Edexcel Certificate

Edexcel International GCSE

Centre Number

Candidate Number

Chemistry

Unit: KCH0/4CH0
Science (Double Award) KSC0/4SC0
Paper: 1C

Monday 21 May 2012 – Morning
Time: 2 hours

Paper Reference
KCH0/1C 4CH0/1C
KSC0/1C 4SC0/1C

You must have:
Calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need*.
- Show all the steps in any calculations and state the units.

Information

- The total mark for this paper is 120.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

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1/1/1/1/

Turn over ▶

PEARSON

P 4 0 1 3 4 A 0 1 2 8

4CH0 | 2012 | May/June | Paper 1 | GradeMax

THE PERIODIC TABLE

Period | **Group**

	1	2												3	4	5	6	7	0

1

| | | | | | 1
H
Hydrogen
1 | | | | | | | | | | | | | | 4
He
Helium
2 |

2

| 7
Li
Lithium
3 | 9
Be
Beryllium
4 | | | | | | | | | | | | | 11
B
Boron
5 | 12
C
Carbon
6 | 14
N
Nitrogen
7 | 16
O
Oxygen
8 | 19
F
Fluorine
9 | 20
Ne
Neon
10 |

3

| 23
Na
Sodium
11 | 24
Mg
Magnesium
12 | | | | | | | | | | | | | 27
Al
Aluminium
13 | 28
Si
Silicon
14 | 31
P
Phosphorus
15 | 32
S
Sulfur
16 | 35.5
Cl
Chlorine
17 | 40
Ar
Argon
18 |

4

| 39
K
Potassium
19 | 40
Ca
Calcium
20 | 45
Sc
Scandium
21 | 48
Ti
Titanium
22 | 51
V
Vanadium
23 | 52
Cr
Chromium
24 | 55
Mn
Manganese
25 | 56
Fe
Iron
26 | 59
Co
Cobalt
27 | 59
Ni
Nickel
28 | 63.5
Cu
Copper
29 | 65
Zn
Zinc
30 | 70
Ga
Gallium
31 | 73
Ge
Germanium
32 | 75
As
Arsenic
33 | 79
Se
Selenium
34 | 80
Br
Bromine
35 | 84
Kr
Krypton
36 |

5

| 86
Rb
Rubidium
37 | 88
Sr
Strontium
38 | 89
Y
Yttrium
39 | 91
Zr
Zirconium
40 | 93
Nb
Niobium
41 | 96
Mo
Molybdenum
42 | 99
Tc
Technetium
43 | 101
Ru
Ruthenium
44 | 103
Rh
Rhodium
45 | 106
Pd
Palladium
46 | 108
Ag
Silver
47 | 112
Cd
Cadmium
48 | 115
In
Indium
49 | 119
Sn
Tin
50 | 122
Sb
Antimony
51 | 128
Te
Tellurium
52 | 127
I
Iodine
53 | 131
Xe
Xenon
54 |

6

| 133
Cs
Caesium
55 | 137
Ba
Barium
56 | 139
La
Lanthanum
57 | 179
Hf
Hafnium
72 | 181
Ta
Tantalum
73 | 184
W
Tungsten
74 | 186
Re
Rhenium
75 | 190
Os
Osmium
76 | 192
Ir
Iridium
77 | 195
Pt
Platinum
78 | 197
Au
Gold
79 | 201
Hg
Mercury
80 | 204
Tl
Thallium
81 | 207
Pb
Lead
82 | 209
Bi
Bismuth
83 | 210
Po
Polonium
84 | 210
At
Astatine
85 | 222
Rn
Radon
86 |

7

| 223
Fr
Francium
87 | 226
Ra
Radium
88 | 227
Ac
Actinium
89 |

Key

Relative atomic mass
Symbol
Name
Atomic number

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Answer ALL questions.

1   A student was asked to find the mass of salt dissolved in 100 cm³ of sea water.

She was given the following instructions.

    Step **A**   Weigh an empty evaporating basin

    Step **B**   Transfer 50 cm³ of sea water into the basin

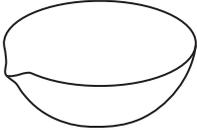   Step **C**   Heat the sea water in the basin until all the water has evaporated
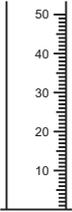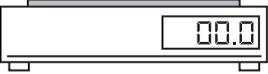
    Step **D**   Allow the basin and residue to cool

    Step **E**   Weigh the basin and residue of salt

(a) During the experiment, the student used several pieces of apparatus.
Some of them are shown in the table.

Complete the table.

(6)

Image of apparatus	Name of apparatus	One step in which the apparatus was used
	evaporating basin	**C**
	....	....
....	tripod	....
	....	....

(b) State, with a reason, **one** safety precaution that the student should take when doing this experiment.

(2)

Precaution

....

Reason

....

....

....

(c) The student obtained the following results.

mass of basin and salt (step **E**) = 81.50 g

mass of empty basin (step **A**)   = 78.60 g

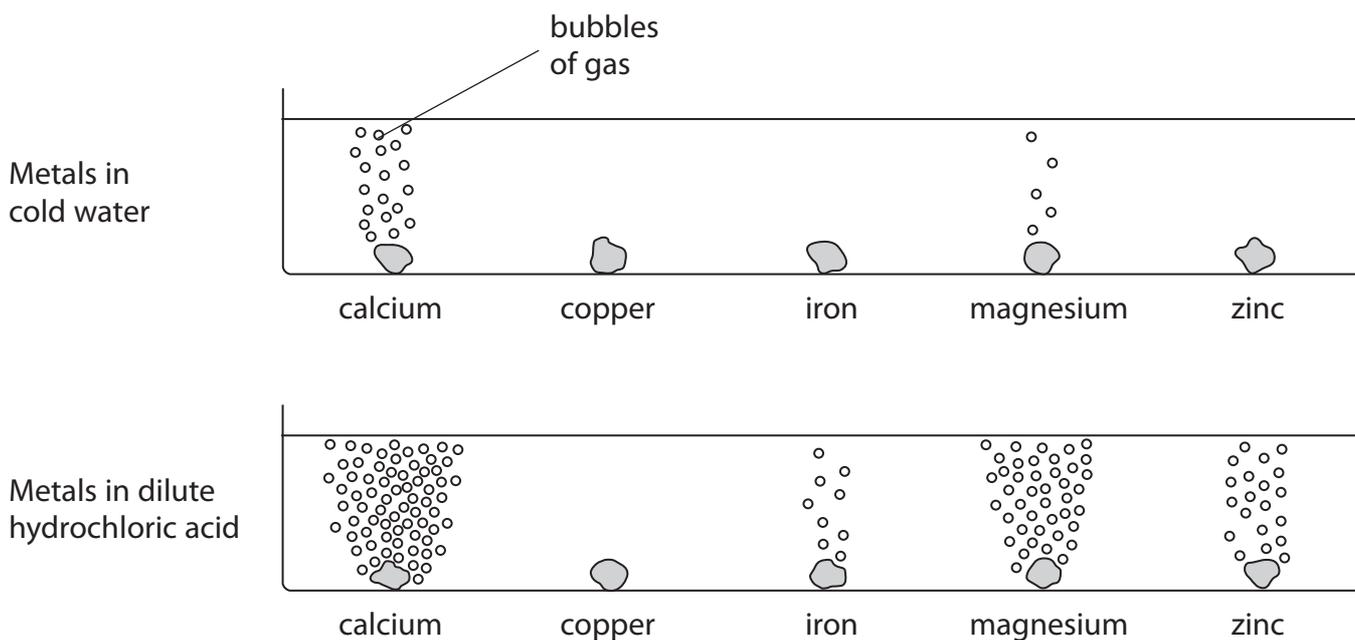Calculate the mass of salt dissolved **in 100 cm³** of sea water.

(1)

Mass of salt = ... g

(Total for Question 1 = 9 marks)

2 The diagrams show the reactions of some metals with cold water and with dilute hydrochloric acid.

bubbles of gas

Metals in cold water

calcium   copper   iron   magnesium   zinc

Metals in dilute hydrochloric acid

calcium   copper   iron   magnesium   zinc

(a) Answer the following questions, using only the metals that appear in the diagrams.

(i) Name **two** metals that react with cold water.

(2)

.... and ....

(ii) Name **one** metal that reacts with dilute hydrochloric acid but **not** with cold water.

(1)

....

(iii) Arrange the five metals in order of reactivity.

(3)

Most reactive metal   ....

....

....

....

Least reactive metal   ....

(b) Some magnesium powder is added to dilute sulfuric acid in a test tube.
A colourless solution is formed and a gas is given off.

When more magnesium is added, the reaction continues for a while and then stops, leaving some magnesium powder in the test tube.

When a flame is placed at the mouth of the test tube, the gas burns with a squeaky pop.

(i) Identify the gas produced.

(1)

....

(ii) Suggest why the reaction stops.

(1)

....

....

(iii) State the name of the colourless solution.

(1)

....

(iv) How could you separate the magnesium powder from the colourless solution?

(1)

....

....

(c) In some fireworks, magnesium powder reacts quickly with oxygen in the air.
During this reaction heat energy is produced.

(i) What name is given to reactions in which heat energy is produced?

(1)

....

(ii) Name the compound formed when magnesium reacts with oxygen.

(1)

....

(Total for Question 2 = 12 marks)

3 When solutions are mixed together, precipitates sometimes form.

(a) Barium carbonate is an insoluble compound. It is formed as a precipitate when solutions of the soluble compounds barium chloride and sodium carbonate are mixed.

When solutions of the soluble compounds potassium chloride and sodium sulfate are mixed, no precipitate is formed.

Complete the table to show the results of mixing solutions of some compounds.

(3)

	sodium carbonate solution	sodium sulfate solution
barium chloride solution	precipitate of barium carbonate	....
potassium chloride solution	....	no precipitate
calcium chloride solution	precipitate of calcium carbonate	....

(b) When solutions of lead(II) nitrate and potassium bromide are mixed, a precipitate of lead(II) bromide and a solution of potassium nitrate are produced.

The equation for the reaction is

$$Pb(NO_3)_2(\text{................}) + 2KBr(\text{................}) \rightarrow PbBr_2(\text{................}) + 2KNO_3(\text{................})$$
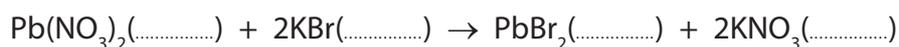
Complete the equation by inserting the state symbols.

(1)

(c) In order to prepare a **pure**, **dry** sample of lead(II) bromide, a student took the mixture produced in part (b).

He then

- filtered the mixture
- washed the solid residue with distilled water
- left the solid in a warm place for several hours

(i) Why did the student filter the mixture?

(1)

....

....

....

(ii) Why did he wash the solid residue?

(1)

....

....

....

(iii) Why is it better to use distilled water rather than tap water to wash the solid residue?

(1)

....

....

....

(iv) Why did he leave the solid in a warm place?

(1)

....

....

....

(Total for Question 3 = 8 marks)

4 The diagram shows the positions of some elements in the Periodic Table.

1	2											3	4	5	6	7	0
																	He
																F	
Na																**Cl**	
K																**Br**	

(H is shown in the top row between groups 2 and 3.)

(a) Complete the following sentence.

(1)

The elements in the Periodic Table are arranged in order of ....

....

(b) Name an element shown in the diagram that is:

(2)

(i) a metal ....

(ii) a halogen ....

(c) (i) Name **two** elements in the diagram that react together to form an ionic compound.

(1)

.... and ....

(ii) Draw a dot and cross diagram for the ions in the compound formed in (c)(i).
Show only the outer electrons. Include the charge on each ion.

(3)

(d) Chlorine reacts quickly with hot iron to form iron(III) chloride.
Bromine reacts less quickly with hot iron to form iron(III) bromide.

Suggest how fluorine reacts with hot iron and name the compound formed.

(2)

....

....

(e) When chlorine gas is bubbled through an aqueous solution of sodium bromide,
a displacement reaction takes place.

The ionic equation for the reaction is:

$$Cl_2(g) + 2Br^-(aq) \rightarrow 2Cl^-(aq) + Br_2(aq)$$

State the colour change that you would observe in the solution during this reaction.

(2)

Colour at start ....

Colour at end ....

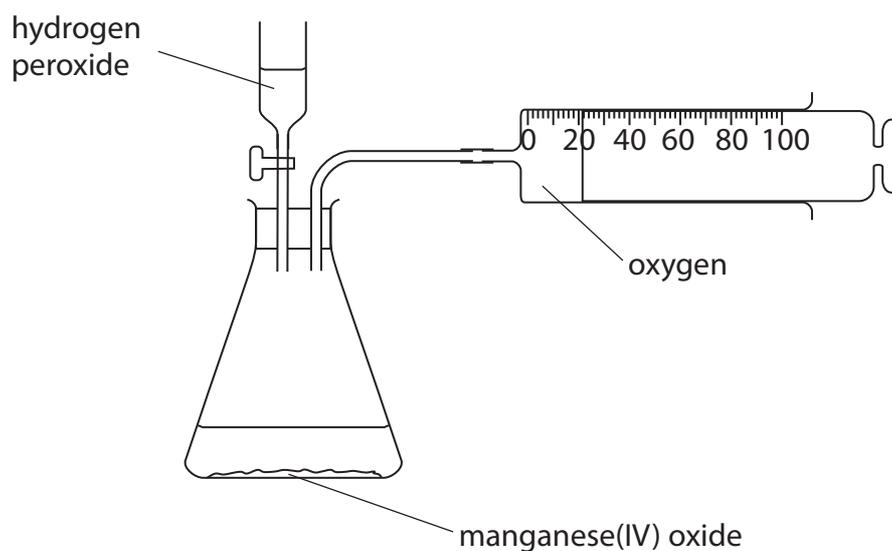**(Total for Question 4 = 11 marks)**

5   The apparatus in the diagram is used to collect the oxygen produced by the decomposition of hydrogen peroxide, H_2O_2

(a) Write a chemical equation for the decomposition of hydrogen peroxide.

(2)

....

(b) Describe a test to show that the gas collected in the syringe is oxygen.

(1)

....

....
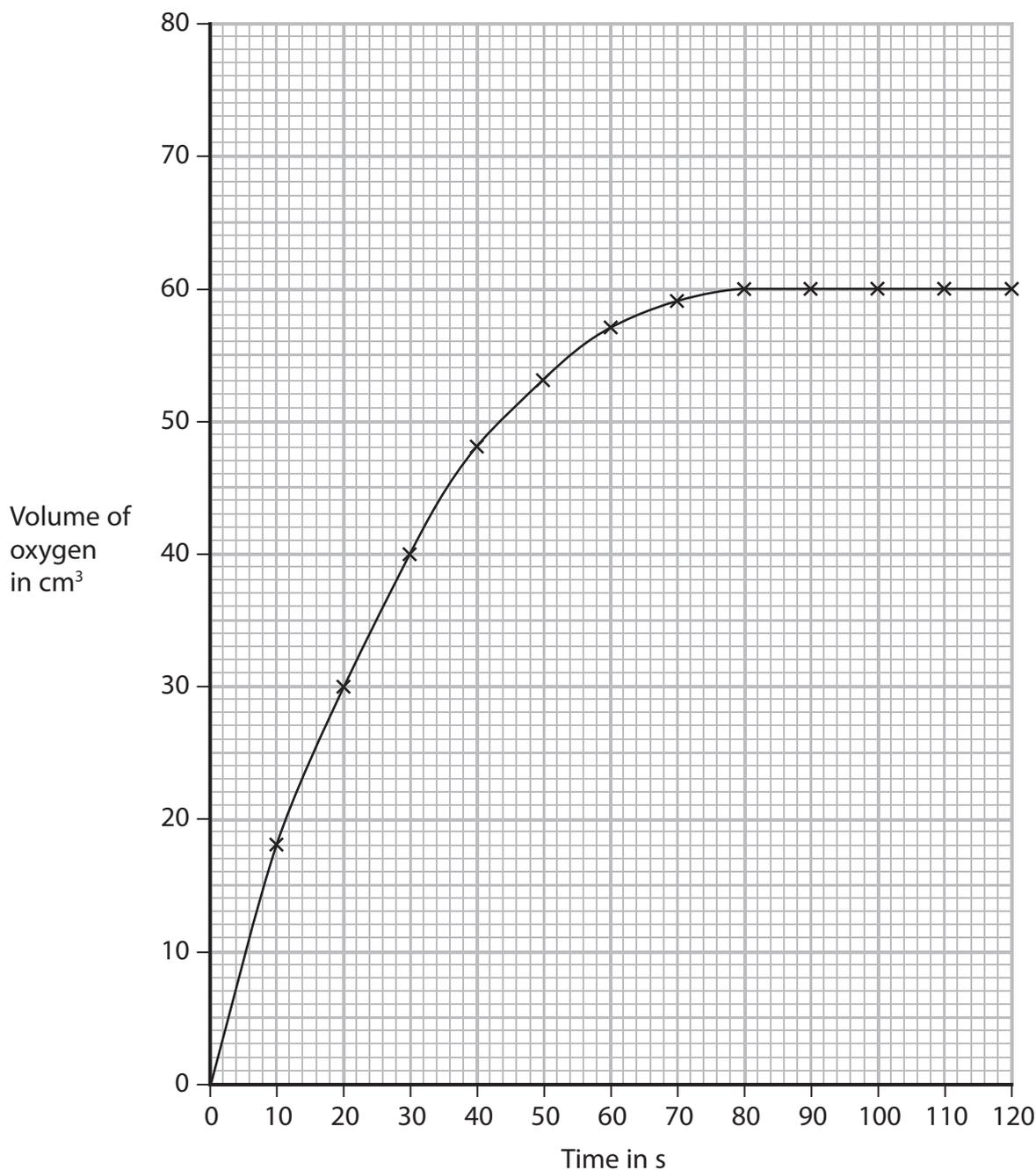
(c) Manganese(IV) oxide is a catalyst for this reaction.

State and explain the effect of a catalyst on the rate of this reaction.

(3)

....

....

....

....

....

....

(d) The graph shows the results from an experiment using a 0.50 mol/dm³ solution of hydrogen peroxide at 25 °C.

(i) On the same axes, sketch the curve you would expect with the same volume of a 0.25 mol/dm³ solution of hydrogen peroxide at 25 °C. Label this curve **A**.

(2)

(ii) On the same axes, sketch the curve you would expect with the same volume of a 0.50 mol/dm³ solution of hydrogen peroxide at 35 °C. Label this curve **B**.

(2)

(Total for Question 5 = 10 marks)

6 The element carbon has three common isotopes.
These are carbon-12, carbon-13 and carbon-14.

(a) Complete the table to show the number of protons and neutrons in each isotope of carbon.

(2)

Isotope	Mass number	Number of protons	Number of neutrons
carbon-12	12	6	6
carbon-13	13		
carbon-14	14		

(b) Explain, in terms of electrons, why the three isotopes have the same chemical properties.

(1)

....

....

(c) (i) State what is meant by the term **relative atomic mass, A_r**

(2)

....

....

....

....

(ii) A sample of carbon contained 98.90% carbon-12 and 1.10% carbon-13.

Use this information to calculate the relative atomic mass of carbon in the sample.
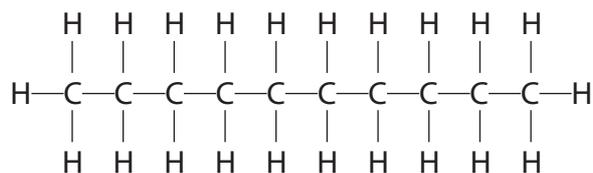Give your answer to **two** decimal places.

(3)

Relative atomic mass ....

(Total for Question 6 = 8 marks)

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7 Decane is a hydrocarbon found in crude oil.

The diagram shows the structure of a decane molecule.

H H H H H H H H H H
| | | | | | | | | |
H—C—C—C—C—C—C—C—C—C—C—H
| | | | | | | | | |
H H H H H H H H H H

(a) (i) Explain why decane is described as a hydrocarbon.

(2)

....

....

(ii) Give the molecular formula for decane.

(1)

....
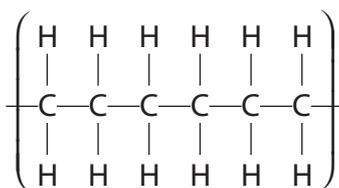
(b) Decane and ethene, C_2H_4, are produced during the cracking of eicosane, $C_{20}H_{42}$

Ethene is used to make poly(ethene).
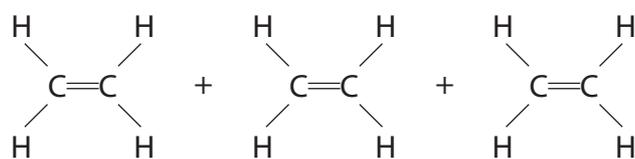
ethene

poly(ethene)

(i) What is the name given to this type of polymerisation?

(1)

....

(ii) Use the diagram to state **two** changes that occur during the formation of poly(ethene).

(2)

....

....

....

....

(c) Explain why cracking is an important process in the oil industry.

(4)

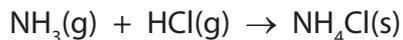..

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....

(Total for Question 7 = 10 marks)

8 When ammonia gas and hydrogen chloride gas mix, they react together to form a white solid called ammonium chloride.

The equation for the reaction is:

$$NH_3(g) + HCl(g) \rightarrow NH_4Cl(s)$$

A cotton wool pad was soaked in ammonia solution and another was soaked in hydrogen chloride solution. The two pads were then put into opposite ends of a dry glass tube at the same time.

After five minutes, a white ring of solid ammonium chloride formed.

pad soaked
in ammonia
solution

white ring
of ammonium
chloride

pad soaked in
hydrogen chloride
solution

60 cm   40 cm
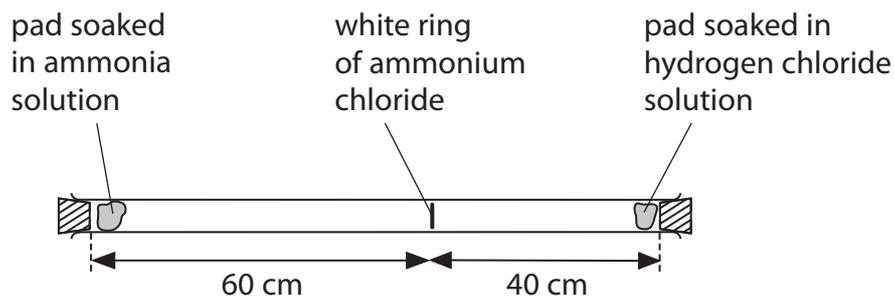
(a) (i) What name is given to the movement of the two gases?

(1)

....

   (ii) Identify which gas is moving faster and give a reason for your choice.

(1)

....

....

(b) The experiment was repeated at a higher temperature.

   State and explain how this change would affect the time taken for the white ring to form.

(3)

....

....

....

....

....

....

(c) Gas particles move at a speed of several hundred metres per second at room temperature.

Suggest **one** reason why it took five minutes for the white ring to form.

(1)

....

....

(Total for Question 8 = 6 marks)

9 When water is added to a mixture of sand and cement, a reaction takes place between silicon dioxide in the sand and calcium oxide in the cement. The reaction produces a salt called calcium silicate.
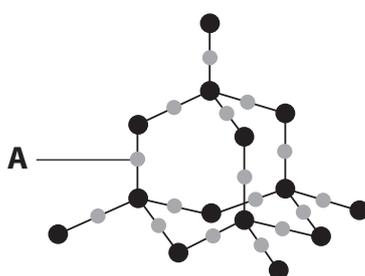
The equation for the reaction is:

$$SiO_2 + CaO \rightarrow CaSiO_3$$

(a) Explain why silicon dioxide reacts with calcium oxide.

(2)

....

....

(b) Part of the structure of silicon dioxide is shown in the diagram.

A —

(i) What does particle **A** represent? Give a reason for your answer.

(2)

....

....

(ii) Explain, in terms of its bonding and structure, why silicon dioxide has a very high melting point.

(4)

....

....

....

....

....

....

....

....

....

(Total for Question 9 = 8 marks)

10 When sodium is burned in air, one of the products is a pale yellow solid, **X**.

(a) A sample of solid **X** was found to contain 1.15 g of sodium and 0.80 g of oxygen.

(i) Show, by calculation, that the empirical formula of **X** is NaO.

(2)

(ii) The relative formula mass of **X** is 78.

Deduce the formula of **X**.

(2)

Formula of **X** ....

(b) Solid **X** reacts with water to form sodium hydroxide, NaOH, and hydrogen peroxide, H_2O_2

(i) Write a chemical equation to represent the reaction between **X** and water.

(2)

....

(ii) The solution formed in the reaction between **X** and water turns red litmus blue.

Identify the ion that causes this change.

(1)

....

(iii) The displayed formula for hydrogen peroxide is H—O—O—H.

Complete the dot and cross diagram to show the arrangement of the outer shell (valence) electrons in a molecule of hydrogen peroxide.

(2)

$$H_X^{\circ} O \qquad O \; {}_X^{\bullet} H$$

(Total for Question 10 = 9 marks)

Turn over ▶

11 A student carried out a series of tests on a solid, **M**, in order to identify the ions that could be present.

The table shows her results.

Test	Method	Result
Test 1	Carry out a flame test on solid **M**	Lilac flame
Test 2	Dissolve solid **M** in water, and divide the solution into three portions, A, B and C	
	Portion A – add dilute sodium hydroxide solution	Green precipitate
	Portion B – add dilute hydrochloric acid, then barium chloride solution	No change
	Portion C – add dilute nitric acid, then silver nitrate solution	Yellow precipitate

(a) Identify the ion responsible for

(3)

   (i)   the lilac colour in the flame test

....

   (ii) the green precipitate when sodium hydroxide solution was added

....

   (iii) the yellow precipitate when silver nitrate solution was added

....

(b) Describe how the student should carry out a flame test on solid **M**.

(3)

....

....

....

....

....

....

....

....

(c) (i) Why was dilute nitric acid added to the solution of solid **M** before using silver nitrate solution?

(1)

....

(ii) Why should dilute hydrochloric acid **not** be used in place of dilute nitric acid in this test?

(2)

....

....

....

(d) The tests for negative ions that the student carried out involved precipitation.

Suggest **one** negative ion that cannot be identified by a precipitation reaction.

(1)

....

(Total for Question 11 = 10 marks)

12 Lead can be extracted from lead(II) sulfide, PbS, in two stages.

Stage 1: Lead(II) sulfide is heated in air. It reacts with oxygen to produce lead(II) oxide and sulfur dioxide.

Stage 2: The lead(II) oxide is then heated in a blast furnace with coke.

(a) Write a chemical equation for the reaction in **Stage 1**.

(2)

....

(b) The equation for the reaction that occurs when lead(II) oxide is heated with coke in a blast furnace is:

$$2PbO + C \rightarrow 2Pb + CO_2$$

(i) State, with a reason, whether PbO is oxidised or reduced in this reaction.

(1)

....

....

....

(ii) Calculate the minimum mass, in tonnes, of coke needed to react with 44.6 tonnes of lead(II) oxide.
[1 tonne = 10^6 g]

(3)

Mass of coke needed = ... tonnes

(c) The molten lead obtained from the blast furnace contains 0.1% silver dissolved as an impurity.

The silver is removed by:

- adding zinc to the mixture of molten lead and silver at 530 °C and removing the mixture of molten zinc and silver that forms on top of the molten lead

- heating the mixture of molten zinc and silver until the zinc boils off as a gas, leaving almost pure, solid silver behind

Use the information above to answer the following questions.

(i) What can you deduce about the relative solubility of silver in zinc and in lead?

(1)

....

....

(ii) What can you deduce about the melting point of the mixture of zinc and silver?

(1)

....

....

(iii) What can you deduce about the boiling point of zinc compared to that of silver?

Explain your answer.

(2)

....

....

....

....

(iv) Suggest why so much trouble is taken to remove such a small amount of silver from the lead.

(1)

....

....

(Total for Question 12 = 11 marks)

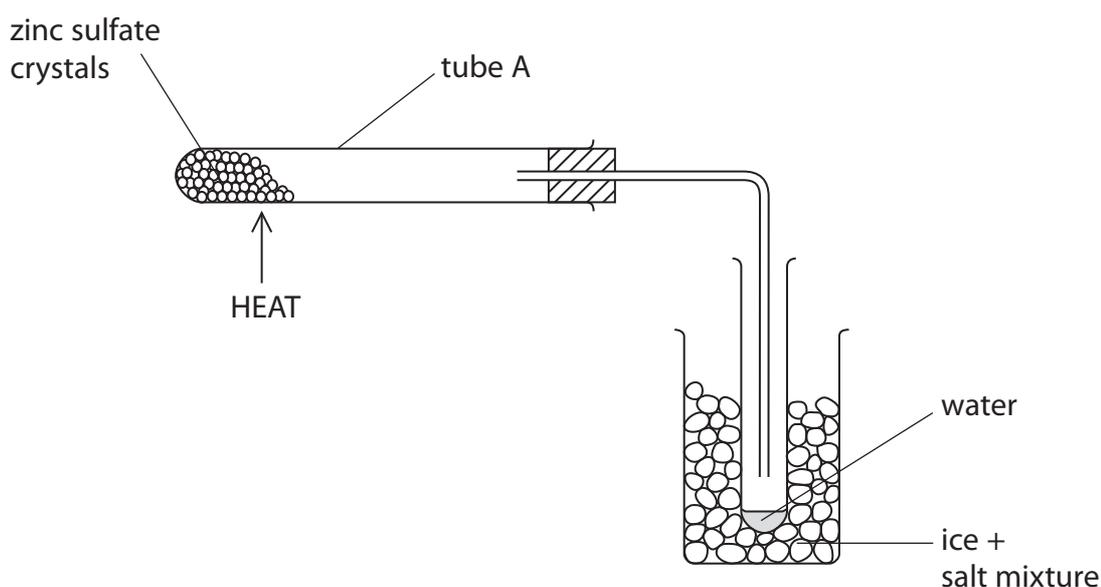**13** (a) Crystals of hydrated zinc sulfate, $ZnSO_4.xH_2O$, contain water of crystallisation.

A student used the apparatus shown to remove and collect the water of crystallisation from the crystals in order to find the value of x.

He weighed the empty tube A.

He placed a sample of hydrated zinc sulfate crystals in tube A and reweighed it.

He heated the tube, allowed it to cool and weighed it again.

He repeated this process until two consecutive masses were the same. This is known as 'heating to constant mass'.

When hydrated zinc sulfate crystals are heated gently, they decompose according to the following equation:

$$ZnSO_4.xH_2O \rightarrow ZnSO_4 + xH_2O$$
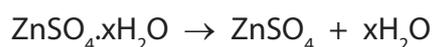
The following masses were recorded:

Mass of tube A   = 10.12 g

Mass of tube A + $ZnSO_4.xH_2O$ = 18.73 g

Mass of tube A and $ZnSO_4$ after heating to constant mass   = 14.95 g

(i) Calculate the mass of $ZnSO_4$ formed after heating to constant mass.

(1)

....

(ii) Calculate the mass of water collected after heating to constant mass.

(1)

....

(iii) The relative formula mass of $ZnSO_4$ is 161

The relative formula mass of water is 18

Use this information, and your answers to (a)(i) and (a)(ii), to calculate the value of x in the formula $ZnSO_4.xH_2O$

Show your working.

(3)

x = ...

(b) Why is it necessary to heat the crystals to constant mass?

(1)

....

....

(c) Describe how the student could use a chemical test to show that the liquid collected was water.

(2)

....

....

....

....

(Total for Question 13 = 8 marks)

(TOTAL FOR PAPER = 120 MARKS)

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