Surname	Centre Number	Candidate Number
Other Names		0

WJEC CBAC

GCSE

4472/02

ADDITIONAL SCIENCE/CHEMISTRY

CHEMISTRY 2
HIGHER TIER

P.M. MONDAY, 20 May 2013

1 hour

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

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) used in your answers 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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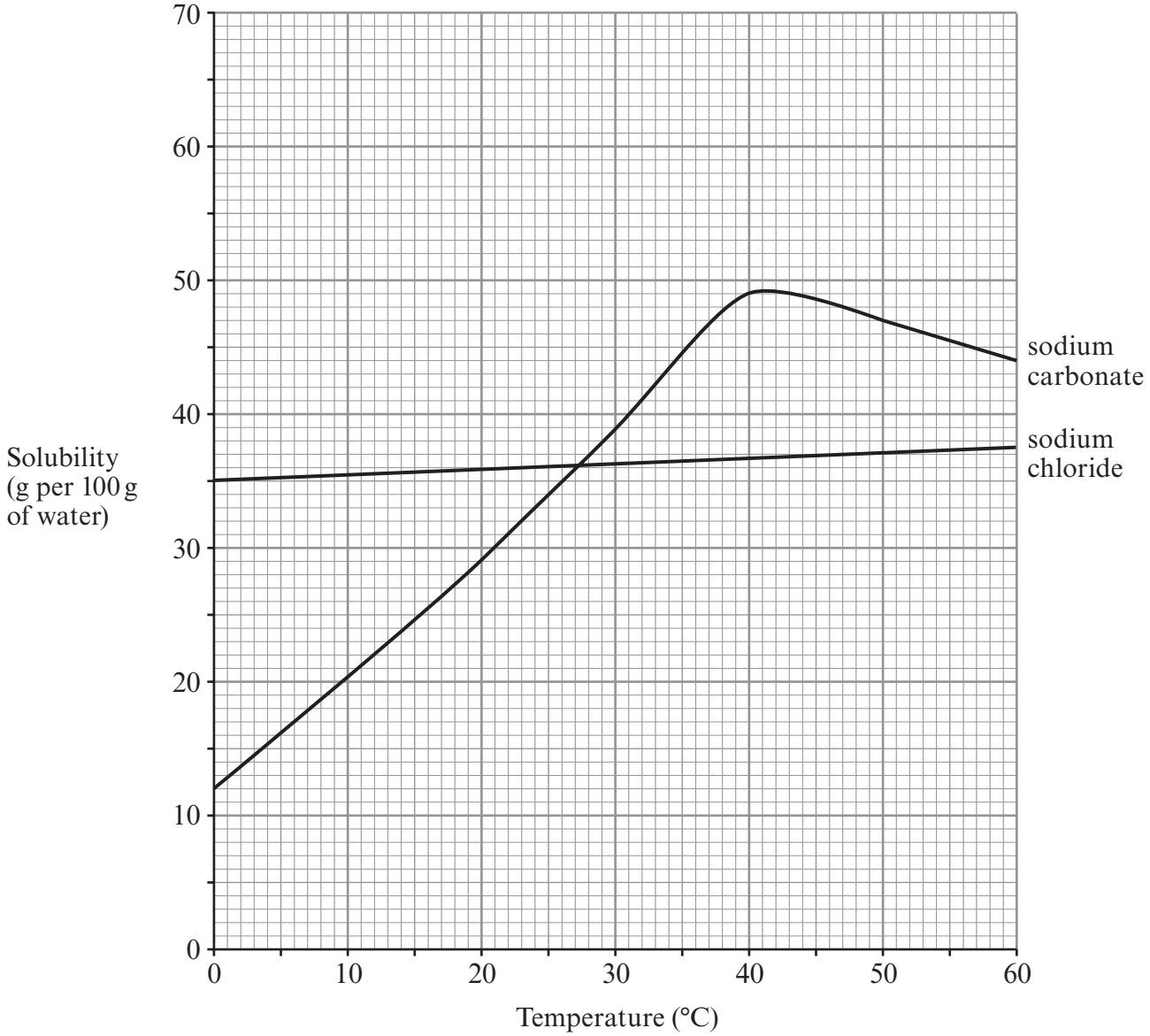
Answer **all** *questions.*

1. The graphs below show the solubilities of sodium chloride and sodium carbonate in water at different temperatures.



(a) Describe the trend in the solubility of sodium carbonate. [1]

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Examiner only

(b) The table below shows the solubility of sodium bromate in water at different temperatures.

Temperature (°C)	0	10	20	30	40	50	60
Solubility (g per 100 g of water)	25	29	35	41	48	55	64

Plot the results from the table on the grid opposite and draw a suitable line. [3]

(c) List the three sodium compounds in order of solubility at 40 °C. [1]

Most soluble .....

.....

Least soluble .....

(d) The solubility of silver chloride is 0.0002 g in 100 g of water at room temperature, 20 °C.

You are given a mixture of sodium chloride and silver chloride powder. Describe how you would obtain a sample of silver chloride from the mixture. [3]

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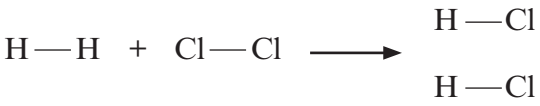
2. The reaction between hydrogen and chlorine to give hydrogen chloride can be represented by the following equation.



The relative amounts of energy needed to break the bonds shown are given in the table below.

Bond	Amount of energy needed to break the bond (kJ)
H — H	436
Cl — Cl	242
H — Cl	431

NOTE: *The amount of energy **released** in making a bond is equal and opposite to that **needed** to break the bond.*

(a) Using the bond energy values in the table, calculate

(i) the relative energy needed to break all the bonds in the **reactants**, [2]

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(ii) the relative energy given out when all the bonds in the **product** are formed. [2]

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(b) Using your answers to part *(a)*, state whether the reaction between hydrogen and chlorine is exothermic or endothermic and give a reason for your answer. [1]

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3. *(a)* A group of students carry out an experiment to investigate the relative hardness of four samples of water, **A**, **B**, **C** and **D**.

The students add soap solution, 0.5 cm^3 at a time, to sample **A**. The mixture is shaken after each addition. The volume of soap solution needed to produce 1 cm of lather is recorded. They test samples **B**, **C** and **D** in exactly the same way. They then repeat the experiment after boiling each sample of water.

The results obtained are shown in the table below.

Water sample	Volume of soap solution needed (cm^3)	
	Before boiling	After boiling
A	10.5	10.5
B	1.5	1.5
C	6.0	1.5
D	9.5	7.0

(i) State which water sample is the hardest and give a reason for your answer. [1]

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(ii) State which water sample contains both permanent and temporary hard water and give a reason for your answer. [2]

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Examiner only

(b) A different group of students carry out a similar investigation with the same water samples, **A**, **B**, **C** and **D**.

Their results are as follows.

Water sample	Volume of soap solution needed (cm^3)	
	Before boiling	After boiling
A	6.0	6.0
B	1.0	1.0
C	3.5	1.0
D	5.5	3.0

Compare the results obtained by the two groups, commenting on the similarity and suggesting a reason for the difference. [2]

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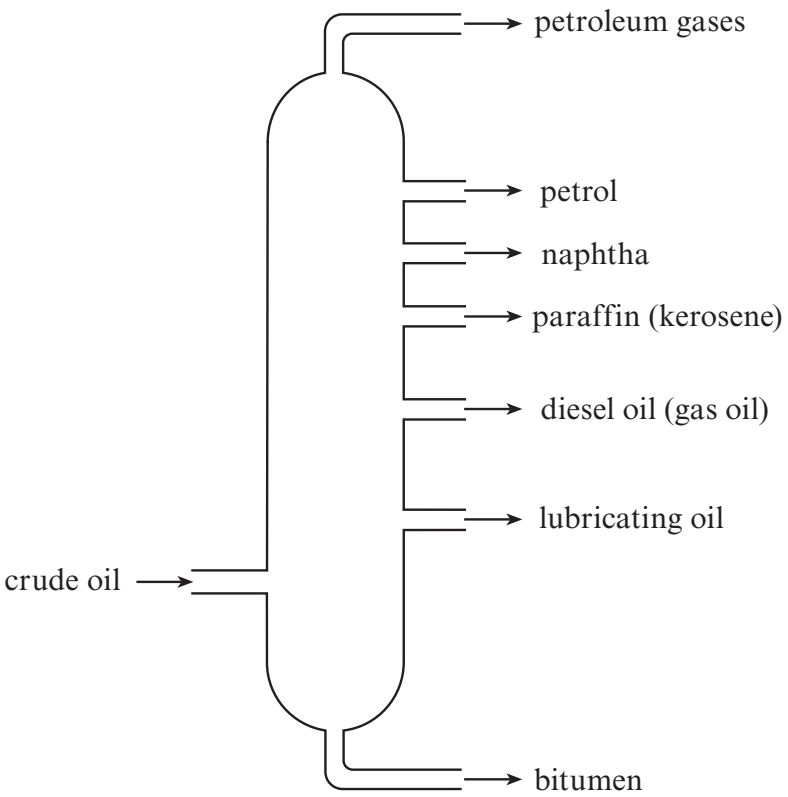
4. The diagram below represents the separation of crude oil into useful fractions in industry.



Write an account of this industrial process. [6 QWC]

Include in your answer

- the name of the separation method,
- what crude oil is,
- a description of how crude oil is separated.

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5. *(a)* Give the electronic structure of sodium, Na. [1]

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(b) Draw a diagram to show the metallic bonding in sodium. [2]

(c) (i) Sodium reacts vigorously with water.

Give **two** observations you would make when a small piece of sodium is added to a trough of water. [1]

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.....

(ii) Name the products of this reaction. [1]

..... and .....

(d) As you go down Group 1 of the Periodic Table the elements become more reactive.

State the main difference you would see if potassium instead of sodium was added to water. [1]

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(e) Explain why Group 1 metal reactivity increases down the group. [2]

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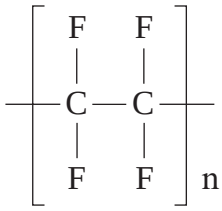
6. *(a)* (i) Give the chemical name of the polymer represented by the diagram below. [1]



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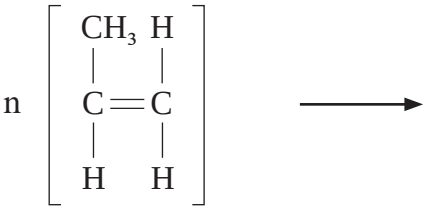
(ii) Propene undergoes polymerisation to give the polymer polypropene.

I Complete the equation for the production of polypropene. [1]



II Name this type of polymerisation. [1]

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(b) There are two types of plastic: thermoplastics and thermosets.

Give **one** similarity and **one** difference in their structures. [2]

Similarity .....

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Difference .....

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7. Substance **S** is a white, solid metal bromide. It dissolves readily in water to give a colourless solution.

(a) On carrying out a flame test with substance **S** a red colour was seen. Name the metal ions present in substance **S**. [1]

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(b) Some silver nitrate solution was added to a solution of substance **S**.

(i) State what was seen. [1]

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(ii) Give the **ionic** equation for the reaction taking place. [2]

..... + ... ⟶ .....

(c) When a Group 7 gas, **G**, is passed through a solution of **S**, the solution turns orange.

(i) Name gas **G**. ..... [1]

(ii) Give the name of the **type** of reaction that takes place between gas **G** and substance **S**. [1]

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Examiner only

8. James and Dilys were asked to carry out an experiment to find the formula of an oxide of copper. In their experiment a crucible containing copper was weighed before heating, then after 5 minutes, 10 minutes and 15 minutes of heating.

Results

Mass of crucible (g)	25.0
Mass of crucible and copper before heating (g)	37.7
Mass of crucible and copper after heating for 5 minutes (g)	40.4
Mass of crucible and copper after heating for 10 minutes (g)	40.9
Mass of crucible and copper after heating for 15 minutes (g)	40.9

(a) In their calculation they did not use the mass recorded after 5 minutes.
Give the reason why they correctly ignored this value. [1]

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(b) Calculate the simplest formula of the copper oxide using the above data. [3]

Show your working.

$A_r(Cu) = 63.5$ $A_r(O) = 16$

Simplest formula .....

4

Examiner only

9. *(a)* Lithium reacts with sulfur to form lithium sulfide.

Using the electronic structures below, draw dot and cross diagrams to show the transfer of electrons and the formation of ions that occur as the reaction takes place. [3]

lithium = 2,1 sulfur = 2,8,6

(b) Sodium chloride and magnesium oxide both have giant ionic structures.

The melting points of the two compounds are given below.

Compound	Melting point (°C)
sodium chloride	801
magnesium oxide	2852

Explain the difference in the melting points of the two compounds. [2]

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Examiner only

(c) Using the electronic structures below, draw a dot and cross diagram to show the bonding in a molecule of hydrogen peroxide. [2]

The structural formula for hydrogen peroxide is as follows.

H — O — O — H

hydrogen = 1 oxygen = 2,6

Examiner only

10. Explain, using particle theory, how the rate of a chemical reaction depends on concentration and temperature. [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+}		

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: