Surname	Centre Number	Candidate Number
Other Names		0

WJEC CBAC

New GCSE

4462/02

SCIENCE A
HIGHER TIER
CHEMISTRY 1

A.M. WEDNESDAY, 18 January 2012

1 hour

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

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

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.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

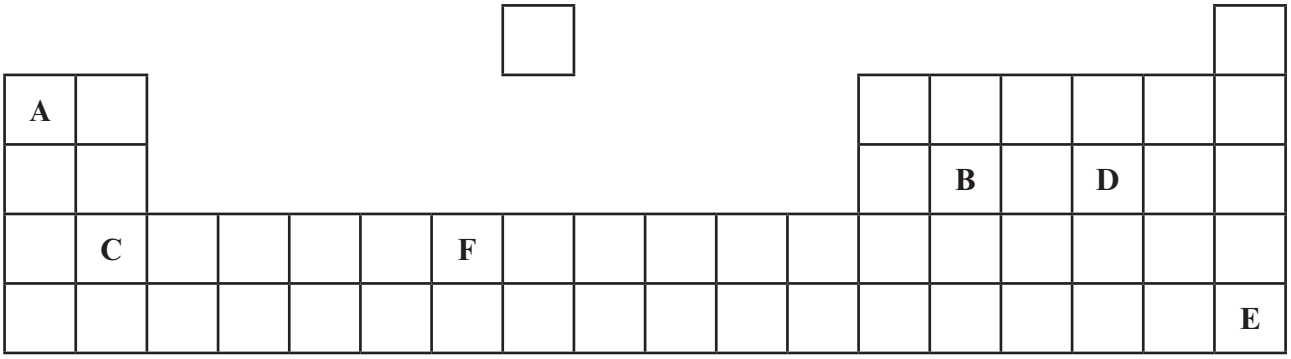
You are reminded of the necessity for good English and orderly presentation in your answers.

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.

Answer **all** *questions.*

1. *(a)* The following diagram shows an outline of the Periodic Table.

The letters shown are NOT the chemical symbols of the elements.



(i) Give the letters of the elements that represent metals and those that represent non-metals. [1]

Metals .....

Non-metals .....

(ii) One of the elements **A-F** shows properties of both metals and non-metals.

I. Give the letter that represents this element.

..... [1]

II. State the group and period to which this element belongs. [1]

Group .....

Period .....

(b) The following table shows information about some of the elements in Group 7 of the Periodic Table.

Name of element	Symbol	Melting point / °C	Boiling point / °C	Reaction with hot sodium
fluorine	F	–219	–188	explosive
chlorine	Cl	–101	–34	very vigorous
bromine	Br	–7	59	vigorous
iodine	I	114	184	slow

(i) Fluorine is a gas at room temperature, 20 °C. Give the states of bromine and iodine at room temperature. [2]

	State at room temperature
bromine	
iodine	

(ii) Astatine is below iodine in this group of the Periodic Table. Use the information in the table to predict the properties of astatine. [2]

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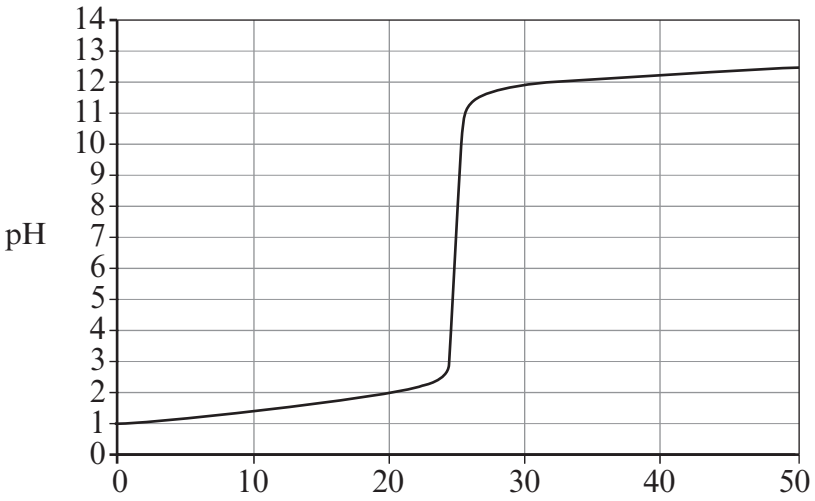
Examiner only

2. Rebecca was asked to investigate how the pH changed during the reaction between hydrochloric acid and potassium hydroxide. She slowly added potassium hydroxide solution to 25 cm^3 of dilute hydrochloric acid and recorded the pH using a pH sensor. The results are shown in the graph below.



(a) (i) Use the graph to give

I. the pH of the hydrochloric acid **before** adding potassium hydroxide, [1]

.....

II. the volume of potassium hydroxide required to **neutralise** the acid. [1]

..... cm^3

(ii) Rebecca could also have investigated the pH change using universal indicator solution.

I. State the colour of universal indicator when the solution is neutral. [1]

.....

II. Give **one** advantage of using a pH sensor to investigate changes in pH. [1]

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.....

(b) Acids also react with bases such as copper oxide.

Describe how a pure sample of copper sulfate crystals can be prepared from copper oxide. [3]

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Examiner only

3. The following diagram shows the 'periodic table' published by Dmitri Mendeleev in 1869.

I	II	III	IV	V	VI	VII	VIII		
H 1.01									
Li 6.94	**Be** 9.01	**B** 10.8	**C** 12.0	**N** 14.0	**O** 16.0	**F** 19.0			
Na 23.0	**Mg** 24.3	**Al** 27.0	**Si** 28.1	**P** 31.0	**S** 32.1	**Cl** 35.5			
K 39.1 **Cu** 63.5	**Ca** 40.1 **Zn** 65.4		**Ti** 47.9	**V** 50.9 **As** 74.9	**Cr** 52.0 **Se** 79.0	**Mn** 54.9 **Br** 79.9	**Fe** 55.9	**Co** 58.9	**Ni** 58.7
Rb 85.5 **Ag** 108	**Sr** 87.6 **Cd** 112	**Y** 88.9 **In** 115	**Zr** 91.2 **Sn** 119	**Nb** 92.9 **Sb** 122	**Mo** 95.9 **Te** 128	**I** 127	**Ru** 101	**Rh** 103	**Pd** 106
Cs 133 **Au** 197	**Ba** 137 **Hg** 201	**La** 139 **Tl** 204	**Pb** 207	**Ta** 181 **Bi** 209	**W** 184		**Os** 194	**Ir** 192	**Pt** 195

The modern version of the Periodic Table is shown on the back page of this examination paper.

Describe how Mendeleev constructed his table and how it compares with today's Periodic Table. [6 QWC]

In your answer you should refer to

- how Mendeleev arranged the elements in his table,
- differences and similarities between the two tables.

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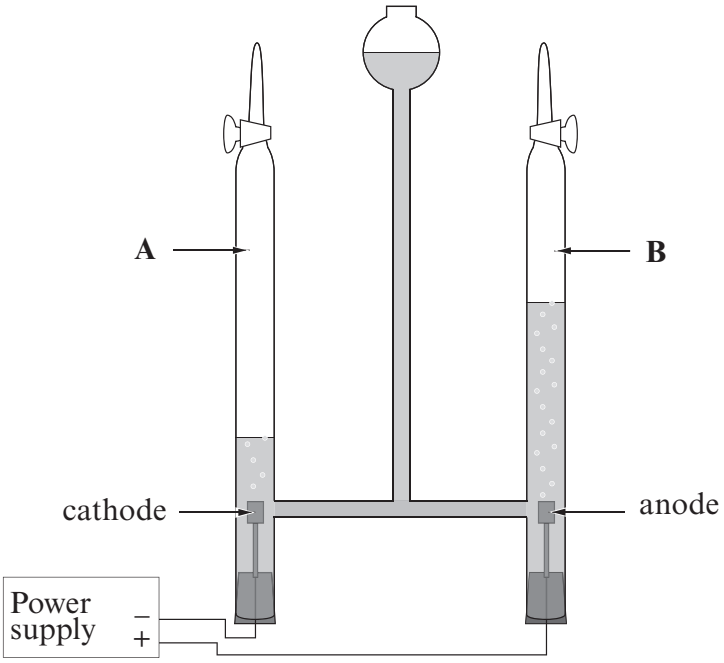
4. *(a)* Hydrogen gas can be produced from water using electrolysis. The following diagram shows the apparatus that could be used in the laboratory to demonstrate the electrolysis of water.



Name gases **A** and **B**. Give the chemical test for each gas, giving the expected result in both cases. [3]

Gas **A** .....

Gas **B** .....

Test for gas **A** .....

.....

Test for gas **B** .....

.....

(b) Hydrogen gas is used as a fuel. Give **one** advantage and **one** disadvantage of the use of hydrogen as a fuel. [2]

Advantage .....

.....

Disadvantage .....

.....

(c) Another gas that can be used as a fuel is methane. Fill in the boxes to balance the following symbol equation for the combustion of methane. [1]

$$CH_4 + \square\ O_2 \longrightarrow \square\ H_2O + CO_2$$

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5. Crude oil is a mixture of compounds known as hydrocarbons. It can be separated into fractions using fractional distillation. The following table shows some properties of the main fractions collected.

Name of fraction	Carbon chain length range	Boiling point range /°C
refinery gas	1 - 4	below 60
petrol	.....	60 - 150
naphtha	8 - 12	150 - 200
kerosene	11 - 15	200 - 260
diesel	15 - 20	.....
lubricating oil	18 - 25	310 - 400
fuel oil	20 - 27	400 - 500
bitumen	above 35	above 500

(a) Complete the table to show

I. the range of carbon chain length in petrol, [1]

II. the boiling point range of diesel. [1]

(b) Give **two** reasons why the process of fractional distillation is important in everyday life. [2]

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.....

(c) Use the information in the table to explain why each fraction is collected over a temperature **range**. [2]

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Examiner only

6. Complete the following table by inserting the formulae of the missing ions and compounds.

You may find it useful to refer to the table of formulae of common ions printed inside the back page of this examination paper. [3]

Name	Formula of positive ion	Formula of negative ion	Formula of compound
sodium chloride	Na^+	Cl^-	NaCl
calcium fluoride	.....	.....	CaF_2
sodium carbonate	Na^+	CO_3^{2-}	.....
magnesium hydroxide	Mg^{2+}	OH^-	.....

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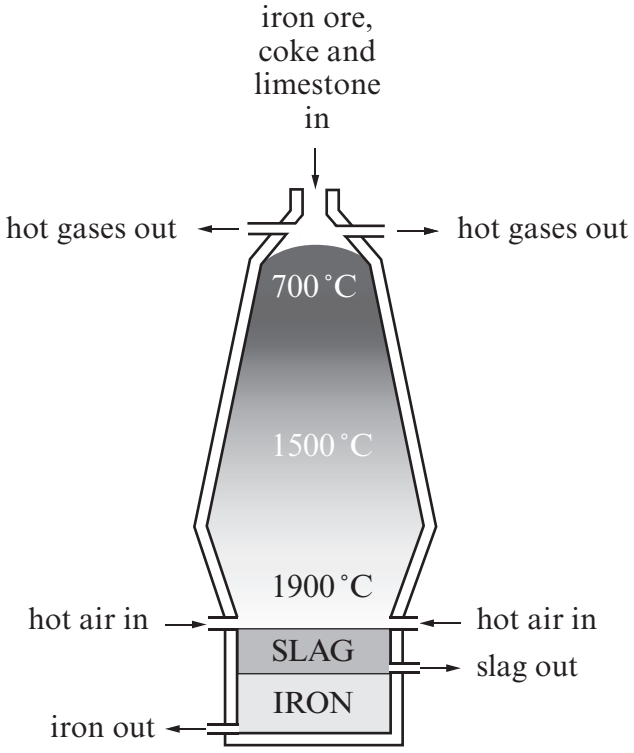
Examiner only

7. Iron can be extracted from its ore in the blast furnace.



(a) Three raw materials used in this process are iron ore, coke and limestone. Explain why each of these materials is used in the blast furnance. [3]

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Examiner only

(b) One reaction that takes place in the blast furnace is shown below.

iron oxide + carbon monoxide ⟶ iron + carbon dioxide

(i) State which of the substances shown in the above equation is oxidised and which is reduced, giving reasons for your answers. [2]

.....

.....

.....

(ii) Fill in the boxes to balance the symbol equation for this reaction. [1]

Fe_2O_3 + ☐ CO ⟶ ☐ Fe + ☐ CO_2

(c) Most of the iron produced is converted into an alloy called steel before use.

State what is meant by an *alloy*. [1]

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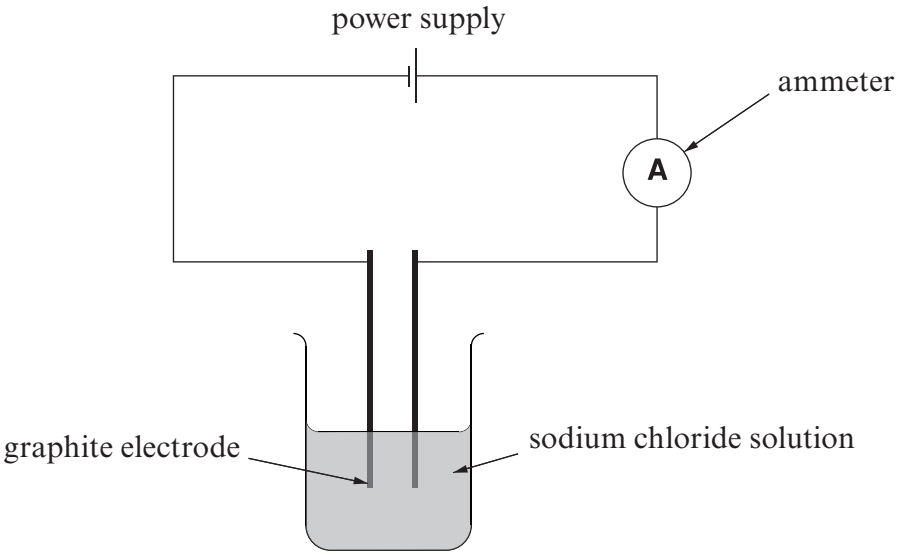
8. Three groups of students used the apparatus shown in the following diagram to investigate how the electric current that a sodium chloride solution conducts depends on the concentration of the solution. Each group prepared their own sodium chloride solutions by dissolving carefully weighed samples of sodium chloride in 50 cm^3 of water.



Their results are shown in the following table.

Group A		Group B		Group C	
Concentration / M	Current / A	Concentration / M	Current / A	Concentration / M	Current / A
0.1	0.07	0.1	0.06	0.1	0.06
0.2	0.14	0.2	0.12	0.2	0.13
0.3	0.20	0.3	0.19	0.3	0.20
0.4	0.28	0.4	0.26	0.4	0.27
0.5	0.35	0.5	0.33	0.5	0.34

Examiner only

(a) Using the information in the table, describe the relationship between the concentration of the sodium chloride solution and the current that flows. [1]

.....

(b) Using the information in the table, state whether the evidence supporting your conclusion in part *(a)* is strong or weak, and give a reason for your answer. [1]

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.....

(c) (i) Calculate the mean value for the current measured using sodium chloride solution with a concentration of 0.5 M. [1]

.....

.....

(ii) Use the following formula to calculate the percentage variation in the current measured using this solution.

$$\frac{\text{(furthest value from mean value} - \text{mean value)}}{\text{mean value}} \times 100\%$$

[2]

.....

.....

(iii) Suggest a reason why each group obtained slightly different values for the current measured at this concentration. [1]

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Examiner only

9. *(a)* A student finds an unlabelled bottle containing a white powder. He suspects that the powder may be either sodium carbonate, sodium chloride or sodium hydroxide.

Describe how the student could identify the substance. [3]

Your answer must include the expected observations for **each** substance.

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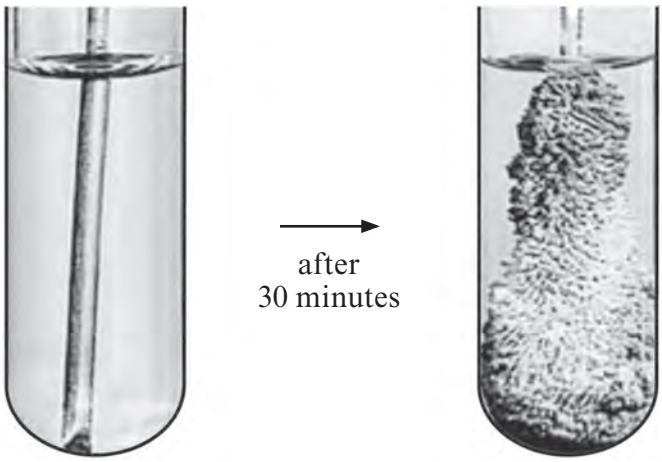
(b) When a copper rod is placed in a solution of silver nitrate, a chemical reaction takes place as shown in the following photographs.



(i) Give a **word** equation for the reaction taking place. [1]

..... + ... ⟶ ..... + ...

(ii) Explain why this reaction takes place. [2]

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10. The Earth's original atmosphere contained mainly carbon dioxide and water vapour with smaller amounts of other gases such as methane and ammonia. Describe the formation of the original atmosphere and explain how it changed to its present-day composition. [6 QWC]

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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^{+}		

Turn over.

PERIODIC TABLE OF ELEMENTS

1	2											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: