Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4472/02

W15-4472-02

ADDITIONAL SCIENCE/CHEMISTRY

CHEMISTRY 2
HIGHER TIER

A.M. TUESDAY, 13 January 2015

1 hour

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

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020001

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.

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.

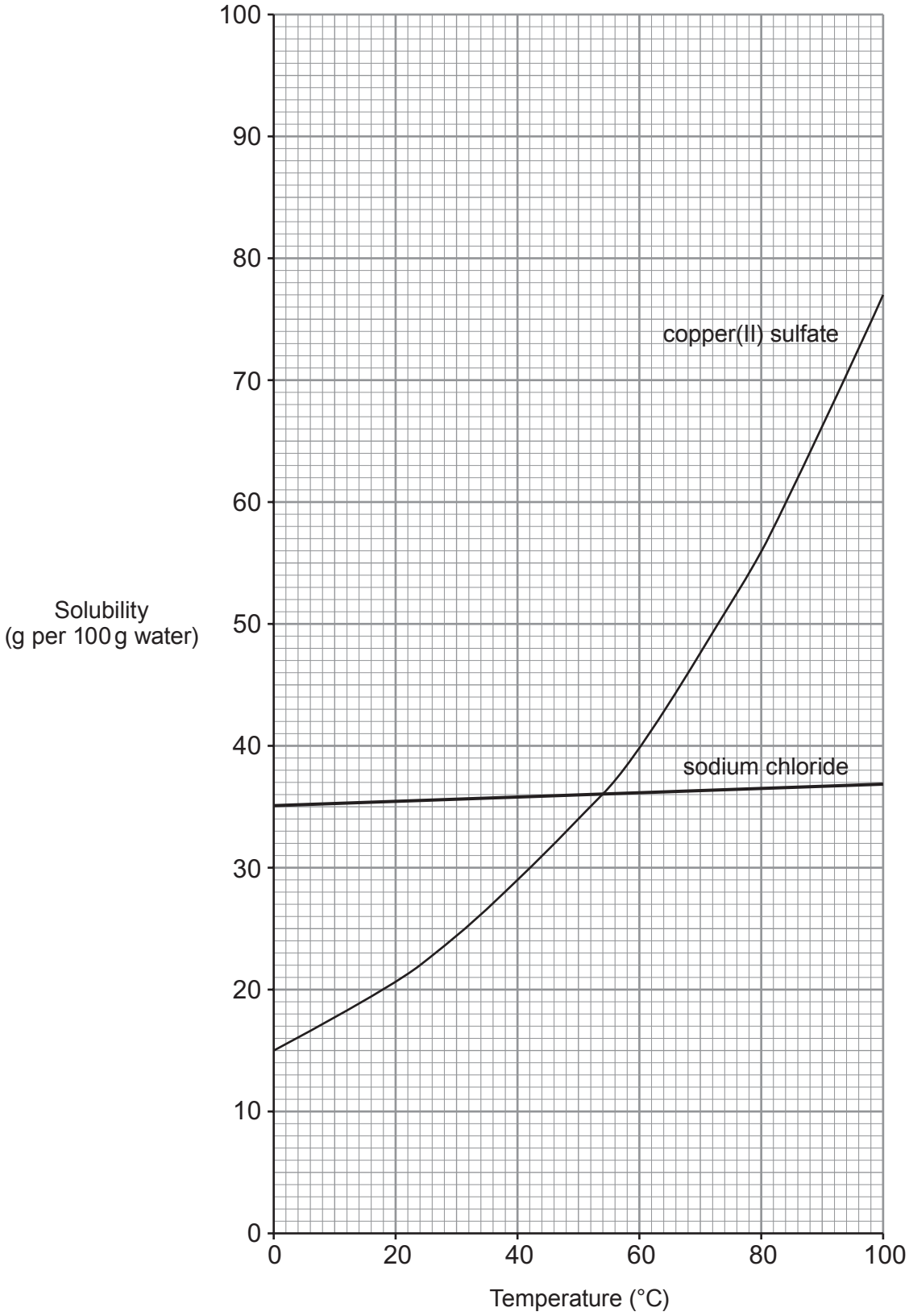
You are reminded of the necessity for good English and orderly presentation in your answers.

Assessment will take into account the quality of written communication (QWC) in your answers to questions **3** and **9**.

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. The graphs below show the solubilities of sodium chloride and copper(II) sulfate in water at different temperatures.



Examiner only

(a) Compare the solubilities of copper(II) sulfate and sodium chloride below 54 °C, at 54 °C and above 54 °C. [3]

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(b) Calculate the mass of solid copper(II) sulfate that forms when a saturated solution in 50 g of water at 80 °C cools to 40 °C. [2]

Mass of solid copper(II) sulfate = ... g

(c) State why the temperature scale on a solubility graph ranges from 0 °C to 100 °C. [2]

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7

Turn over.

Examiner only

2. *(a)* (i) Complete the following table of information about the atoms of some elements. [5]

Element	Symbol	Number of protons	Number of neutrons	Number of electrons
beryllium	$^{9}_{4}Be$	4	5	4
fluorine	$^{19}_{9}F$	9	.....	.....
calcium	.....	20	20	.....
argon	$^{40}_{18}Ar$	.....	22	18

(ii) Give the **names** of the elements which have the same mass number. [1]

..... and .....

(iii) Using **X** to represent an electron, draw the electronic structure of argon. [1]

(b) Boron has two isotopes, $^{11}_{5}B$ and $^{10}_{5}B$.

Give **one** similarity and **one** difference between the nuclei of these two boron atoms. [2]

Similarity .....

Difference .....

9

Examiner only

3. Lithium, sodium and potassium are Group 1 metals.

(a) A teacher wanted to demonstrate the similarities and differences in how each metal reacted with water. She added a small piece of each metal separately to a trough of water.

Describe what you would **see** when each metal is added to water and state how the observations can be used to establish the trend in reactivity within the group. [6 QWC]

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(b) The teacher then demonstrated the reaction of sodium with oxygen.

Complete and balance the symbol equation for this reaction. [2]

$$\square\ Na + O_2 \longrightarrow \square$$ .....

8

Examiner only

4. *(a)* A group of students were given three water samples labelled **A**, **B** and **C**.

They were told that one was temporary hard water, one was permanent hard water and one distilled water, but they were not told which was which. Temporary hard water is softened by boiling.

Describe an investigation you would carry out using soap solution to identify each sample. [5]

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(b) Suggest a reason why energy may be wasted in homes in hard water areas. [1]

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6

Examiner only

5. *(a)* Potassium reacts with sulfur to form potassium sulfide.

Using the electronic structures below, draw dot and cross diagrams to show how bonding takes place during the formation of potassium sulfide. [3]

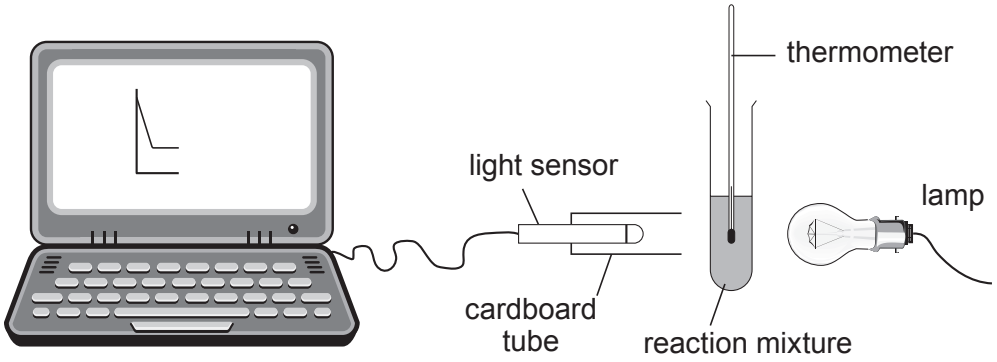
potassium = 2,8,8,1 sulfur = 2,8,6

(b) Using the electronic structures below, draw a dot and cross diagram to show the bonding in a molecule of sulfur difluoride, SF_2. [2]

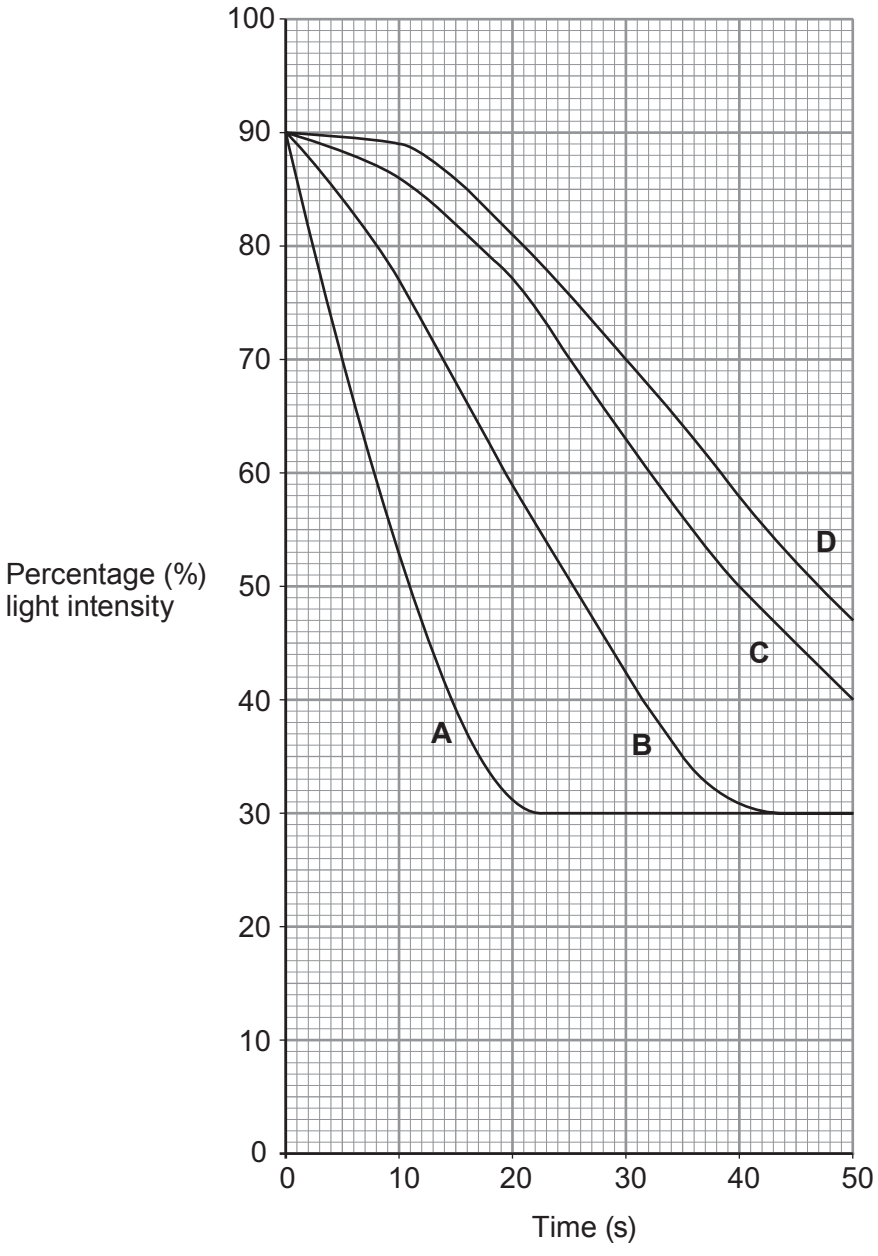
sulfur = 2,8,6 fluorine = 2,7

Examiner only

6. Sodium thiosulfate solution reacts with dilute hydrochloric acid forming a yellow precipitate. This reaction can be investigated using the equipment below. The yellow precipitate formed during the reaction causes a reduction in the amount of light reaching the light sensor.



5 cm^3 of dilute hydrochloric acid was added separately to 10 cm^3 sodium thiosulfate solutions at four different temperatures. All other factors were kept the same. The results are shown on the grid below.



Examiner only

(a) Give the letter **A**, **B**, **C** or **D** of the graph which represents the reaction carried out at the highest temperature and give the reason for your choice. [1]

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(b) The rate of reaction can be calculated using the formula:

$$\text{rate} = \frac{1}{\text{time}}$$

The reaction is considered to be complete when the percentage light intensity reaches 30 %. Use the formula to find the mean rate for experiment **A**. [2]

Rate = ... / s

(c) State and explain, using particle theory, the conclusion you draw from the investigation. [3]

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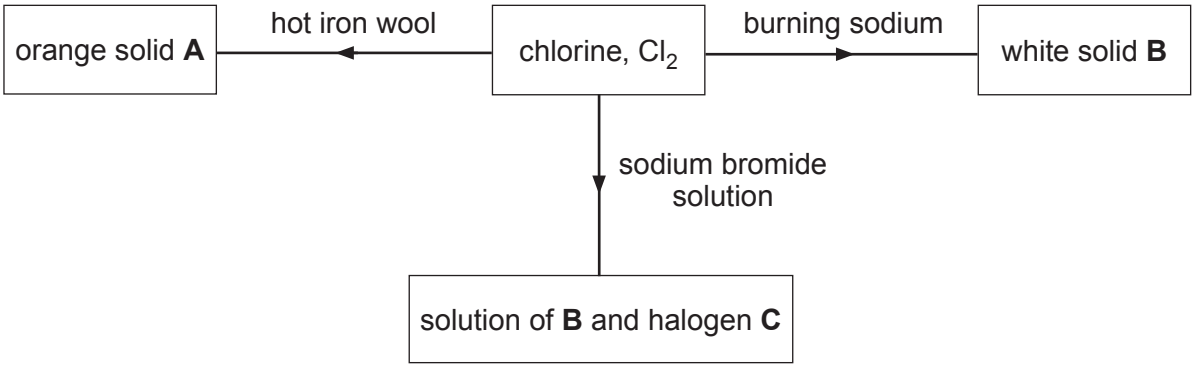
Examiner only

7. *(a)* The diagram below shows some reactions of chlorine, Cl_2.



Give the chemical names for substances **A**, **B** and **C**. [3]

A .....

B .....

C .....

(b) Silver nitrate solution can be used to detect the presence of aqueous halide ions.

(i) The equation below represents the reaction occurring between silver nitrate solution and sodium chloride solution.

$$AgNO_3(aq) + NaCl(aq) \longrightarrow AgCl(s) + NaNO_3(aq)$$

Write the **ionic** equation for the reaction. [2]

..... + ... ⟶ .....

(ii) When silver nitrate solution is added to magnesium bromide solution, $MgBr_2(aq)$, a cream precipitate is formed.

Write the balanced **symbol** equation for this reaction. [3]

..... + ... ⟶ ..... + ...

8

Examiner only

8. *(a)* An unknown alkane, **X**, was found to contain 9.0 g of carbon and 2.0 g of hydrogen. Calculate the simplest formula for this alkane. [3]

A_r(H) = 1 A_r(C) = 12

Simplest formula .....

(b) Calculate the percentage by mass of carbon in butane, an alkane containing four carbon atoms. [2]

A_r(H) = 1 A_r(C) = 12

Percentage by mass of carbon = ... *%*

5

Turn over.

Examiner only

9. Describe and explain the process of addition polymerisation. Include examples to support your answer. [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^{+}		
Zinc	Zn^{2+}		

Turn over.

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: