



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 23 FEBRUARY 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.

Write your answers in the spaces provided in this question paper.

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

- 1 (a) Five of the six statements, **A**, **B**, **C**, **D**, **E** and **F** below can be used to describe the words given in the table which follows.

Descriptions

- A** a liquid which can dissolve a solid
- B** a solid which has lost its water of crystallisation
- C** when a solute is dissolved in a solvent
- D** the mass of solute needed to saturate 100g of water at a certain temperature
- E** a solid which has water of crystallisation
- F** a solid that dissolves in a liquid

Match each word to the correct description letter **A**, **B**, **C**, **D**, **E** or **F**. [5 marks]

Word	Description letter
hydrated	
solvent	
solubility	
anhydrous	
solution	

- (b) The colours and formulae of three forms of solid copper sulfate are given in the table below.

colour of copper sulfate	formula of copper sulfate
blue	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
green	$\text{CuSO}_4 \cdot \text{H}_2\text{O}$
white	CuSO_4

- (i) What word can be used to describe **blue** copper sulfate?

Circle the correct answer. [1 mark]

anhydrous dehydrated hydrated hydrogenated

- (ii) Give the formula of the form of solid copper sulfate which would be best for detecting the presence of water. [1 mark]
-

	sodium	magnesium	aluminium	silicon	phosphorus	sulfur	chlorine	argon
electronic configuration	2,8,1	2,8,2	2,8,3	2,8,4	2,8,5	2,8,6	2,8,7	2,8,8
melting point/°C	98	639	660	1410	44	113	-101	-189
boiling point/°C	883	1090	2467	2680	280	445	-35	-186
metal or non-metal	metal	metal	metal	non-metal	non-metal	non-metal	non-metal	non-metal
mass number	23	24	27	28	31	32	35	40

2 The table on page 4 shows information about elements from Period 3 of the Periodic Table.

Use this information and your own knowledge to answer the following questions about elements from Period 3 of the Periodic Table.

(a) Name the **metal** which has the highest **melting point**.
[1 mark]

(b) Name the **non-metal** which has the lowest **boiling point**. [1 mark]

(c) How many of the Period 3 elements are gases at room temperature (20 °C)? [1 mark]

(d) How can you tell from the table that sulfur is in Group 6 of the Periodic Table? [1 mark]

(e) Describe the trend in mass number as you move across the table. [1 mark]

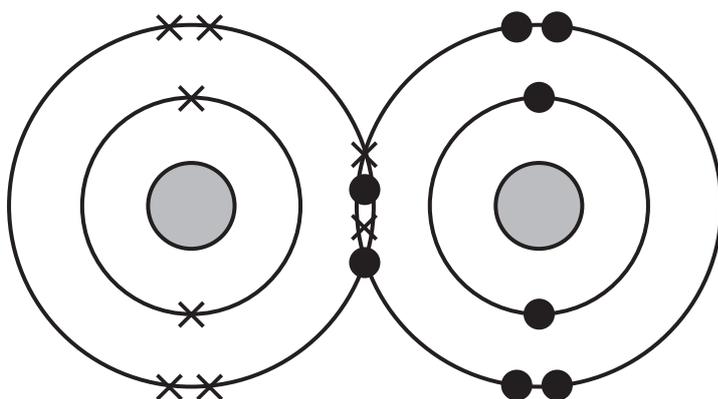
(f) Use the information in the table to:

(i) work out the atomic number of argon. [1 mark]

(ii) work out the number of neutrons in an argon atom.
[1 mark]

(iii) explain why argon is unreactive. [1 mark]

- 4 The diagram below shows the bonding in an oxygen molecule.



(a) Complete the statements below:

(i) In an oxygen molecule there are _____ lone pairs of electrons. [1 mark]

(ii) In an oxygen molecule there are _____ shared pairs of electrons. [1 mark]

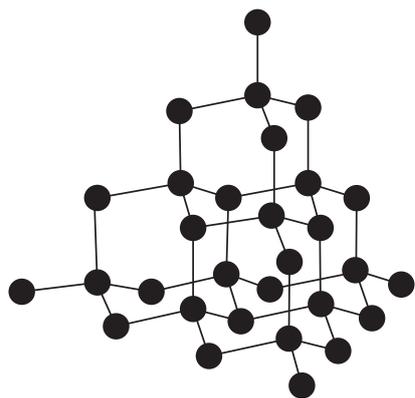
(b) Name the type of bonding in an oxygen molecule. [1 mark]

(c) Oxygen is described as being diatomic. What does this mean? [1 mark]

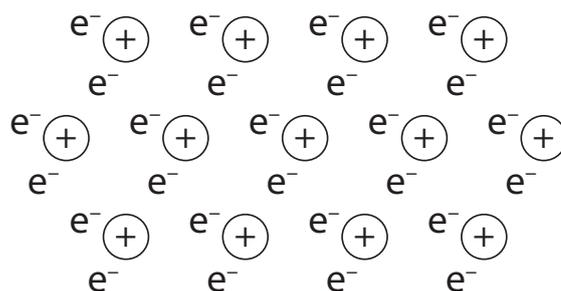
(d) Hydrogen sulfide, H_2S , is a compound with bonding similar to water.

In the space below draw a dot and cross diagram to show how the outer electrons are arranged when atoms of hydrogen and sulfur combine to form this compound.
[3 marks]

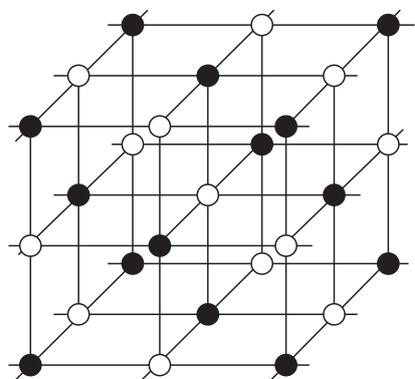
5 The diagrams below show four different giant structures.



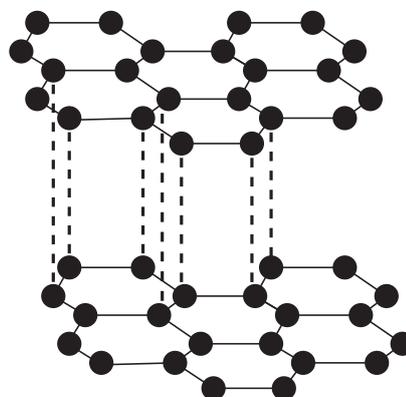
A



B



C



D

(a) In which two of these structures **A**, **B**, **C** or **D** is the bonding covalent? [1 mark]

_____ and _____

(b) Which structure **A**, **B**, **C** or **D** could represent sodium chloride? [1 mark]

(c) (i) Which structure **A**, **B**, **C** or **D** could represent graphite? [1 mark]

(ii) Describe how the structure of graphite makes it suitable for its use as a lubricant. [2 marks]

(d) Which structure **A**, **B**, **C** or **D** could represent a very hard substance which could be used in cutting tools? [1 mark]

- 6 (a) The table below gives some information about metal oxides and their reactions with acids to produce ionic salts.

Complete the table by filling in the blank spaces.

[6 marks]

metal oxide	acid used	formula of cation in salt	formula of anion in salt	formula of salt produced
sodium oxide	hydrochloric acid		Cl ⁻	
	sulfuric acid	Ca ²⁺	SO ₄ ²⁻	CaSO ₄
copper oxide	nitric acid	Cu ²⁺	NO ₃ ⁻	
potassium oxide		K ⁺		K ₂ SO ₄

- (b) Metal oxides which do **not** dissolve in water are called _____ [1 mark]

- (c) Write an ionic equation, including state symbols, to show how the ions present in acids and alkalis form water. [3 marks]
-

(d) Different crops often require the soil to have a very specific pH.

The table below gives some information on these requirements.

Use this information and your own knowledge to answer the questions that follow.

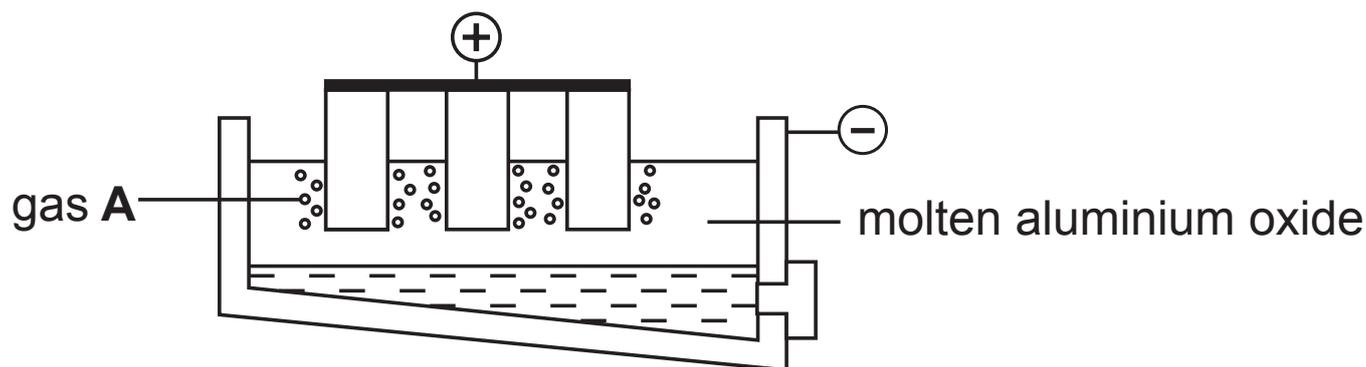
Crop	pH range of soil
potatoes	4.8–5.5
broccoli	6.7–8.0
strawberries	5.5–6.5
blueberries	4.0–5.5

(i) What instrument should the farmer use to measure **accurately** the pH of the soil? [1 mark]

(ii) Which of the four listed crops can grow in the most acidic conditions? [1 mark]

(iii) Which is the only one of the four listed crops which can grow in alkaline soil? [1 mark]

- 7 The diagram below shows how aluminium is extracted from molten aluminium oxide.



- (a) What name is given to the process used to extract aluminium from aluminium oxide? [1 mark]

- (b) What name is given to the electrodes at which gas **A** is produced? [1 mark]

- (c) Write a half equation for the formation of gas **A**. [3 marks]

- (d) Explain why the electrodes at which gas **A** is produced need to be replaced regularly. [2 marks]

(e) Give two factors which need to be taken into account when deciding on a site for an aluminium extraction plant. [2 marks]

- 1. _____
- 2. _____

(f) Describe and explain two ways, not related to the location of the site, in which the high costs of the **production** of aluminium from aluminium oxide are **minimised**. [4 marks]

- 1. _____

- 2. _____

- 8 The table below shows observations from an investigation to compare the reactivity of the halogens. Solutions of four halogens **P**, **Q**, **R**, and **S** were added separately to solutions of the three halides shown. Use your knowledge and the information in the table to answer the questions which follow.

halogen solution used	observations with sodium iodide solution	observations with sodium bromide solution	observations with sodium chloride solution
P	colour change	no reaction	no reaction
Q	colour change	colour change	no reaction
R	colour change	colour change	reaction
S	no reaction	no reaction	no reaction

- (a) List the elements **P**, **Q**, **R**, and **S** in order of reactivity starting with the **most** reactive. [2 marks]

- (b) The reaction between **R** and sodium chloride solution produces a gas and the solution formed remains colourless.

Name the gas and solution formed. [2 marks]

gas _____

solution _____

(c) (i) Write a balanced symbol equation for the reaction between sodium bromide and chlorine. [3 marks]

(ii) Describe the colour change which would be observed during this reaction. [2 marks]
from _____ to _____

(iii) Name this **type** of reaction. [1 mark]

THIS IS THE END OF THE QUESTION PAPER

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Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
Total Marks	

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