Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4462/02

S15-4462-02

SCIENCE A/CHEMISTRY

CHEMISTRY 1
HIGHER TIER

P.M. FRIDAY, 12 June 2015

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**7**	
2.	**7**	
3.	**4**	
4.	**6**	
5.	**6**	
6.	**6**	
7.	**6**	
8.	**5**	
9.	**7**	
10.	**6**	
Total	**60**	

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ADDITIONAL MATERIALS

In addition to this 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(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.

You are reminded that assessment will take into account the quality of written communication used in your answer to questions **4** and **10**.

The Periodic Table is printed on the back cover of the examination paper and the formulae for some common ions on the inside of the back cover.

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Answer **all** *questions.*

1. The following table contains some information about five elements, **A**, **B**, **C**, **D** and **E**.

Element	Melting point (°C)	Boiling point (°C)	Electrical conductivity
A	113	445	poor
B	−39	357	good
C	3550	4828	poor
D	−101	−35	poor
E	1540	2750	good

(a) Give the **letter** of the element, **A-E**, that is a liquid at 20 °C. Explain your choice. [3]

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(b) State which element could be iron and explain your choice. [3]

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(c) State **one** property of iron that is not mentioned in the table. [1]

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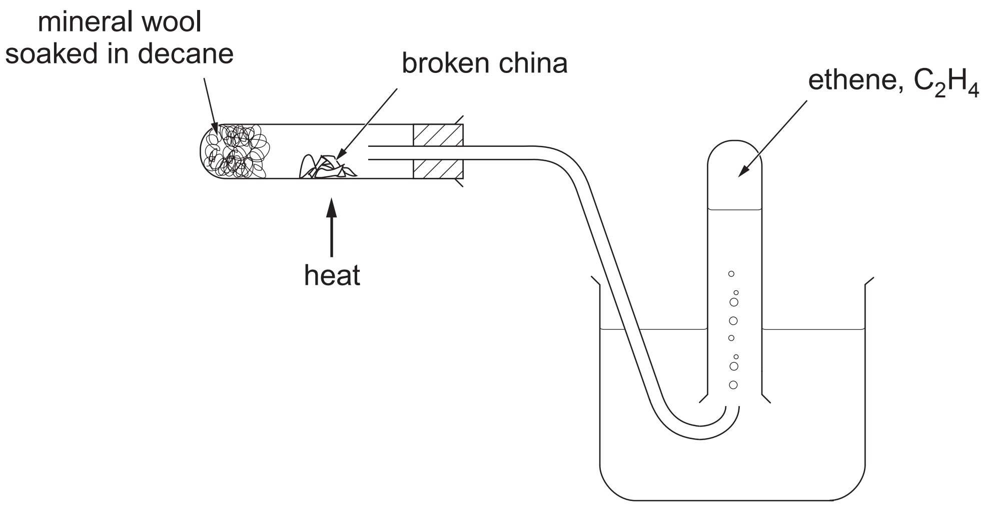
2. *(a)* The following diagram shows an experiment that could be carried out in the laboratory to obtain ethene from decane, $C_{10}H_{22}$.



(i) Complete the following **symbol** equation for the reaction taking place. [1]

$C_{10}H_{22} \longrightarrow$ .... + C_2H_4

(ii) Name the process which has taken place. [1]

....

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 (4462-02) **Turn over.**

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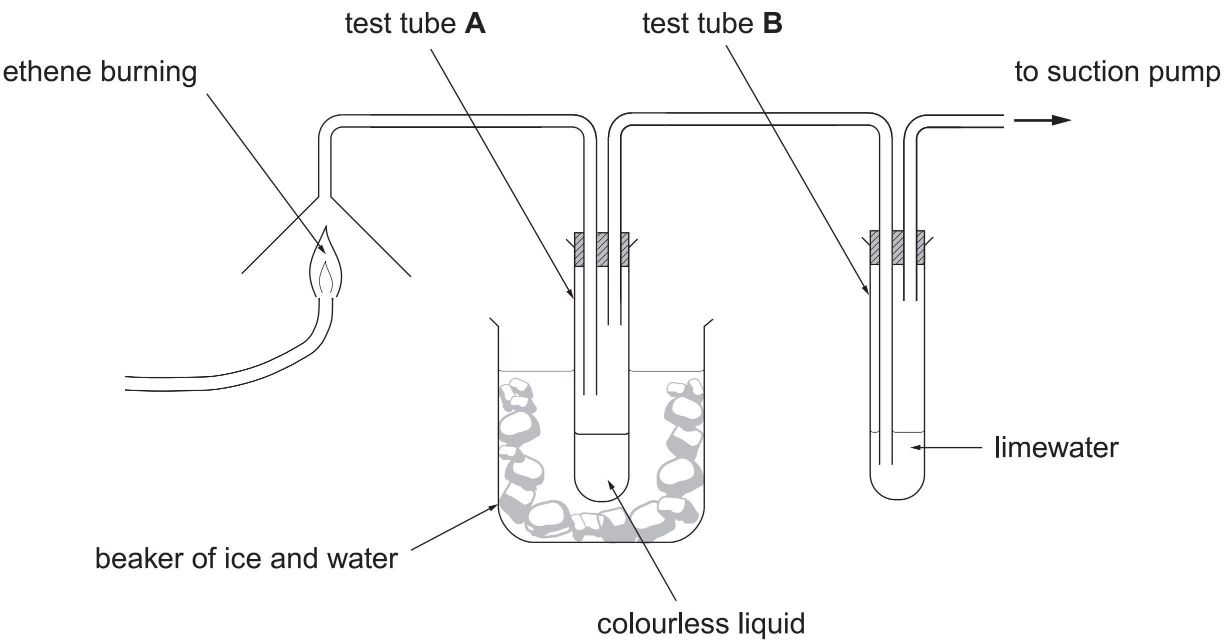
(b) Ethene is a hydrocarbon.

The following diagram shows apparatus that can be used to investigate the products formed when ethene is burned.



(i) State what you would expect to happen to the limewater in test tube **B** and give the reason for your answer. [1]

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(ii) The experiment was repeated with hydrogen being burned instead of ethene.

I. State what would be seen in test tube **A**. Give a reason for your answer. [2]

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II. State and explain what would be seen in test tube **B**. [2]

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3. The table below gives information about the concentration of ions in drinking water from four different locations.

Location	Concentration of ions (mol / m^3 of water)					
	Na^+	NH_4^+	Mg^{2+}	F^-	SO_4^{2-}	NO_3^-
A	3.4	2.1	2.0	2.1	2.5	2.3
B	0.2	0.6	2.7	4.4	0.0	0.1
C	0.0	0.3	0.4	0.4	0.2	0.0
D	0.1	0.4	0.0	0.0	0.4	0.2

(a) (i) Sodium sulfate can be formed from the ions found in water at location **A**. [1]

Write the formula of sodium sulfate. ....

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(ii) Suggest the names of **two** compounds that could be formed from the ions present in the water at location **C**. [1]

Compound 1 ....

Compound 2 ....

(b) State the location where you would expect to find the least amount of tooth decay. Give a reason for your choice. [2]

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4. Fossil fuels such as coal release sulfur dioxide into the atmosphere when burned. This causes acid rain. Describe how acid rain is formed and its effects on the environment. [6 QWC]

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5. Copper(II) sulfate was made by reacting copper(II) carbonate with an acid.

(a) Give the name of the acid used. [1]

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(b) The first stage of the preparation is the addition of excess copper(II) carbonate to the acid. Give **two** observations that show a reaction is taking place. [2]

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(c) Describe how you would prepare copper(II) sulfate crystals from the mixture in part *(b)*. [2]

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(d) A different salt can be made by reacting copper(II) oxide with dilute hydrochloric acid. Complete the **word** equation for the reaction that takes place. [1]

copper(II) oxide + hydrochloric acid ⟶ .... + ...

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6. *(a)* Crude oil is a source of some very important fuels. State how crude oil was formed. [2]

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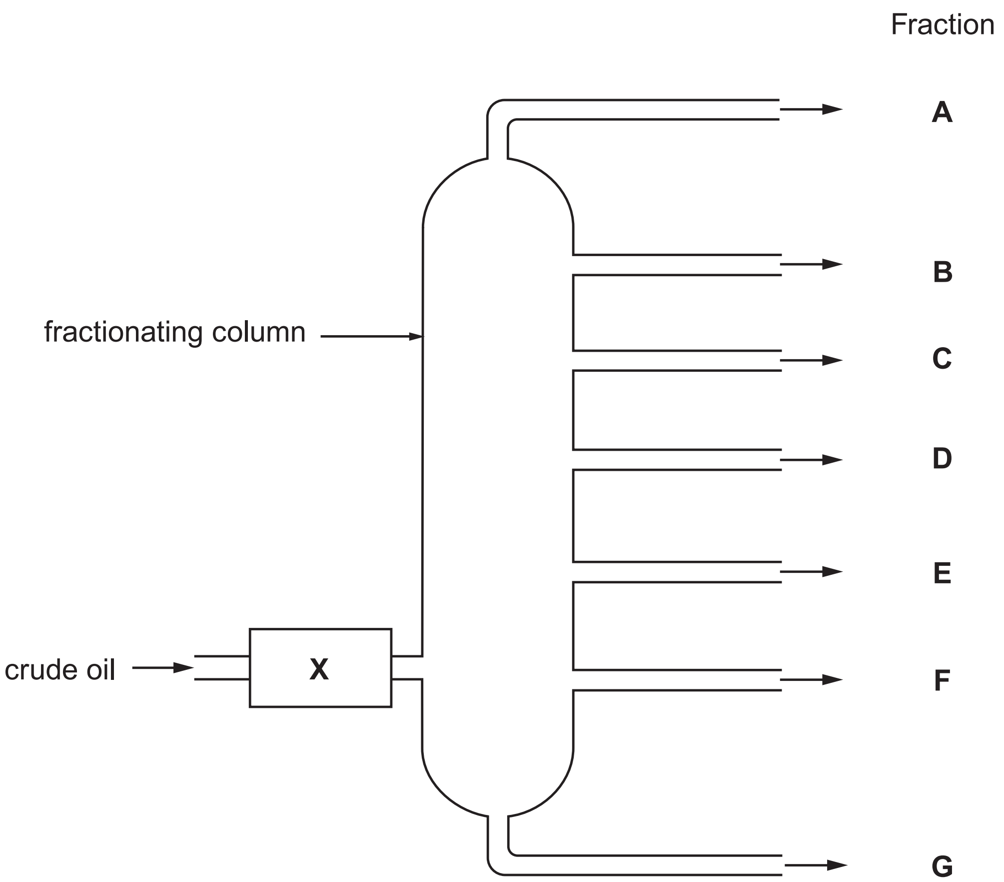
(b) Crude oil is a mixture of compounds called hydrocarbons. They are separated into different fractions in a fractionating column.



(i) State what happens to the crude oil in **X** before it is allowed to enter the fractionating column. [1]

....

(ii) State the property of hydrocarbons which allows them to be separated using this method. [1]

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(c) A similar process can also be used to separate gases from air.

The table below shows the boiling points of three gases that can be obtained from air.

Gas	Boiling point (°C)
argon	−186
nitrogen	−196
oxygen	−182

To separate the gases, air is compressed and cooled to become liquid air. The liquid air is then allowed to warm up slowly.

State which of the three gases boils first when liquid air warms up and give the reason for your answer. [2]

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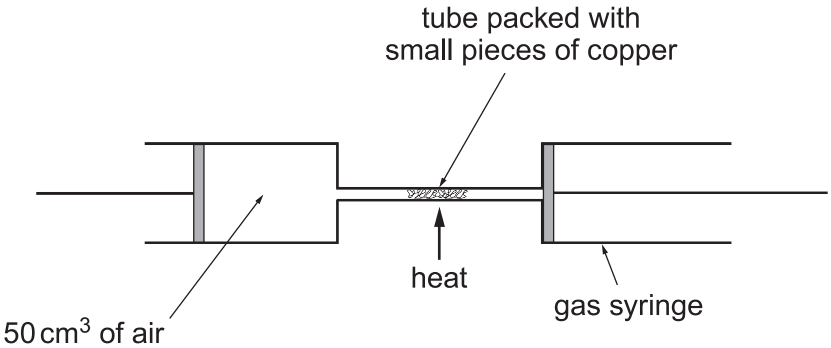
7. *(a)* The percentage of oxygen in air can be found by using the apparatus shown below.



50 cm^3 of air was trapped in one of the syringes. The air was passed forwards and backwards over the heated copper. The copper reacted with the oxygen in the air producing solid copper(II) oxide. The final volume of gas was recorded when the apparatus had cooled to room temperature.

Results

Volume of air before heating	50.0 cm^3
Volume of air after heating and cooling	40.5 cm^3

(i) Use the results to calculate the percentage of oxygen in air. [2]

Percentage of oxygen in air = ... *%*

(ii) Suggest why the value for the percentage of oxygen in air calculated in part (i) is lower than the expected value. [1]

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(iii) State what happens to the amount of carbon dioxide inside the apparatus during the experiment. Give the reason for your answer. [2]

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(b) Copper(II) oxide can be formed by heating copper(II) nitrate.

Balance the equation for the reaction. [1]

$$\square\ Cu(NO_3)_2 \longrightarrow \square\ CuO + \square\ NO_2 + O_2$$

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8. *(a)* Complete the following table. [3]

Positive ion	Negative ion	Formula
Na^+	Br^-	NaBr
Ba^{2+}	OH^-	....
....	SO_4^{2-}	$Fe_2(SO_4)_3$
K^+	....	K_2HPO_4

(b) Explain how a sodium atom and a bromine atom form ions when they react to make sodium bromide. [2]

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9. *(a)* Aluminium can be extracted by the electrolysis of molten aluminium oxide.

(i) State what is added to aluminium oxide to reduce its melting point. [1]

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(ii) Aluminium metal is released at the cathode according to the following electrode equation.

$$Al^{3+} + 3e^{-} \longrightarrow Al$$

Balance the electrode equation for the reaction that takes place at the anode. [1]

$$\square\, O^{2-} - \square\, e^{-} \longrightarrow O_2$$

(b) Lead can be produced by the electrolysis of molten lead(II) bromide, $PbBr_2$.

(i) Complete the balanced electrode equation for the reaction that takes place at the cathode. [2]

.... + ... $\longrightarrow$ Pb

(ii) Explain the formation of bromine during the electrolysis of molten lead(II) bromide. [3]

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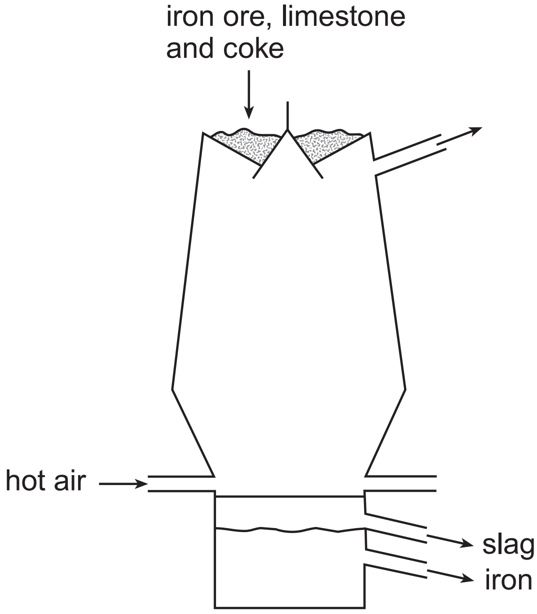
10. The diagram below shows the blast furnace which is used to extract iron.



Give a detailed description of the extraction of iron. [6 QWC]

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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+}		

PERIODIC TABLE OF ELEMENTS

1	2	Group										3	4	5	6	7	0
								$^{1}_{1}H$ Hydrogen									$^{4}_{2}He$ Helium
$^{7}_{3}Li$ Lithium	$^{9}_{4}Be$ Beryllium											$^{11}_{5}B$ Boron	$^{12}_{6}C$ Carbon	$^{14}_{7}N$ Nitrogen	$^{16}_{8}O$ Oxygen	$^{19}_{9}F$ Fluorine	$^{20}_{10}Ne$ Neon
$^{23}_{11}Na$ Sodium	$^{24}_{12}Mg$ Magnesium											$^{27}_{13}Al$ Aluminium	$^{28}_{14}Si$ Silicon	$^{31}_{15}P$ Phosphorus	$^{32}_{16}S$ Sulfur	$^{35}_{17}Cl$ Chlorine	$^{40}_{18}Ar$ Argon
$^{39}_{19}K$ Potassium	$^{40}_{20}Ca$ Calcium	$^{45}_{21}Sc$ Scandium	$^{48}_{22}Ti$ Titanium	$^{51}_{23}V$ Vanadium	$^{52}_{24}Cr$ Chromium	$^{55}_{25}Mn$ Manganese	$^{56}_{26}Fe$ Iron	$^{59}_{27}Co$ Cobalt	$^{59}_{28}Ni$ Nickel	$^{64}_{29}Cu$ Copper	$^{65}_{30}Zn$ Zinc	$^{70}_{31}Ga$ Gallium	$^{73}_{32}Ge$ Germanium	$^{75}_{33}As$ Arsenic	$^{79}_{34}Se$ Selenium	$^{80}_{35}Br$ Bromine	$^{84}_{36}Kr$ Krypton
$^{86}_{37}Rb$ Rubidium	$^{88}_{38}Sr$ Strontium	$^{89}_{39}Y$ Yttrium	$^{91}_{40}Zr$ Zirconium	$^{93}_{41}Nb$ Niobium	$^{96}_{42}Mo$ Molybdenum	$^{99}_{43}Tc$ Technetium	$^{101}_{44}Ru$ Ruthenium	$^{103}_{45}Rh$ Rhodium	$^{106}_{46}Pd$ Palladium	$^{108}_{47}Ag$ Silver	$^{112}_{48}Cd$ Cadmium	$^{115}_{49}In$ Indium	$^{119}_{50}Sn$ Tin	$^{122}_{51}Sb$ Antimony	$^{128}_{52}Te$ Tellurium	$^{127}_{53}I$ Iodine	$^{131}_{54}Xe$ Xenon
$^{133}_{55}Cs$ Caesium	$^{137}_{56}Ba$ Barium	$^{139}_{57}La$ Lanthanum	$^{179}_{72}Hf$ Hafnium	$^{181}_{73}Ta$ Tantalum	$^{184}_{74}W$ Tungsten	$^{186}_{75}Re$ Rhenium	$^{190}_{76}Os$ Osmium	$^{192}_{77}Ir$ Iridium	$^{195}_{78}Pt$ Platinum	$^{197}_{79}Au$ Gold	$^{201}_{80}Hg$ Mercury	$^{204}_{81}Tl$ Thallium	$^{207}_{82}Pb$ Lead	$^{209}_{83}Bi$ Bismuth	$^{210}_{84}Po$ Polonium	$^{210}_{85}At$ Astatine	$^{222}_{86}Rn$ Radon
$^{223}_{87}Fr$ Francium	$^{226}_{88}Ra$ Radium	$^{227}_{89}Ac$ Actinium															

Key:

Mass number → A

X ← Element Symbol

Atomic number → Z

Name

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