Surname	Centre Number	Candidate Number
Other Names		0



GCSE

4472/01



ADDITIONAL SCIENCE/CHEMISTRY

CHEMISTRY 2 FOUNDATION TIER

A.M. TUESDAY, 13 January 2015

1 hour

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

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 answer to question 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.

Answer all questions.

1. (a) The diagram below shows the three main stages in the treatment of public water supplies.

water source	Stage 1	Stage 2	Stage 3		
reservoir	sedimentation	filtration	process	A	homes
(i)) Reservoirs are a water so Give the name of one oth		water supplies.		[1]
(ii)) Give the number of the removed from the water.	stage where lar	ge insoluble pa	rticles settle	out and are [1]
	Stage				
(iii)		lorination	boiling d	listillation	
	In stage 3 the water is ste the box above the name			-organisms.	Choose from [1]
	Process A				
	drought conditions, sugges rsonal hygiene.	t one way you	could conserve	e water with	out affecting [1]

[3]

2. Draw a line to link each type of smart material to its property.

Property

thermochromic pigment

Smart material

absorbs water up to 1000 times its volume

hydrogel

changes colour with changing temperature

shape memory alloy

regains its original shape when heated

photochromic pigment

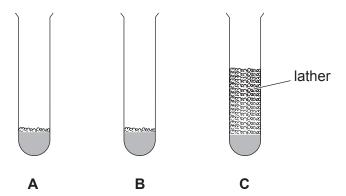
changes colour with changing light intensity

4472 010003

3

© WJEC CBAC Ltd. (4472-01) Turn over.

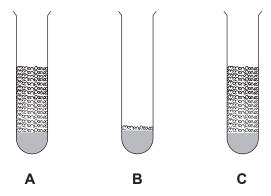
- 3. (a) An investigation was carried out to compare the hardness of three water samples A, B and C.
 - (i) 1 cm³ of soap solution was added to 5 cm³ of the three water samples. Each tube was shaken for 1 minute. The results are shown in the diagram below.



hich of the samples contain hard water. Give the reason for your answer.	
	2]
•	•

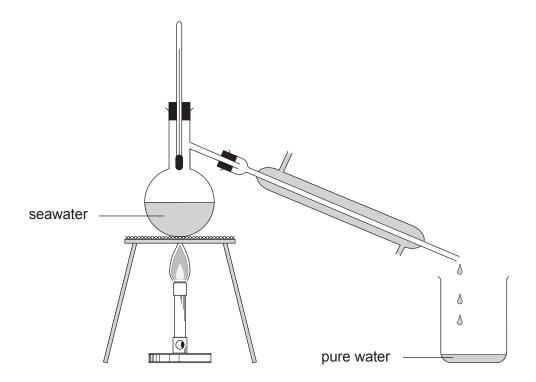
(ii) Water can contain temporary or permanent hardness. Water containing temporary hardness can be softened by boiling.

 $1\,\mathrm{cm^3}$ of soap solution was added to $5\,\mathrm{cm^3}$ of **boiled** samples of **A**, **B** and **C**. Each tube was shaken for 1 minute. The results are shown below.



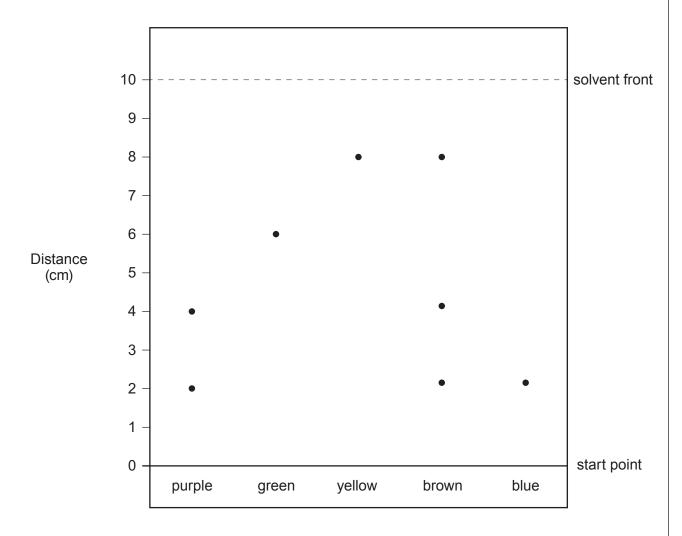
State what reasoning.	results	tell	you	about	samples	Α,	В	and	C.	Include	your [2]
	 										· · · · · · · · · · · · · · · · · · ·

4472 010005



(i)	Describe how pure water is separated from seawater.	[3]
(ii)	Suggest what you would see if 1 cm ³ of soap solution were added to 5 cm ³ of p water in a test tube and the tube shaken for 1 minute. Give the reason for y answer.	

4. The diagram below shows the chromatogram of several food colourings.



Food colouring

(a)	Use the chromatogram to give the two food colourings that are mixed to make bro	wn food
	colouring.	[1]

..... and

(b)	The R _f value of a substance can be used to identify that substance.
	The R _f value for a red food colouring is 0.4.

Use the equation below to calculate the distance this red food colouring would move on this chromatogram. [2]

distance moved = $R_f \times distance$ moved by the solvent

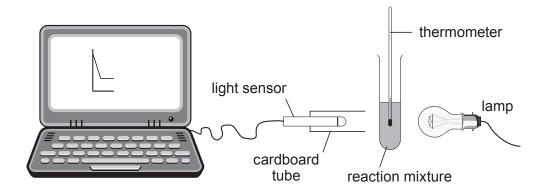
Distance moved = cm

(c) Give the reason why water is used as the solvent when obtaining this chromatogram of food colourings.[1]

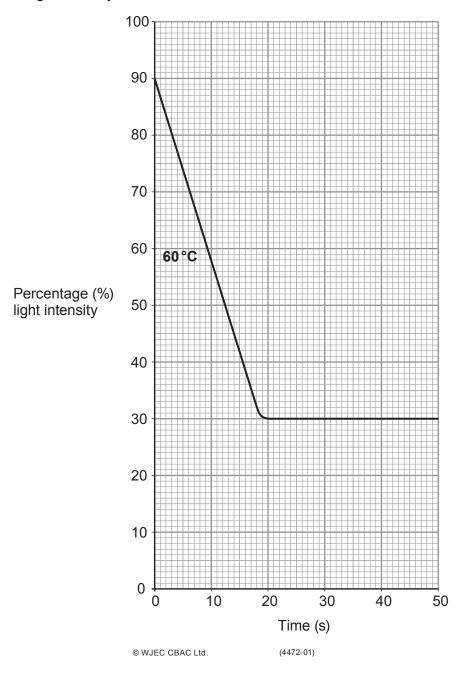
.....

4

5. Sodium thiosulfate solution reacts with dilute hydrochloric acid forming a yellow precipitate. This reaction was investigated using the equipment below.



 $5\,\mathrm{cm^3}$ of dilute hydrochloric acid was added to $10\,\mathrm{cm^3}$ sodium thiosulfate solution at $60\,^\circ\mathrm{C}$ and the light intensity was measured over time. The results are shown on the grid below.



(a)	Use the graph to find the time taken for the reaction to stop.	[1]	or
	<i>Time</i> =s		
(b)	The experiment was repeated at 40 °C. The reaction stopped after 35 s. Carefully draw the graph of this experiment on the same grid.	[1]	
(c)	Explain why the light intensity decreases as this reaction takes place.	[2]	
(d)	Suggest one possible reason why the light intensity does not fall to 0%.	[1]	

Examiner only

5

6. (a) The following diagram shows the structural formula of propene.

Give the molecular formula of propene.

[1]

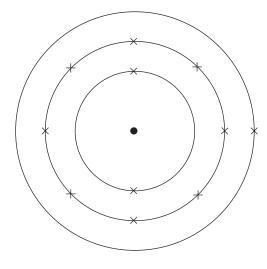
(b) An alkane contains three carbon atoms and eight hydrogen atoms. Draw its structural formula. [1]

(c) The equation below shows the formation of polyethene from ethene.

n
$$C = C$$
H
H
H
 $C = C$
H

Describe what happens to ethene molecules during the formation of polyethene. [3]

7. (a) The diagrams below show the electronic structure of a sodium atom and a chlorine atom.



sodium atom

chlorine atom

(i) Give the number of electrons in the ${\color{blue} outer}$ shell of

[1]

a sodium atom,

a chlorine atom.

(ii) Sodium reacts with chlorine to form a white solid.

I State, in terms of electrons, what happens to sodium and chlorine atoms during this reaction. [2]

II Complete the **word** equation for this reaction. [1]

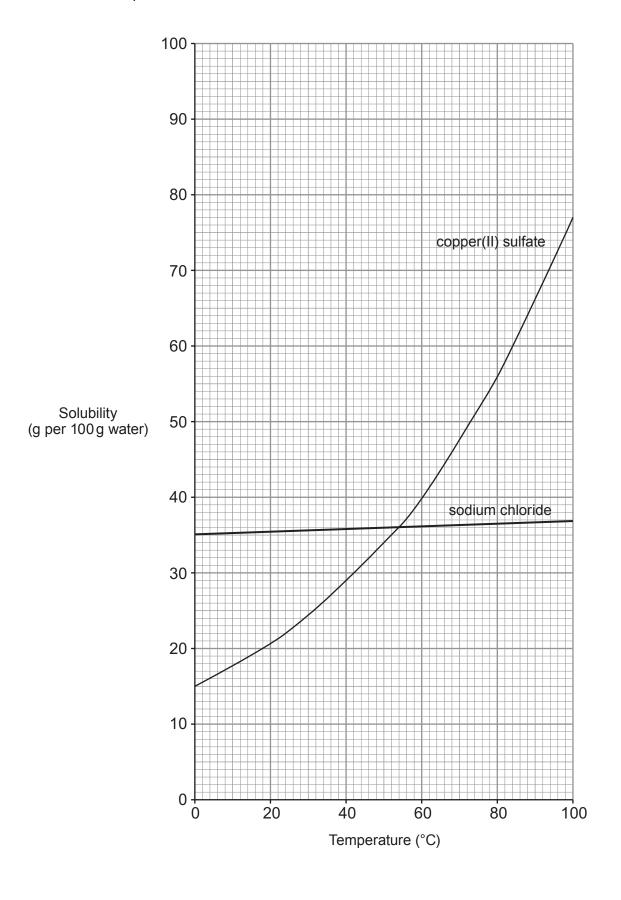
sodium + chlorine ----

(b) Sodium chlorate, NaClO $_3$, is used to bleach paper. Calculate the relative formula mass (M_r) of sodium chlorate. [2]

$$A_r(O) = 16$$
 $A_r(Na) = 23$ $A_r(CI) = 35.5$

$$M_{\rm r}({\rm NaClO_3}) = \dots$$

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



(a)	Compare the solubilities of copper(II) sulfate and sodium chloride below 54 °C, at 54 °C and above 54 °C.	
(b)	Calculate the mass of solid copper(II) sulfate that forms when a saturated solution in 50 of water at 80 °C cools to 40 °C. [2]	
(c)	Mass of solid copper(II) sulfate =	

9. (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 Ar		22	18

(ii)	Give the names of the elements which have the same mass number.				
	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

			Exar
).	Lithiu	m, 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]	
	•••••		
	•••••		
	•••••		
	•••••		
	•••••		
	(b)	The teacher then demonstrated the reaction of sodium with oxygen.	
	(2)	Complete and balance the symbol equation for this reaction. [2]	
		Na + O ₂ →	
		END OF PAPER	

END OF PAPER

BLANK PAGE

BLANK PAGE

© WJEC CBAC Ltd. (4472-01) Turn over.

BLANK PAGE

FORMULAE FOR SOME COMMON IONS

POSITIV	E IONS	NEGATIVE IONS						
Name	Formula	Name	Formula					
Aluminium	Al ³⁺	Bromide	Br ⁻					
Ammonium	NH ₄ ⁺	Carbonate	CO ₃ ²⁻					
Barium	Ba ²⁺	Chloride	CI ⁻					
Calcium	Ca ²⁺	Fluoride	F ⁻					
Copper(II)	Cu ²⁺	Hydroxide	OH ⁻					
Hydrogen	H ⁺	lodide	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

	0	⁴ He	Helium	20 Ne	Neon	40 Ar	Argon	84 Kr 36 Kr	Krypton	131 Xe	Xenon	²²² Rn	Radon					
		4 0	<u> </u>	ш														
	_			9 6	n Fluorine	35 CI	Chlorine	80 Br 35 Br	n Bromine	127	n lodine	210 At 85 At	n Astatine					
	9			0 8	Oxygen	32 S	Sulfur	⁷⁹ Se	Selenium	128 Te	Tellurium	²¹⁰ Po	Polonium					
	2			N 41 N 7	Nitrogen	31 P	Phosphorus	75 AS	Arsenic	122 Sb	Antimony	209 Bi	Bismuth					
	4			12 C	Carbon	28 Si	Silicon	73 Ge	Germanium	119 Sn 50 Sn	Tin	²⁰⁷ Pb	Lead					
)	က			# 5 B	Boron	27 AI	Aluminium	70 Ga	Gallium	115 In	Indium	204 TI	Thallium				<u>,</u>	IOO
								65 Zn	Zinc	112 Cd	Cadmium	201 Hg	Mercury				0	Element Symbol
								64 29 Cu	Copper	108 47 47	Silver	197 Au	Gold					בופווג ה
))								59 Ni	Nickel	106 Pd	Palladium	195 Pt	Platinum			Γ	\ >	,
		Ţ	Hydrogen					59 Co	Cobalt	103 Rh	Rhodium	192 	Iridium			_	<u>∢</u>	
	dn							⁵⁶ Fe	Iron	101 Ru	Ruthenium	190 OS	Osmium					ŗ
) 	Group							55 Mn	Manganese	99 TC	Technetium	¹⁸⁶ Re	Rhenium				Mass number	Atomic cimotor
								52 Cr	Chromium	96 42 Mo	Molybdenum	184 W	Tungsten		Key:	:	Mass	A+0+
								51 V 23 V	Vanadium	93 Nb	Niobium	¹⁸¹ Ta	Tantalum					
								48 Ti	Titanium	91 Zr	Zirconium	179 Hf	Hafnium					
								45 Sc	Scandium	89 ★	Yttrium	139 La 57 La	Lanthanum	²²⁷ ₈₉ Ac	Actinium			
	7			⁹ ₄ Be	Beryllium	24 Mg	Magnesium	40 Ca	Calcium	88 38 Sr	Strontium	137 Ba	Barium	226 Ra 88	Radium			
	_			3 ⁷ Li	Lithium	23 Na	Sodium	39 K	Potassium	86 Rb	Rubidium	133 CS 55	Caesium	223 Fr 87	Francium			

Name

© WJEC CBAC Ltd.

(4472-01)