry out to identify each of these gases. [2]

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

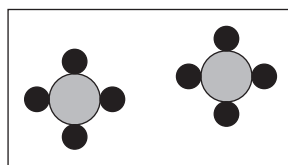
(ii) The following diagrams show the arrangement of atoms in different gases.



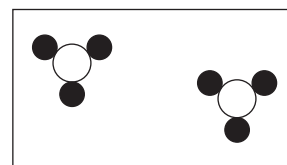
A



B



C



D

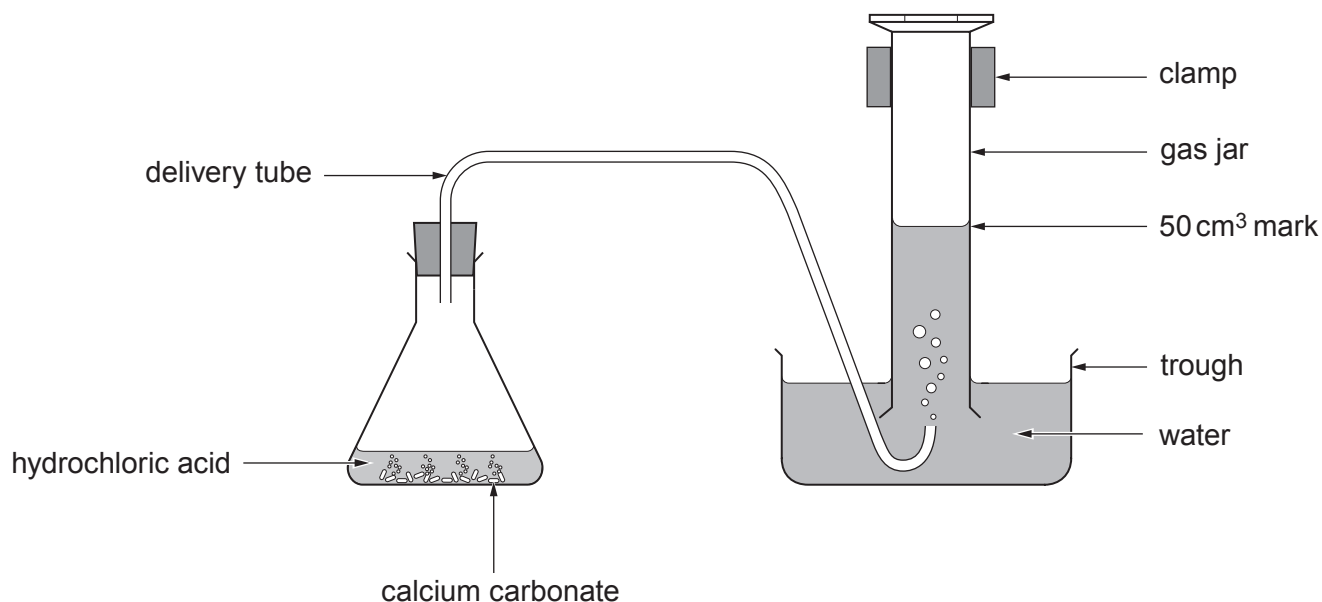
Give the **letter** of the diagram that represents

carbon dioxide

ammonia

[2]

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 cm³ 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

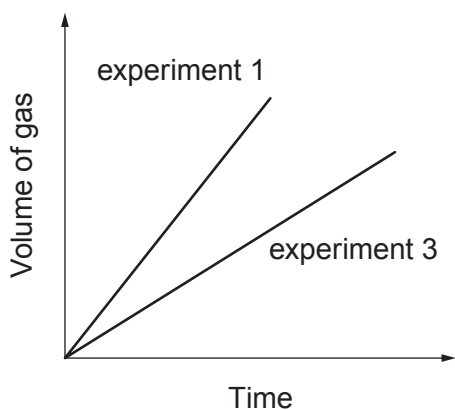
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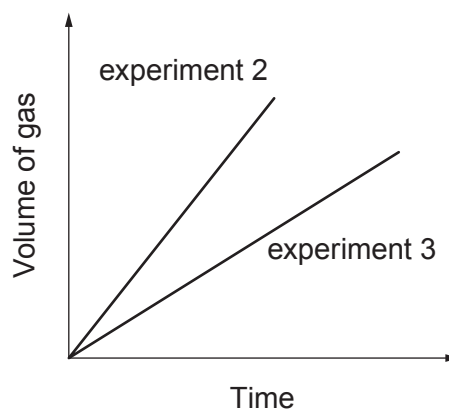
- (ii) Give **two** factors relating to the calcium carbonate that should be kept the same to ensure a fair test. [2]

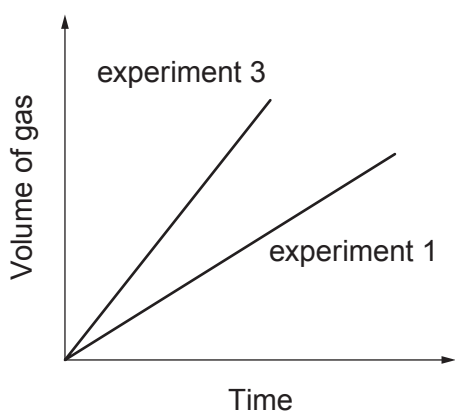
Factor 1

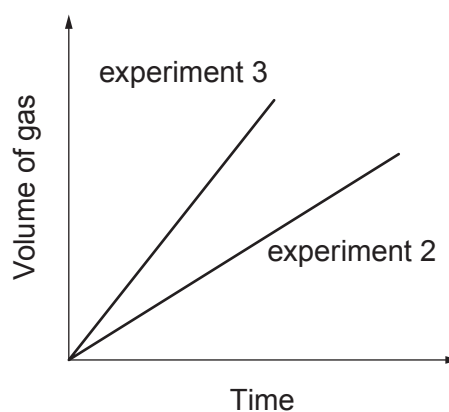
Factor 2

- (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]

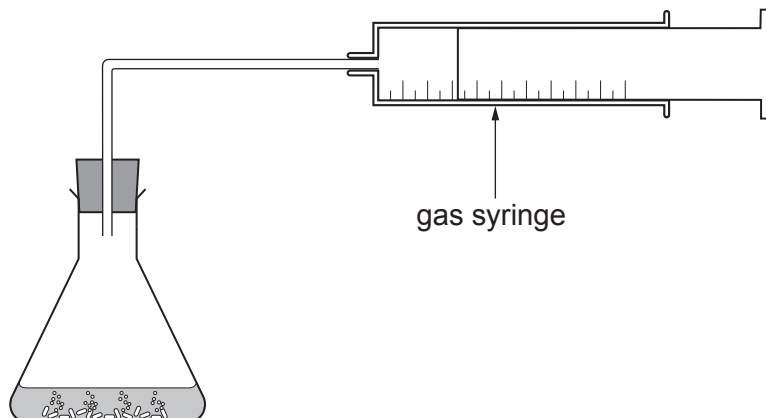








(b) An alternative method for collecting the gas is shown below.



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

[2]

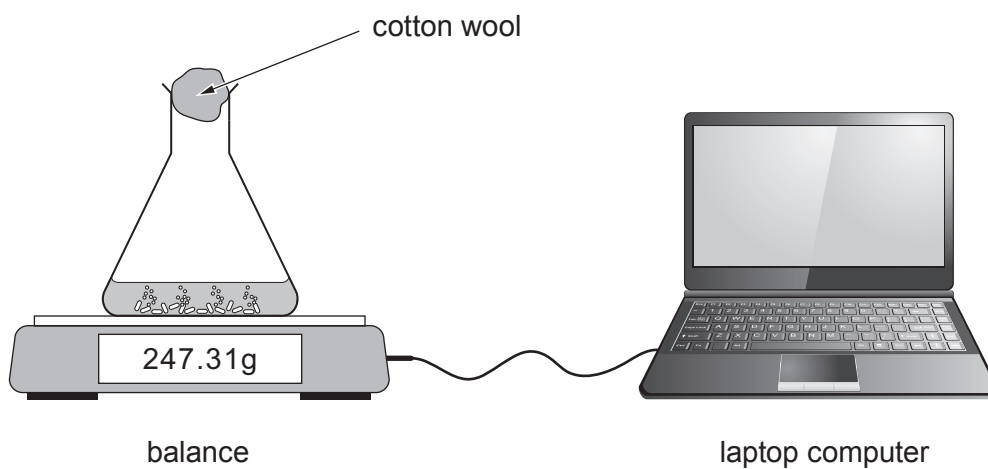
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- (c) The reaction can also be investigated by recording the change in mass over time.



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

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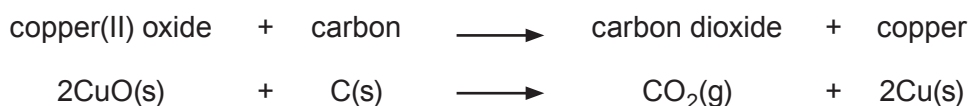
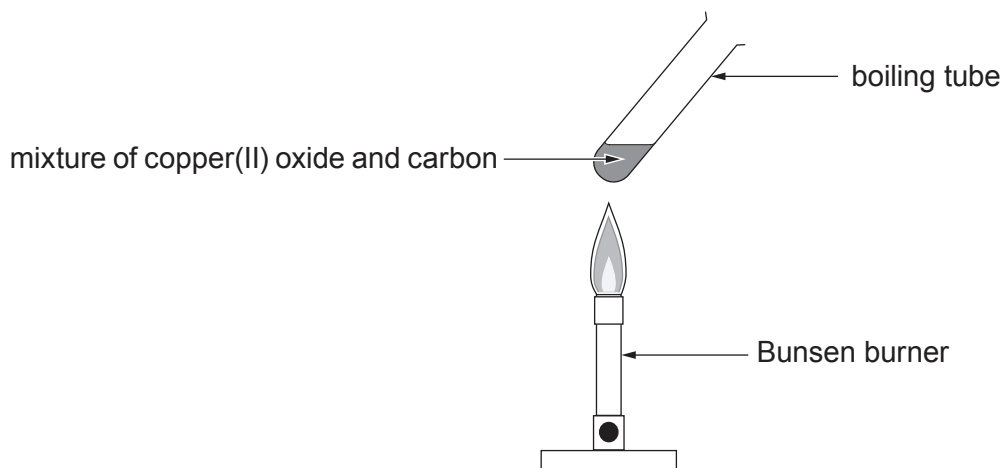
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- (ii) Give **one** benefit of connecting the balance to a laptop computer. [1]

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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.



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

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.....

- (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	<input type="checkbox"/>
carbon and aluminium oxide	<input type="checkbox"/>
carbon and iron oxide	<input type="checkbox"/>
gold and copper oxide	<input type="checkbox"/>
magnesium and copper oxide	<input type="checkbox"/>

- (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]

$$A_r(\text{Cu}) = 63.5 \quad A_r(\text{S}) = 32$$

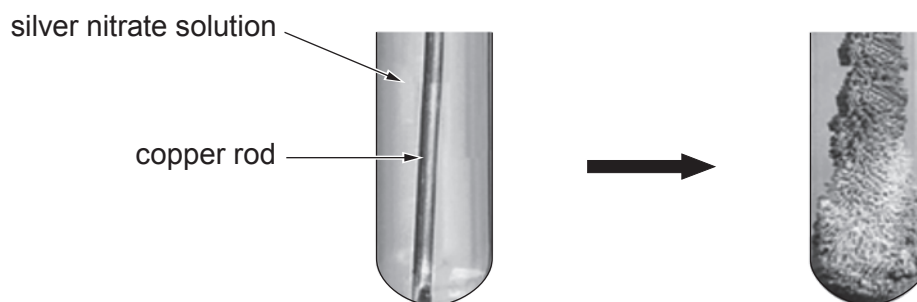
Percentage by mass = %

.....

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.....

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 10cm copper rod was placed in 25cm³ 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

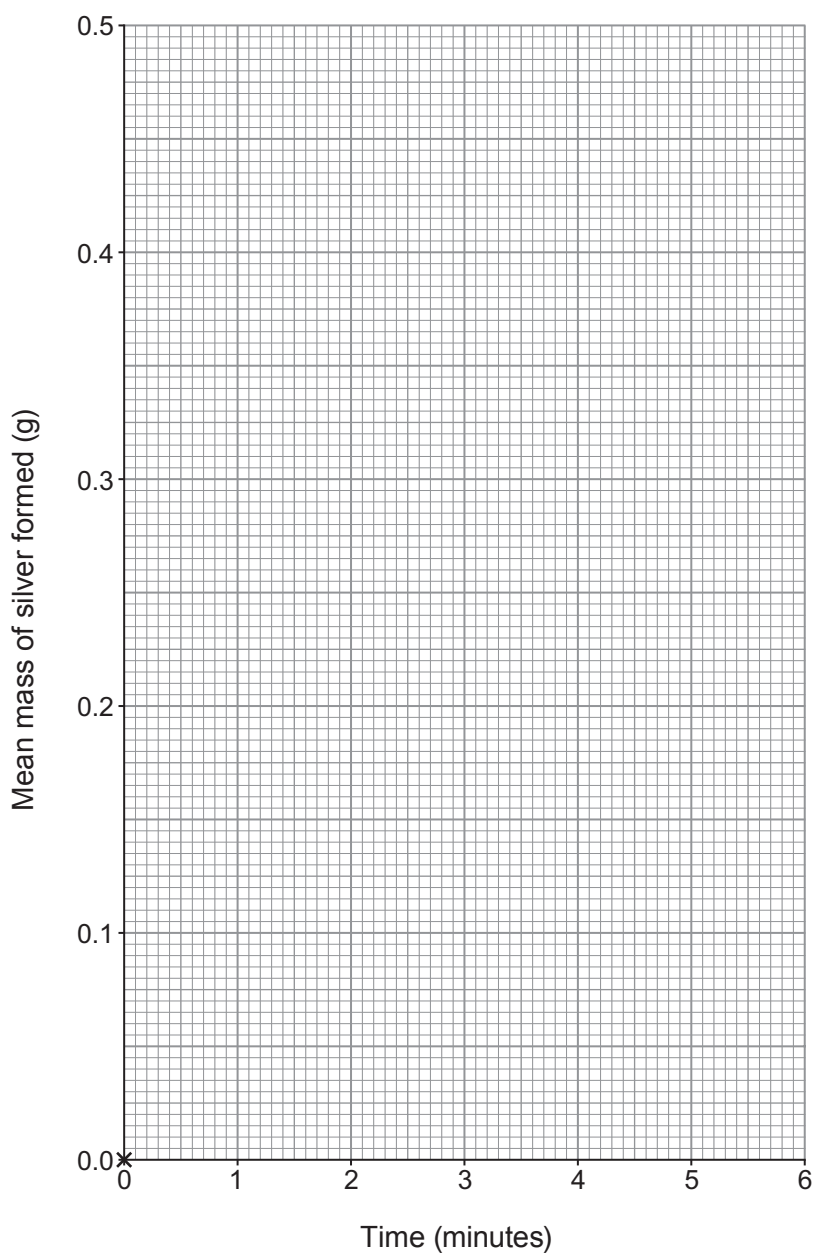
- (i) Circle the **two** results that were not used in calculating mean values. [1]
- (ii) State how the results for 2 minutes show the best repeatability. [1]

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.....

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

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only



(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

(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]

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

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(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]

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SECTION BExaminer
only

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]

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- (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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Examiner
only

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

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(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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END OF PAPER

15

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 3 4 5 6 7 0

Group

7 Li Lithium 3	9 Be Beryllium 4	11 Na Sodium 11	12 C Carbon 6	13 Al Aluminium 13	14 N Nitrogen 7	15 P Phosphorus 15	16 O Oxygen 8	17 F Fluorine 9	18 Ne Neon 10
19 K Potassium 19	20 Ca Calcium 20	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
37 Rb Rubidium 37	38 Sr Strontium 38	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
86 Rb Rubidium 37	87 Sr Strontium 38	89 Y Yttrium 39	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
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	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
223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89	226 Ra Radium 88	227 Ac Actinium 89	227 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89	226 Ra Radium 88	227 Ac Actinium 89
55 Cs Caesium 55	56 Ba Barium 56	57 La Lanthanum 57	58 Ce Cerium 58	59 Pr Praseodymium 59	60 Nd Neodymium 60	61 Pm Promethium 61	62 Sm Samarium 62	63 Eu Europium 63	64 Gd Gadolinium 64
85 At Astatine 85	86 Rn Radon 86	87 Fr Francium 87	88 Ra Radium 88	89 Ac Actinium 89	90 Th Thorium 90	91 Pa Protactinium 91	92 U Uranium 92	93 Np Neptunium 93	94 Pu Plutonium 94
103 Bi Bismuth 83	104 Po Polonium 84	105 At Astatine 85	106 Rn Radon 86	107 Fr Francium 87	108 Ra Radium 88	109 Ac Actinium 89	110 Th Thorium 90	111 Pa Protactinium 91	112 U Uranium 92
121 In Indium 49	122 Sb Antimony 51	123 Te Tellurium 52	124 Po Polonium 84	125 Bi Bismuth 83	126 Pb Lead 82	127 At Astatine 85	128 Rn Radon 86	129 Fr Francium 87	130 Ra Radium 88
49 In Indium 49	50 Tl Thallium 81	51 Pb Lead 82	52 Po Polonium 84	53 Bi Bismuth 83	54 Pt Platinum 78	55 Au Gold 79	56 Hg Mercury 80	57 Tl Thallium 81	58 Pb Lead 82
47 Ag Silver 47	48 Cd Cadmium 48	49 In Indium 49	50 Tl Thallium 81	51 Pb Lead 82	52 Po Polonium 84	53 Bi Bismuth 83	54 Pt Platinum 78	55 Au Gold 79	56 Hg Mercury 80
29 Cu Copper 29	30 Zn Zinc 30	31 Ga Gallium 31	32 Ge Germanium 32	33 As Arsenic 33	34 Se Selenium 34	35 Br Bromine 35	36 Kr Krypton 36	37 Rb Rubidium 37	38 Sr Strontium 38
65 Zn Zinc 30	66 Ga Gallium 31	67 Ge Germanium 32	68 As Arsenic 33	69 Se Selenium 34	70 Br Bromine 35	71 Kr Krypton 36	72 Rb Rubidium 37	73 Sr Strontium 38	74 Y Yttrium 39
108 Ag Silver 47	109 Cd Cadmium 48	110 In Indium 49	111 Sn Tin 50	112 Sb Antimony 51	113 Te Tellurium 52	114 Po Polonium 84	115 Bi Bismuth 83	116 Pt Platinum 78	117 Au Gold 79
106 Pd Palladium 46	107 Ag Silver 47	108 Cd Cadmium 48	109 In Indium 49	110 Sn Tin 50	111 Sb Antimony 51	112 Te Tellurium 52	113 Po Polonium 84	114 Bi Bismuth 83	115 Pt Platinum 78
103 Rh Rhodium 45	104 Pd Palladium 46	105 Ag Silver 47	106 Cd Cadmium 48	107 In Indium 49	108 Sn Tin 50	109 Sb Antimony 51	110 Te Tellurium 52	111 Po Polonium 84	112 Bi Bismuth 83
59 Co Cobalt 27	60 Ni Nickel 28	61 Cu Copper 29	62 Zn Zinc 30	63 Ga Gallium 31	64 Ge Germanium 32	65 As Arsenic 33	66 Se Selenium 34	67 Br Bromine 35	68 Kr Krypton 36
59 Co Cobalt 27	60 Ni Nickel 28	61 Cu Copper 29	62 Zn Zinc 30	63 Ga Gallium 31	64 Ge Germanium 32	65 As Arsenic 33	66 Se Selenium 34	67 Br Bromine 35	68 Kr Krypton 36
192 Ir Iridium 77	193 Pt Platinum 78	194 Au Gold 79	195 Hg Mercury 80	196 Tl Thallium 81	197 Pb Lead 82	198 Bi Bismuth 83	199 Po Polonium 84	200 At Astatine 85	201 Rn Radon 86
192 Ir Iridium 77	193 Pt Platinum 78	194 Au Gold 79	195 Hg Mercury 80	196 Tl Thallium 81	197 Pb Lead 82	198 Bi Bismuth 83	199 Po Polonium 84	200 At Astatine 85	201 Rn Radon 86
186 Re Rhenium 75	187 Os Osmium 76	188 Ir Iridium 77	189 Pt Platinum 78	190 Au Gold 79	191 Hg Mercury 80	192 Tl Thallium 81	193 Pb Lead 82	194 Bi Bismuth 83	195 Po Polonium 84
186 Re Rhenium 75	187 Os Osmium 76	188 Ir Iridium 77	189 Pt Platinum 78	190 Au Gold 79	191 Hg Mercury 80	192 Tl Thallium 81	193 Pb Lead 82	194 Bi Bismuth 83	195 Po Polonium 84
184 W Tungsten 74	185 Re Rhenium 75	186 Os Osmium 76	187 Ir Iridium 77	188 Pt Platinum 78	189 Au Gold 79	190 Hg Mercury 80	191 Tl Thallium 81	192 Pb Lead 82	193 Bi Bismuth 83
184 W Tungsten 74	185 Re Rhenium 75	186 Os Osmium 76	187 Ir Iridium 77	188 Pt Platinum 78	189 Au Gold 79	190 Hg Mercury 80	191 Tl Thallium 81	192 Pb Lead 82	193 Bi Bismuth 83
93 Nb Niobium 41	94 Mo Molybdenum 42	95 Tc Technetium 43	96 Mo Molybdenum 42	97 Ru Ruthenium 44	98 Rh Rhodium 45	99 Pd Palladium 46	100 Ag Silver 47	101 Cd Cadmium 48	102 In Indium 49
93 Nb Niobium 41	94 Mo Molybdenum 42	95 Tc Technetium 43	96 Mo Molybdenum 42	97 Ru Ruthenium 44	98 Rh Rhodium 45	99 Pd Palladium 46	100 Ag Silver 47	101 Cd Cadmium 48	102 In Indium 49
45 Sc Scandium 21	46 Ti Titanium 22	47 V Vanadium 23	48 Ti Titanium 22	49 V Vanadium 23	50 Cr Chromium 24	51 Mn Manganese 25	52 Cr Chromium 24	53 Mn Manganese 25	54 Fe Iron 26
45 Sc Scandium 21	46 Ti Titanium 22	47 V Vanadium 23	48 Ti Titanium 22	49 V Vanadium 23	50 Cr Chromium 24	51 Mn Manganese 25	52 Cr Chromium 24	53 Mn Manganese 25	54 Fe Iron 26
89 Y Yttrium 39	90 Zr Zirconium 40	91 Nb Niobium 41	92 Mo Molybdenum 42	93 Tc Technetium 43	94 Ru Ruthenium 44	95 Rh Rhodium 45	96 Pd Palladium 46	97 Ag Silver 47	98 Cd Cadmium 48
89 Y Yttrium 39	90 Zr Zirconium 40	91 Nb Niobium 41	92 Mo Molybdenum 42	93 Tc Technetium 43	94 Ru Ruthenium 44	95 Rh Rhodium 45	96 Pd Palladium 46	97 Ag Silver 47	98 Cd Cadmium 48
139 La Lanthanum 57	140 Ce Cerium 58	141 Pr Praseodymium 59	142 Nd Neodymium 60	143 Pm Promethium 61	144 Sm Samarium 62	145 Eu Europium 63	146 Gd Gadolinium 64	147 Tb Terbium 65	148 Dy Dysprosium 66
139 La Lanthanum 57	140 Ce Cerium 58	141 Pr Praseodymium 59	142 Nd Neodymium 60	143 Pm Promethium 61	144 Sm Samarium 62	145 Eu Europium 63	146 Gd Gadolinium 64	147 Tb Terbium 65	148 Dy Dysprosium 66
227 Ac Actinium 89	228 Th Thorium 90	229 Pa Protactinium 91	230 U Uranium 92	231 Np Neptunium 93	232 Pu Plutonium 94	233 Am Americium 95	234 Cm Curium 96	235 Bk Berkelium 97	236 Cf Californium 98
227 Ac Actinium 89	228 Th Thorium 90	229 Pa Protactinium 91	230 U Uranium 92	231 Np Neptunium 93	232 Pu Plutonium 94	233 Am Americium 95	234 Cm Curium 96	235 Bk Berkelium 97	236 Cf Californium 98

Key

relative atomic mass

Ar	Symbol
Name	Z

atomic number