Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2016–2017

Double Award Science: Chemistry

MV18

Unit C1

Higher Tier

[GSD22]

THURSDAY 18 MAY 2017, MORNING

Time

1 hour, plus your additional time allowance.

Instructions to Candidates

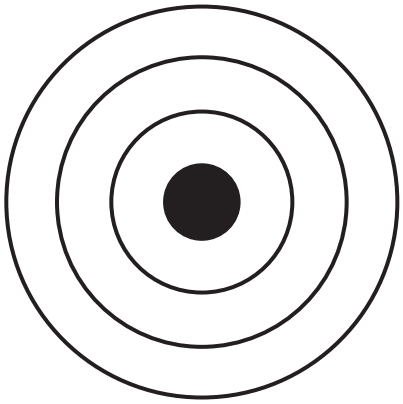
Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Complete in black ink only.
Answer **all eight** questions.

Information for Candidates

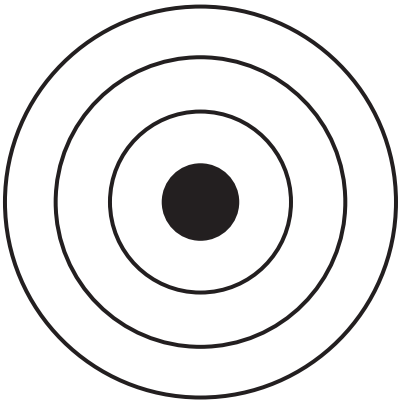
The total mark for this paper is 70.
Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **2**.
A Data Leaflet, which includes a Periodic Table of the elements is provided.

1 Chlorine gas has the chemical formula Cl_2.
Chlorine reacts with magnesium to form the compound magnesium chloride.

(a) (i) Complete the diagrams below to show **all** the electrons in a magnesium atom and a chlorine atom. [2 marks]



magnesium atom



chlorine atom

(ii) Describe how the electronic arrangements of both atoms change when they form magnesium and chloride ions. [2 marks]

_____

_____

_____

(iii) How are the ions held together in magnesium chloride? [1 mark]

_____

(b) (i) In the space below draw a dot and cross diagram to show the bonding in chlorine Cl_2. Only outer electrons are needed. [3 marks]

(ii) Chlorine is described as a diatomic gas. What does the term diatomic mean? [1 mark]

_____

2 Two bottles were found in a chemical store but the labels had fallen off.
The teacher needed to find out which bottle contained **potassium** and which one contained **lithium**.

Describe how the teacher could **safely** react both of the metals with water and compare **similarities** and **differences** that would be observed between the two reactions. [6 marks]

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

Safety precautions needed in carrying out the reactions:

Similarities observed:

Differences observed:

3 **(a)** What is meant by the term solubility? [4 marks]

Solubility is the mass of a solid required to _____

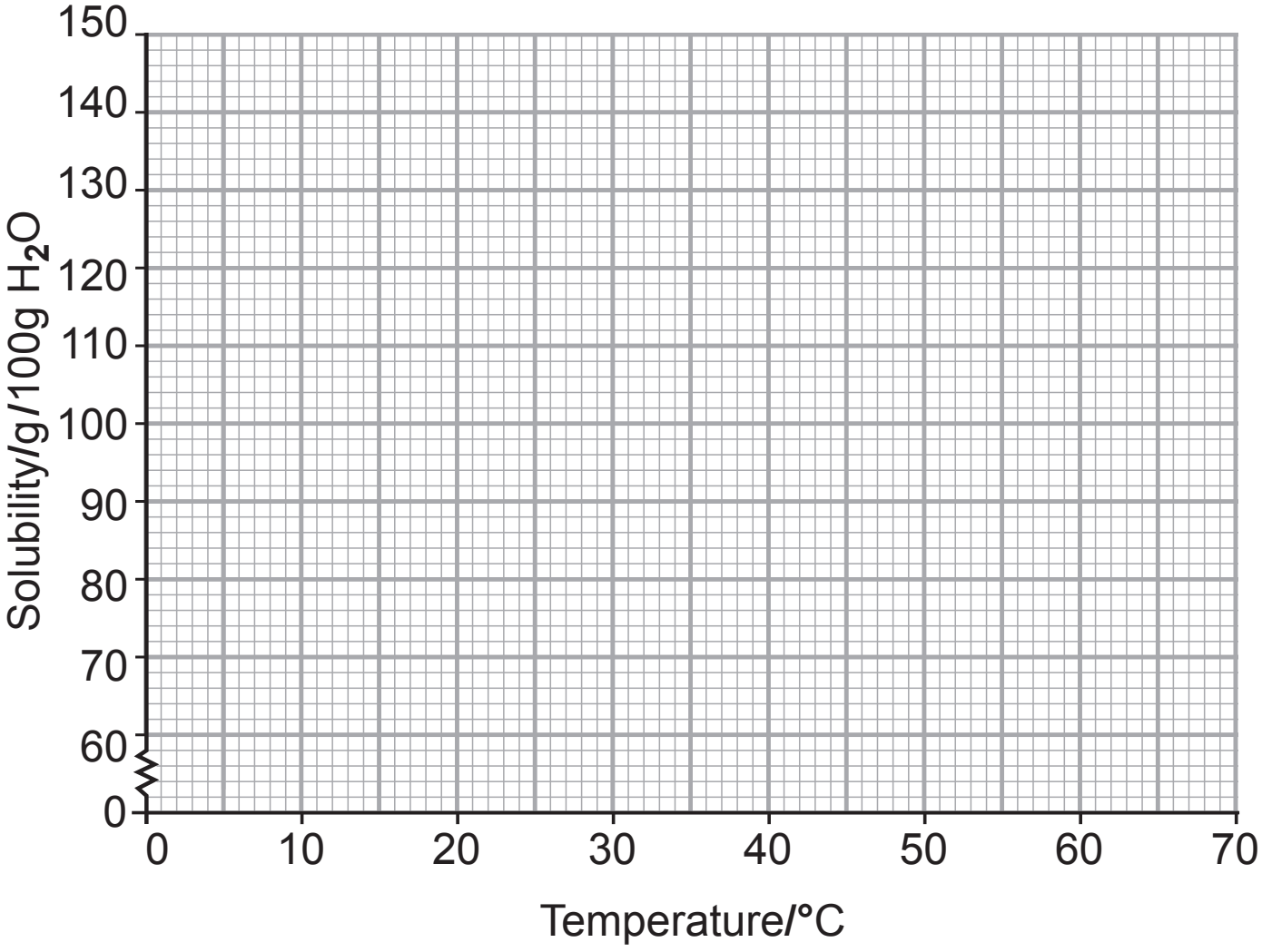
_____

_____

(b) The table below gives the results of an investigation to find the solubility of sodium nitrate ($NaNO_3$) at different temperatures.

Temperature/°C	10	20	30	40	50	60	70
Solubility/g/100g H_2O	80	88	96	105	114	124	135

(i) On the grid below plot a solubility curve for sodium nitrate. [3 marks]



(ii) Use your solubility curve to find the solubility of sodium nitrate at 25 °C. [1 mark]

_____

(iii) Calculate the mass of solid that would crystallise when a saturated solution of sodium nitrate in 50 g of water is cooled from 65 °C to 25 °C. [3 marks]

You must show your working out.

_____ g

(c) (i) Describe the trend in solubility with temperature for sodium nitrate. [1 mark]

_____

_____

(ii) Complete the table below to show how solubility can be expected to change with temperature for the three substances.
Tick (✓) the three correct boxes. [3 marks]

Substance	Solubility **increases** with temperature increase	Solubility **decreases** with temperature increase
potassium chloride		
carbon dioxide		
copper(II) sulfate		

4 The table below gives data on some **atoms** and **ions**, which are labelled A, B and C.

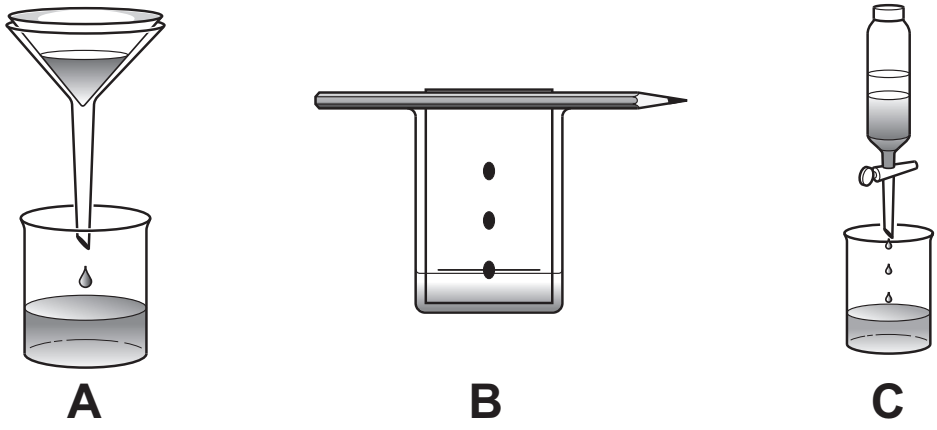
(a) Use your knowledge and understanding of atomic structure to complete the gaps. [3 marks]

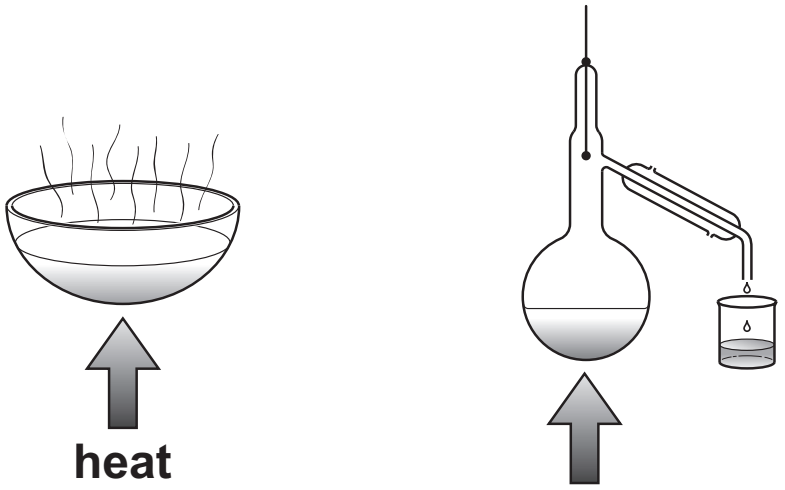
atom/ion	mass number	number of protons	number of neutrons	number of electrons
A		11	12	11
B	16	8		10
C	7		4	2

(b) Work out which atoms or ions are represented by A and B.
Complete the table below. [4 marks]

atom/ion	chemical symbol/formula	charge
A		
B		

5 The diagrams below show five different methods of separating mixtures.





D E

(a) (i) Choose the diagram above which shows the method used to separate excess solid from a saturated solution and draw a circle on that diagram to show where the residue is found. [1 mark]

(ii) A liquid ink is miscible with water. Which diagram **A**, **B**, **C**, **D** or **E** shows the best method for separating miscible liquid mixtures? [1 mark]

_____

(b) Describe what is observed when solid iodine is heated in a boiling tube.
Give **two** observations. [2 marks]

1. _____

_____

2. _____

_____

(c) Argon is a noble gas.
Explain why argon is very unreactive. [2 marks]

_____

_____

_____

6 The table below gives information about four compounds A, B, C and D which dissolve in water to give either acidic, neutral or alkaline solutions.

(a) (i) Complete the table below. [3 marks]

compound	Does it produce H^+ ions in water?	Does it produce OH^- ions in water?	pH	colour of universal indicator in the solution
A	yes	no	4	orange
B	yes	no	1	red
C			14	purple
D	no	no		green

(ii) Use the information given in the table to identify each of the compounds A, B, C and D from the list below: [4 marks]

sulfuric acid ammonia sodium chloride

ethanoic acid sodium hydroxide

A _____

B _____

C _____

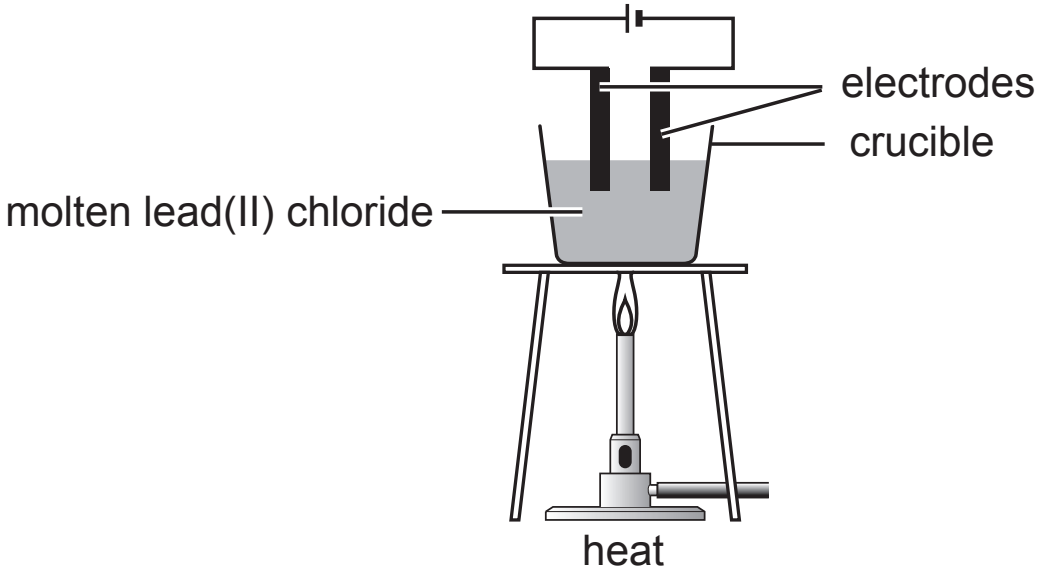
D _____

(b) Complete and balance the equation below for the reaction of copper(II) oxide with hydrochloric acid. [2 marks]

$$CuO \quad + \quad HCl \quad \rightarrow$$

(c) What are the units of concentration for acids? [1 mark]

7 The diagram below shows the apparatus required to carry out the electrolysis of lead(II) chloride.



(a) (i) Explain why the lead(II) chloride needs to be molten. [2 marks]

(ii) Explain why **this** reaction should be carried out in a fume cupboard. [1 mark]

(b) Complete the table with the observations and product formed at each electrode during the electrolysis of lead(II) chloride. [2 marks]

	observations at cathode	product at cathode	observations at anode	product at anode
lead(II) chloride	grey metal beads			

(c) Write a balanced half equation for the reaction at the **anode**. [3 marks]

8 **(a)** Draw a labelled diagram to show the bonding and structure of a metal such as copper. [3 marks]

(b) Copper is used in electrical wiring because it is ductile. Explain, in terms of its structure, why copper is ductile. [2 marks]

(c) Some properties of six different substances A, B, C, D, E, and F are given in the table below.

substance	melting point /°C	boiling point /°C	electrical conductivity	
			solid	liquid
A	–7	58	poor	poor
B	98	883	good	good
C	0	100	poor	poor
D	3662	4827	poor	poor
E	1538	2862	good	good
F	605	1382	poor	good

From the table above choose the substance A, B, C, D, E or F which:

(i) can be identified by using anhydrous copper(II) sulfate. [1 mark]

_____

(ii) could be the element with an electronic configuration of 2,8,1. [1 mark]

_____

(iii) could be the element bromine. [1 mark]

_____

(iv) could be a compound which can undergo electrolysis. [1 mark]

THIS IS THE END OF THE QUESTION PAPER

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
Total Marks	

Examiner Number