



Rewarding Learning

General Certificate of Secondary Education
2016–2017

Centre Number

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Candidate Number

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Double Award Science: Chemistry

Unit C1
Higher Tier

[GSD22]

MV18

THURSDAY 10 NOVEMBER 2016, 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.

Write your answers in the spaces provided in this question paper.
Answer **all seven** 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 **3(d)**.

A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

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1 Six particles are listed below.



From the list of particles above give an example of:

(a) an atom [1 mark]

(b) a compound [1 mark]

(c) a molecular ion [1 mark]

(d) a halogen molecule [1 mark]

2 The table below gives information on the solubility of some gases at different temperatures.

Gas	Formula	Solubility at 10 °C g/100 g water	Solubility at 20 °C g/100 g water
argon	Ar	0.79	0.59
nitrogen	N ₂	0.28	0.18
carbon dioxide	CO ₂	0.25	0.17
oxygen	O ₂	0.57	0.44
chlorine	Cl ₂	1.00	0.71

Use the information in the table and your own knowledge to answer the questions that follow:

(a) (i) Describe the trend in solubility for these gases as the temperature increases. [1 mark]

(ii) Which gas is the most soluble at 20 °C? [1 mark]

(iii) Which gas is the least soluble at 10 °C? [1 mark]

(iv) Which gas had the smallest change in its solubility as the temperature increased? [1 mark]

(v) List the gases in the table which are diatomic.
[2 marks]

(vi) Which gas, listed in the table, is toxic? [1 mark]

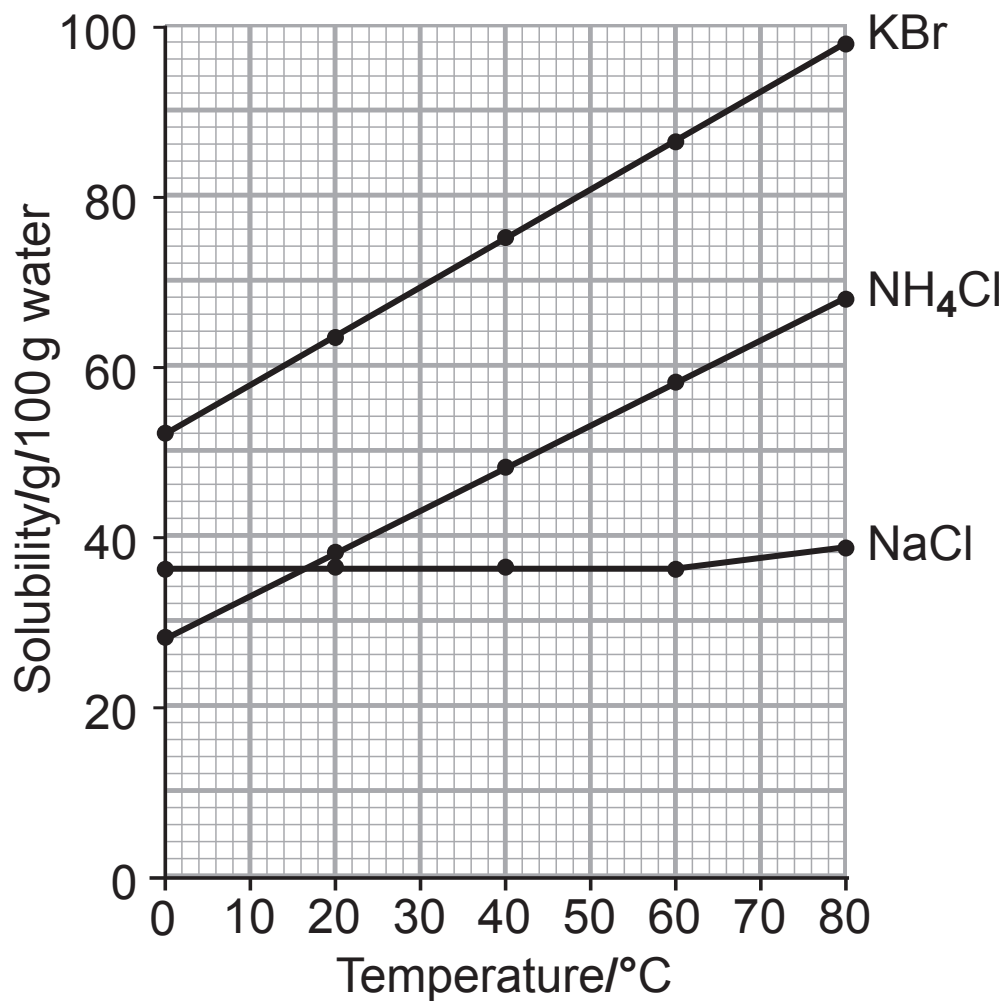
(b) Warm water from a factory was discharged into a local river. There were reports of fish dying.

Complete the sentences by adding the missing words:

(i) This can be described as _____
pollution. [1 mark]

(ii) The fish die because they do not have
enough _____. [1 mark]

(c) The graphs below show the solubility curves for three solids.



Two of these graphs show the normal trend for the solubility of solids.

(i) What is this trend? [1 mark]

(ii) What mass of potassium bromide (KBr) is dissolved in a saturated solution, in 100 g water, at 35 °C?
[1 mark]

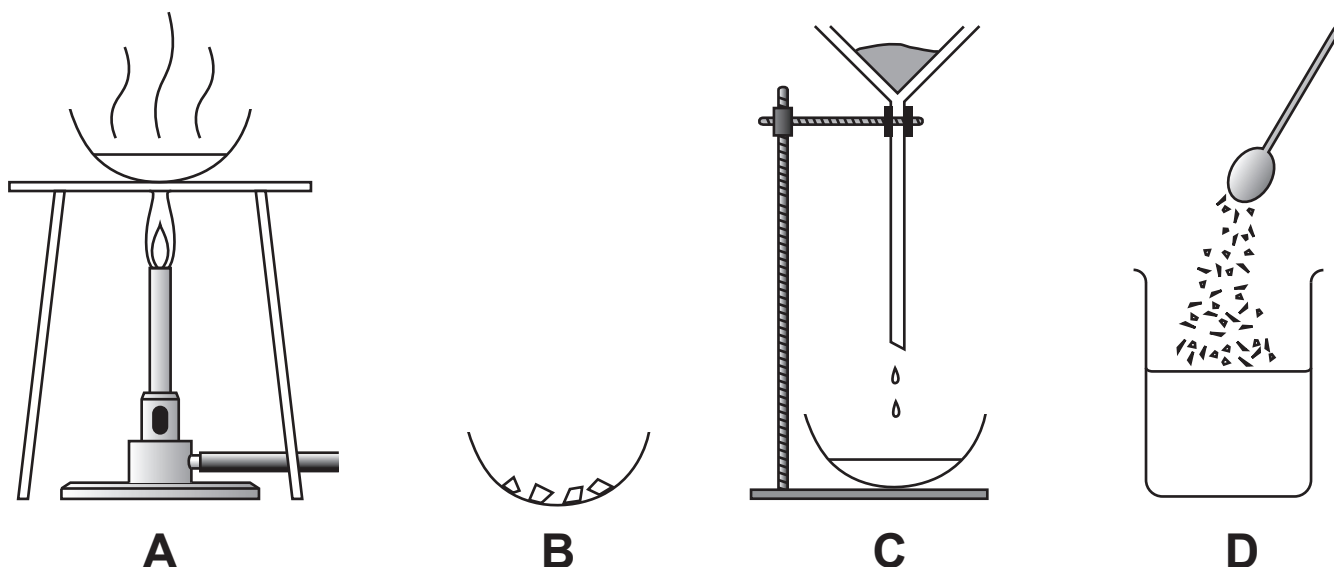
 g

(iii) A saturated solution of potassium bromide (KBr) in 50 g water is cooled from 35 °C to 14 °C. Calculate the mass of crystals that will be deposited at 14 °C. [3 marks]

Show your working.

Answer _____ g

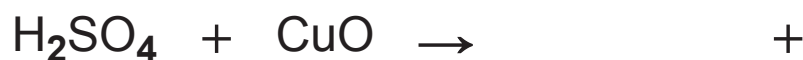
- 3 (a) The diagrams below show different stages in the production of copper sulfate crystals from copper oxide and warm dilute sulfuric acid. They are **not** in the correct order.



Stage **D** happens first and involves adding copper oxide to warm dilute sulfuric acid. Give the correct order for the three stages which follow stage **D**: [1 mark]

D then _____ then _____ then _____

- (b) Complete the symbol equation for the reaction between sulfuric acid and copper oxide. [2 marks]



(c) Copper carbonate also reacts with sulfuric acid to produce copper sulfate crystals.

(i) What colour is solid copper carbonate? [1 mark]

(ii) What gas is formed when copper carbonate reacts with sulfuric acid? [1 mark]

(d) Starting with copper oxide and warm dilute sulfuric acid, describe fully how you would produce a sample of copper sulfate crystals by carrying out the four stages shown in part **(a)**. [6 marks]

Your answer should include:

- the names of all pieces of apparatus used
- an explanation of the steps you would take
- any safety precautions required
- the colours of all substances involved

You will be assessed on your written communication skills including the use of specialist scientific terms.

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(Questions continue overleaf)

- 4 The table below gives information about particles P, Q, R, S and T.
Use this information to answer the questions that follow.

Particle	Number of protons	Number of electrons	Number of neutrons
P	6	6	8
Q	18	18	22
R	6	6	6
S	11	10	12
T	17	17	20

(a) Which particle P, Q, R, S or T is a noble gas? [1 mark]

(b) Which particle P, Q, R, S or T is an ion? [1 mark]

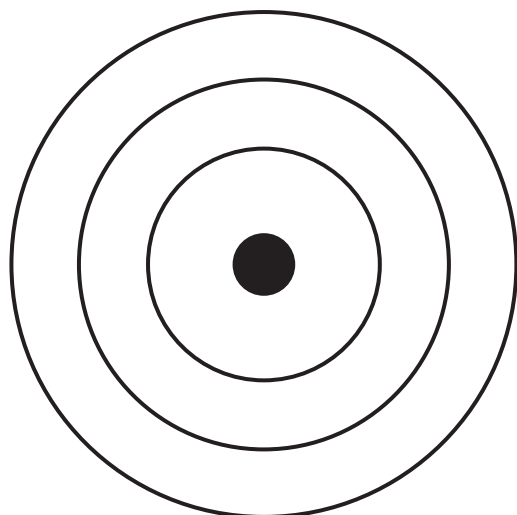
(c) Which two particles are isotopes of the same element?
[1 mark]

_____ and _____

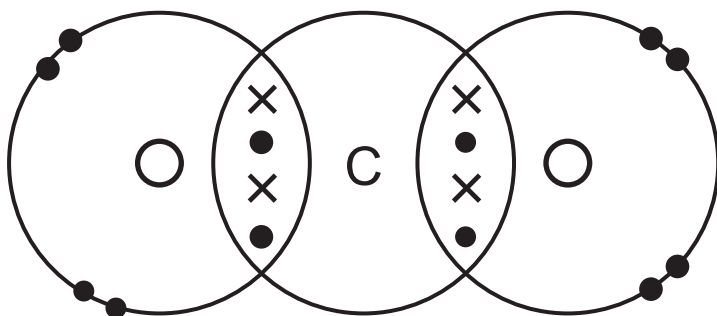
(d) What is the atomic number of particle T? [1 mark]

(e) What is the mass number of particle S? [1 mark]

(f) Use the diagram below to draw the electronic structure of particle T. [1 mark]



- 5 The diagram below shows the electronic arrangement in a molecule of carbon dioxide. Only the outer electrons are shown.



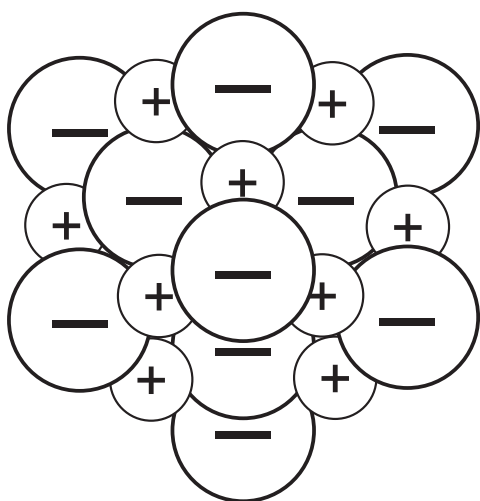
- (a) (i) How many **lone pairs** of electrons does this molecule have? [1 mark]

- (ii) How many **shared pairs** of electrons are shown? [1 mark]

- (iii) What name is given to the type of bonding in carbon dioxide? [1 mark]

(b) Use a dot cross diagram to show **all** the electrons in the bonding of nitrogen gas. [3 marks]

- 6 The diagram shows the arrangement of the particles in solid X.



- (a) Identify and explain the type of bonding in solid X.
[3 marks]

- (b) Predict and explain **two** physical properties you would expect solid X to have. [4 marks]

1. Property _____

Explanation _____

2. Property _____

Explanation _____

(c) Magnesium forms compounds with a similar structure to X.

Describe, in terms of the electrons, how magnesium forms a compound with sulfur. [4 marks]

(d) In the space below draw a labelled diagram to show the bonding in magnesium metal. [3 marks]

7 Lithium reacts with fluorine to form lithium fluoride.

(a) Write a balanced symbol equation for the reaction of lithium with fluorine. [3 marks]

(b) Sodium also reacts with fluorine to produce a salt. Explain why sodium and lithium react in a very similar way. [3 marks]

(c) Lithium and sodium metals can be obtained from their salts by electrolysis.

(i) Explain what is meant by the term electrolysis. [2 marks]

(ii) Graphite electrodes are used in the electrolysis of sodium salts and lithium salts.

Give two properties of graphite which make it suitable for its use as electrodes. [2 marks]

1. _____

2. _____

(d) Reactions take place at both electrodes during the electrolysis of lithium fluoride.

(i) Fluoride ions react at the anode. Write a balanced half equation for this reaction. [3 marks]

(ii) Write the half equation for the reaction at the cathode. [2 marks]

THIS IS THE END OF THE QUESTION PAPER

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Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
Total Marks	

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