



General Certificate of Secondary Education
2017–2018

Centre Number

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Candidate Number

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Double Award Science: Chemistry

Unit C1
Higher Tier

MV18

[GSD22]

THURSDAY 9 NOVEMBER 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 seven** questions.

Information for Candidates

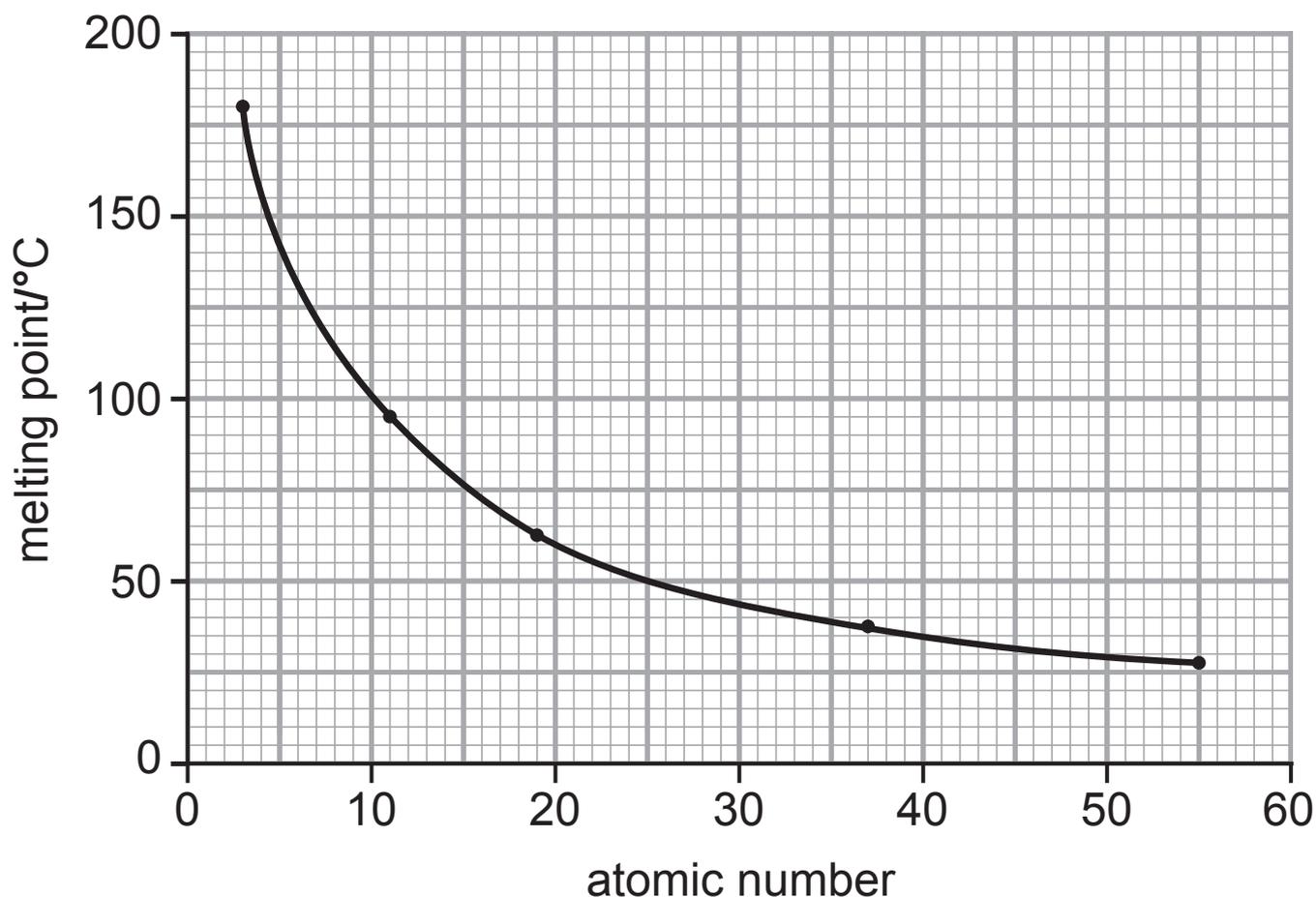
The total mark for this paper is 70.

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(b)**.

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

- 1 The graph below shows how the melting points change with atomic number for five elements. All five elements are in the same Group of the Periodic Table.



- (a) What is the melting point of the element with atomic number 11? [1 mark]
-

- (b) (i) What is the atomic number of the element, shown in the graph, which has the lowest melting point? [1 mark]
-

(ii) Using your Data Leaflet to help you, name the element, which has the lowest melting point of the five elements shown in the graph. [1 mark]

(c) In what Group of the Periodic Table are these five elements found? [1 mark]

(d) Describe the trend shown in this graph. [2 marks]

(e) What is the pattern of reactivity for these elements? [1 mark]

- 2 Labels, showing the contents of two drinks bottles **X** and **Y** are shown below.

carbonated water
sugar
phosphoric acid
colour
pH = 2.5

X

carbonated water
sugar
citric acid
colour
pH = 3.2

Y

The pH of carbonated water is 3.6.

- (a) (i) Which drink contains the strongest acid? [1 mark]

- (ii) Which ingredient in drink **X** causes the pH to fall to 2.5? [1 mark]

- (iii) What method would you use to measure the pH of these drinks **accurately**? [1 mark]

- (iv) Which **ion**, present in both of the drinks, makes them acidic? [1 mark]

(b) Write an **ionic equation** to show neutralisation. Your equation should include **state** symbols. [3 marks]

(c) The table below gives information about salts formed when metal oxides react with acids. Complete the table. [3 marks]

metal oxide	acid used	cation in salt	anion in salt	formula of salt
copper oxide		Cu^{2+}	Cl^-	CuCl_2
sodium oxide	sulfuric acid	Na^+		Na_2SO_4
calcium oxide	nitric acid	Ca^{2+}	NO_3^-	

3 (a) The symbol equation below shows the reaction between copper carbonate and dilute hydrochloric acid.

(i) Balance the equation and also add the three missing state symbols. [2 marks]



(ii) Describe how you could prove that the gas formed in the reaction is carbon dioxide. [2 marks]

(b) Describe **how** you would react some solid copper carbonate with dilute hydrochloric acid and what you would observe happening when you carry out this experiment. [6 marks]

Your answer should include:

- A description of the step or steps you would take and the apparatus you would need
- How you would make sure that the reaction was carried out safely
- Any colour changes or other observations

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

Step or steps taken and apparatus used:

Safety precautions:

Colour changes and other observations:

(c) In a separate experiment dilute hydrochloric acid was reacted with solid calcium carbonate.

Give one observation that is **similar** and two observations that are **different**, when hydrochloric acid is reacted with **calcium carbonate**, rather than copper carbonate.

(i) similar observation: [1 mark]

(ii) different observations: [2 marks]

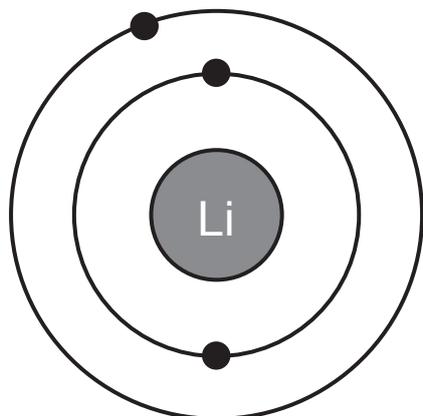
1. _____

2. _____

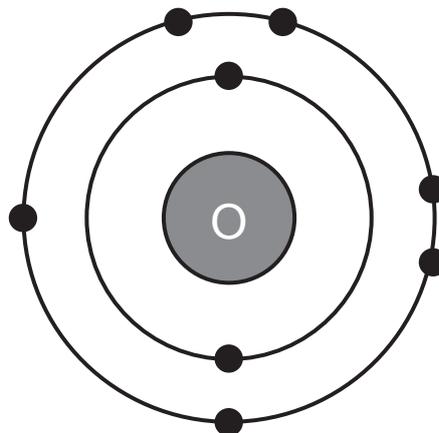
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(Questions continue overleaf)

- 4 The diagrams below show the **electronic** structures of lithium and oxygen atoms.



lithium atom



oxygen atom

- (a) (i) Explain how the electronic arrangements of lithium and oxygen change when lithium oxide is formed. [3 marks]

- (ii) What is the formula for lithium oxide? [1 mark]

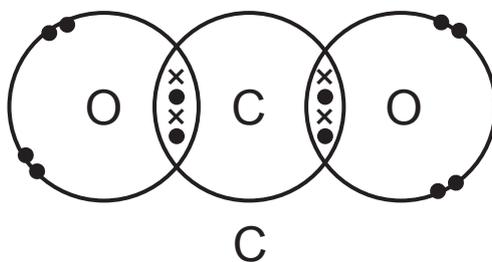
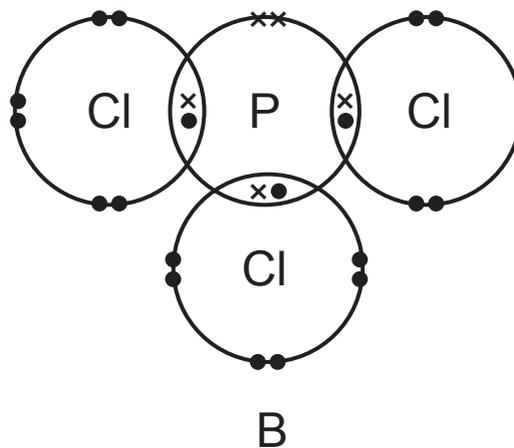
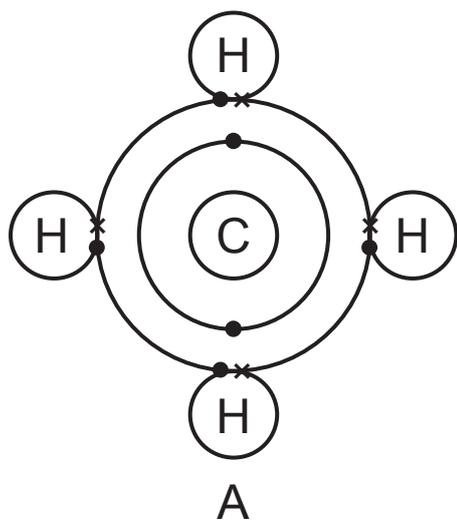
(b) What name is given to the type of bonding in lithium oxide? [1 mark]

(c) Oxygen atoms join together to form molecules of oxygen gas.

(i) In the space below draw a dot and cross diagram to show how **all** the electrons are arranged in an oxygen molecule. [3 marks]

(ii) Explain why oxygen gas is described as diatomic. [1 mark]

(d) The diagrams below show the electronic arrangements of three molecules.

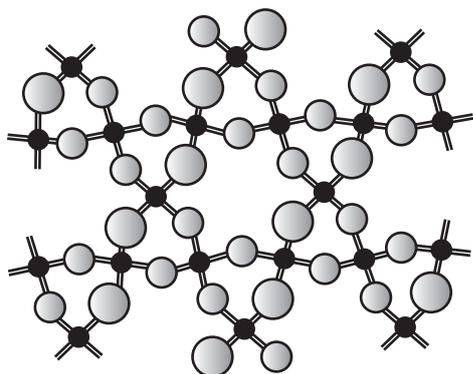


(i) Which molecule A, B or C does not have any lone pairs of electrons? [1 mark]

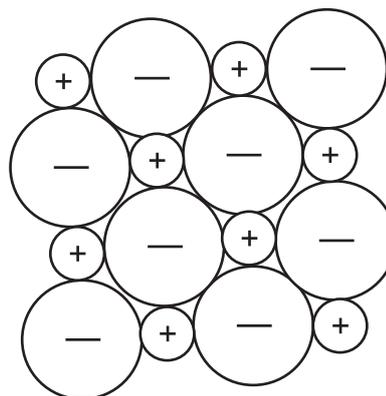
(ii) Which molecule A, B or C has multiple bonds between the atoms? [1 mark]

(iii) In the space below draw a dot and cross diagram to show the bonding in ammonia (NH_3). Only outer electrons are needed. [2 marks]

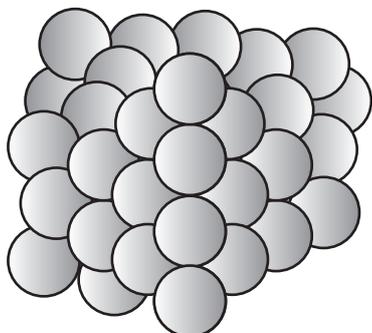
- 5 The diagrams below show the structures of five different substances.



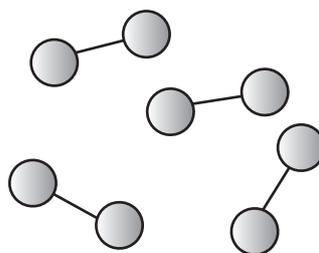
Substance A



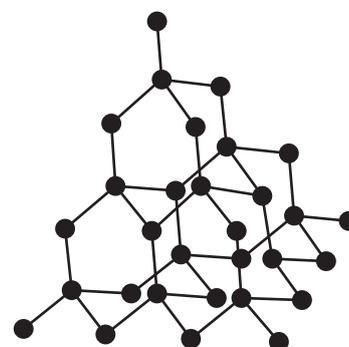
Substance B



Substance C



Substance D



Substance E

- (a) Which substance A, B, C, D, or E has a metallic structure?

Explain your reasoning. [2 marks]

Substance _____

Explanation _____

(b) Which two substances, A, B, C, D, or E can be described as having giant covalent structures?
[1 mark]

_____ and _____

(c) Which two substances A, B, C, D, or E have structures which would conduct electricity when molten?
[1 mark]

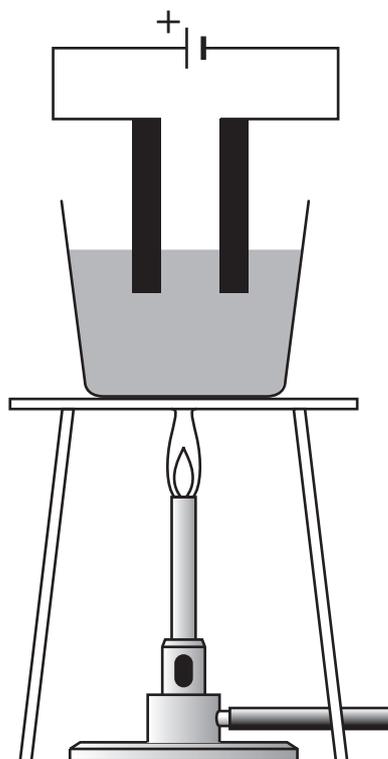
_____ and _____

(d) Which substance A, B, C, D, or E could represent iodine? [1 mark]

(e) Which substance A, B, C, D, or E has a structure which means that it is extremely hard and could be used in cutting tools? [1 mark]

6 (a) The diagram below shows how lead(II) bromide can be electrolysed.

Label the diagram, making sure that you have named each electrode separately. [4 marks]



(b) The table below gives some information about reactions taking place during the electrolysis of some molten halide salts.

(i) Complete the gaps in the table. [4 marks]

halide salt	anode observations	cathode observations	product at anode	product at cathode
lithium iodide	purple gas	silvery beads		
lead(II) bromide			bromine	lead metal
	brown fumes	silvery beads		potassium metal
sodium chloride		silvery beads	chlorine	

(ii) Write a half equation for the reaction taking place at the **anode** during the electrolysis of molten lead(II) bromide. [3 marks]

7 (a) The table below gives information about the **five** halogens, fluorine, chlorine, bromine, iodine and astatine.

(i) Complete the table by identifying each halogen and writing its **symbol** in the correct space in the table.
CLUE – the black solid is astatine. [3 marks]

state at room temperature	colour	halogen symbol
liquid	red–brown	
solid	grey/black	
gas	pale yellow	
solid	black	
gas	greenish–yellow	

(ii) Which halogen, fluorine, chlorine, bromine, iodine or astatine is the least reactive? [1 mark]

(b) When chlorine gas is bubbled into a solution of potassium iodide a colour change takes place.

(i) Describe and explain this colour change.
[3 marks]

colour change from _____

to _____

explanation _____

(ii) Write a balanced symbol equation for the reaction between chlorine and potassium iodide. [3 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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SYMBOLS OF SELECTED IONS

Positive ions

Name	Symbol
Ammonium	NH_4^+
Chromium(III)	Cr^{3+}
Copper(II)	Cu^{2+}
Iron(II)	Fe^{2+}
Iron(III)	Fe^{3+}
Lead(II)	Pb^{2+}
Silver	Ag^+
Zinc	Zn^{2+}

Negative ions

Name	Symbol
Carbonate	CO_3^{2-}
Dichromate	$\text{Cr}_2\text{O}_7^{2-}$
Ethanoate	CH_3COO^-
Hydrogen carbonate	HCO_3^-
Hydroxide	OH^-
Methanoate	HCOO^-
Nitrate	NO_3^-
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

DATA LEAFLET

For the use of candidates taking
 Science: Chemistry,
 Science: Double Award
 or Science: Single Award

Copies must be free from notes or additions of any kind. No other type of data booklet or information sheet is authorised for use in the examinations.

SOLUBILITY IN COLD WATER OF COMMON SALTS, HYDROXIDES AND OXIDES

Soluble
All sodium, potassium and ammonium salts
All nitrates
Most chlorides, bromides and iodides EXCEPT silver and lead chlorides, bromides and iodides
Most sulfates EXCEPT lead and barium sulfates Calcium sulfate is slightly soluble

Insoluble
Most carbonates EXCEPT sodium, potassium and ammonium carbonates
Most hydroxides EXCEPT sodium, potassium and ammonium hydroxides
Most oxides EXCEPT sodium, potassium and calcium oxides which react with water

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chemistry double award single award

