

Name:	Target Grade:	Actual Grade:
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IONIC BONDING

MCQ and STRUCTURED QUESTIONS

READ THESE INSTRUCTIONS FIRST

INSTRUCTIONS TO CANDIDATES

1. Find a quiet, comfortable spot free place from distractions.
2. Spend one minute on each mark.
3. Time yourself for every single question.
4. Every chapter has their own question types. Ensure that you know the different question type for each chapter.
5. Make a conscientious effort to remember your mistakes, especially in terms of answering techniques. E.g Take a picture for the mistakes that you made, keep it in a photo album, and revise it over and over again.
6. Highlight question types that you tend to keep making mistakes and review them nearing exams.
7. Always review the common questions and question type that you tend to make mistakes nearing exams.
8. During exams, classify the question type and recall what you have learnt, how you need to analyse the questions for the different question type, what you need to take note of and answer with the correct answering techniques!

🎯 Wishing you all the best for this test!

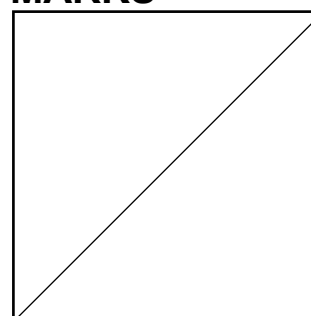
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💡 With lots of love,
Bright Culture 🧡

If you are struggling in this paper, means you need to work harder!

If you need any professional guidance and further advice on how to advance, feel free to WhatsApp us at 91870820 or find us at www.bright-culture.com/. We are committed to connect you to your future to reach your goals.

MARKS



IONIC BONDING MCQ**Paper 1**

1 Which particles are responsible for the conduction of electricity through metals?

- A electrons only
- B electrons and positive ions
- C negative ions only
- D negative ions and positive ions

2 The table shows some of the physical properties of P, Q, R and S.

substance	melting point / °C	boiling point / °C	electrical conductivity		solubility in water
			solid	liquid	
P	122	550	poor	poor	insoluble
Q	690	1790	poor	good	soluble
R	1510	2489	poor	poor	insoluble
S	1453	2730	good	good	insoluble

Which of the following statements about the four substances is correct?

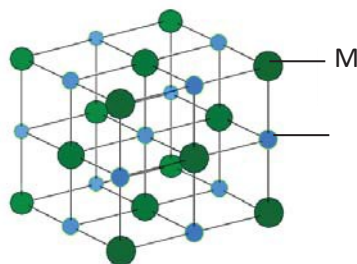
- A P is a simple molecular compound held by weak covalent bonds.
- B Q is an ionic compound with mobile electrons in the liquid state.
- C R is a macromolecule held by strong electrostatic forces of attraction between ions.
- D S has a giant lattice structure with mobile electrons.

3 The melting points of magnesium oxide and calcium oxide are given below.

metal oxide	melting point/ °C
magnesium oxide	2852
calcium oxide	2572

- A The charge of the calcium ion is higher than that of the magnesium ion.
- B The charge of the magnesium ion is higher than that of the calcium ion.
- C The radius of the calcium ion is smaller than that of the magnesium ion.
- D The radius of the magnesium ion is smaller than that of the calcium ion.

- 4 Element L and M form a compound which has a structure shown below.



Based on the structure shown above, deduce the chemical formula of the compound formed between element L and M.

- A LM
 B L_2M
 C LM_2
 D $L_{14}M_{13}$

- 5 Substance X has the following properties:

- melting point above 500°C
- insoluble in water
- conducts electricity only when molten.

What would substance X be?

- A aluminium oxide
 B copper
 C graphite
 D sodium chloride
- 6 A metal Y forms a sulfate salt with the formula, YSO_4 while a non-metal Z forms an ammonium salt with the formula, $(\text{NH}_4)_3\text{Z}$.

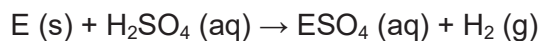
What is the formula of the substance formed between Y and Z?

- A YZ
 B Y_3Z
 C YZ_3
 D Y_3Z_2
- 7 Solid iodine readily forms iodine vapour when heated.

What can be deduced about the nature of the particles in these two states of iodine?

	solid	vapour
A	atomic	ionic
B	atomic	molecular
C	molecular	atomic
D	molecular	molecular

- 8 The equation below shows the reaction between a metal E and dilute sulfuric acid.



A test on electrical conductivity showed that both the reagents and the resulting solution are good conductors of electricity.

Which particles are responsible for the electrical conductivity in metal E, sulfuric acid and ESO_4 ?

	Metal E	Sulfuric acid	ESO_4 (aq)
A	Electrons	Cations	Cations and anions
B	Electrons	Cations and anions	Cations and anions
C	Cations	Electrons	Anions
D	Cations and anions	Cations	Electrons

- 9 Element **M** forms an oxide with a chemical formula of M_2O_3 , which exists as a white crystalline solid at room temperature with a high melting point.

An ion of element **M** has 14 neutrons and two electron shells. Which of the following chemical symbols represents an atom of **M**?

- A** ${}^{14}_5M$
- B** ${}^{14}_{13}M$
- C** ${}^{27}_{12}M$
- D** ${}^{27}_{13}M$
-

IONIC BONDING STRUCTURED QUESTIONS
Paper 2

1 (a) The bonding and structure of a typical metal is shown in Fig. 2A.

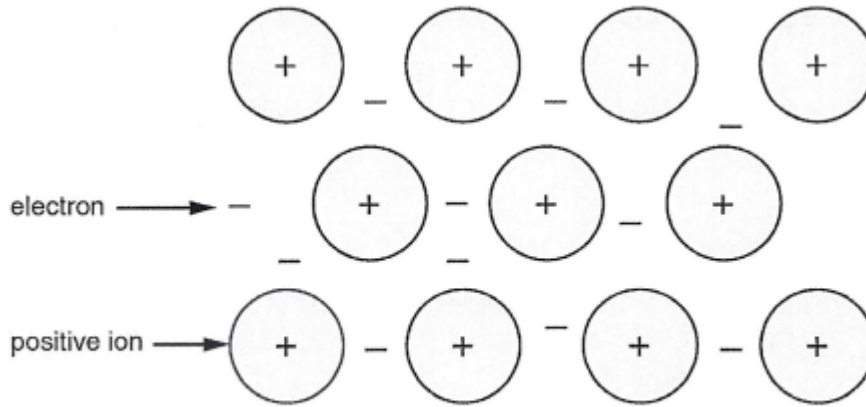


Fig. 2A

Tungsten metal is used to make the filament of light bulbs as it is malleable. It forms tungsten(VI) oxide only when burnt in air under high temperatures.

With reference to Fig. 2A,

(i) Explain, with reference to the bonding and structure of tungsten, why it is malleable.

.....

[2]

(ii) Suggest one way in which Fig. 2A is a poor representation for the bonding and structure of tungsten.

.....
 [1]

- (b) Sodium burns in chlorine gas to form sodium chloride as the only product. Sodium chloride has a melting point of 800 °C. Fig. 28 shows the bonding and structure of sodium chloride.

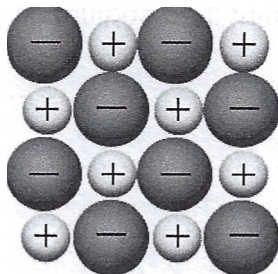


Fig. 28

- (i) Write the balanced chemical equation with state symbols for the reaction to form sodium chloride.

..... [2]

- (ii) State how Fig. 28 is both a good and poor presentation of the structure of sodium chloride at room temperature.

good representation

.....

.....

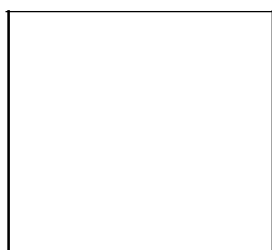
poor representation

.....

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[2]

- (iii) In the box provided, draw a diagram to show how the particles of sodium chloride are arranged at 1000 °C.



[1]

- (iv) Although magnesium oxide has the same structure as sodium chloride, it has a melting point of about 2850 °C.

Suggest and explain, in terms of bonding, why magnesium oxide has a higher melting point than sodium chloride.

.....

.....

[2]

[Total: 10 marks]

- 2 Melting point and boiling point data of the oxides of elements in period 3 of the Periodic Table is provided in the table below.

name	sodium oxide	magnesium oxide	aluminium oxide	silicon dioxide	phosphorus(III) oxide	sulfur dioxide	dichlorine monoxide
melting point /°C	1132	2852	2072	1710	24	-72	-121
boiling point /°C	1950	3600	2977	2230	173	-10	2

- (a) Draw 'dot-and-cross' diagrams to show the bonding in the following substances. Show only the outermost electrons.

(i) Sodium oxide

[2]

(ii) Dichlorine monoxide

[2]

(b) Explain why argon, also a period 3 element, does not form oxides like the rest of the period 3 elements.

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.....[1]

(c) (i) Explain why sodium oxide has a lower melting point than magnesium oxide.

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.....
.....
.....[3]

(ii) With reference to information provided in the table above, suggest if your explanation in (c)(i) applies to all ionic compounds.

.....
.....[1]

(d) Silicon dioxide and sulfur dioxide are both covalent substances.

With reference to the structure and bonding in both covalent substances, explain why silicon dioxide has a higher melting point than sulfur dioxide.

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.....[3]

- (e) Describe what happens to the distance, attraction, movement and energy between/of the particles of sulfur dioxide when it is cooled from room temperature to $-70\text{ }^{\circ}\text{C}$.

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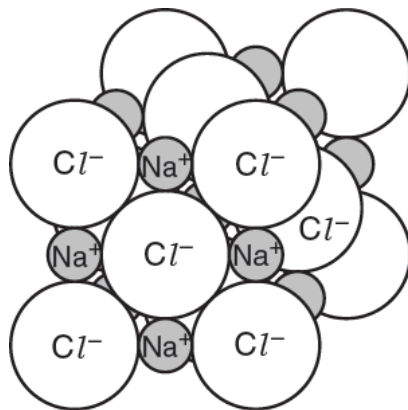
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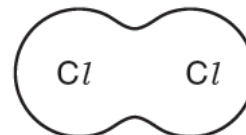
[4]

[Total: 16]

- 3 The structures of sodium chloride and chlorine are shown below.



sodium chloride



chlorine

The melting point of sodium chloride is $801\text{ }^{\circ}\text{C}$. The melting point of chlorine is $-101\text{ }^{\circ}\text{C}$.

- (a) Explain, in terms of structure and bonding, the difference between the melting points of these two substances.

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.....[4]

- (b) Predict whether magnesium oxide would have a higher or lower melting point than sodium chloride. Explain your answer in terms of bonding.

.....
.....
.....[2]

- (c) Chlorine exists as a gas at room temperature while bromine exists as a liquid at room temperature. Explain your answer in terms of bonding.

.....
.....
.....[2]

[Total: 8]

4 Calcium and sulfur are two elements in the Periodic Table.

- (a) State the number of protons and valence electrons of a sulfur atom. [2]

number of protons

number of valence electrons

- (b) The two elements react to form calcium sulfide.

- (i) Draw a Lewis diagram to show the bonding in calcium sulfide. [1]
-
-

- (ii) Explain if you would expect calcium sulfide to conduct electricity at room temperature, referring to its bonding and structure. [2]

.....

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.....

.....

ANSWERS FOR IONIC BONDING MCQ**Paper 1**

1 Which particles are responsible for the conduction of electricity through metals?

- A** electrons only
- B** electrons and positive ions
- C** negative ions only
- D** negative ions and positive ions

2 The table shows some of the physical properties of P, Q, R and S.

substance	melting point / °C	boiling point / °C	electrical conductivity		solubility in water
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Which of the following statements about the four substances is correct?

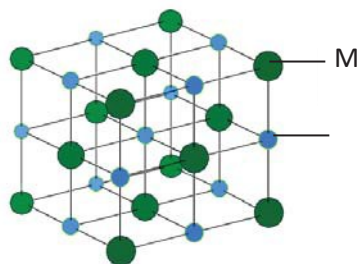
- A** P is a simple molecular compound held by weak covalent bonds.
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- C** The radius of the calcium ion is smaller than that of the magnesium ion.
- D** The radius of the magnesium ion is smaller than that of the calcium ion.

- 4 Element L and M form a compound which has a structure shown below.



Based on the structure shown above, deduce the chemical formula of the compound formed between element L and M.

- A** LM
B L₂M
C LM₂
D L₁₄M₁₃

- 5 Substance X has the following properties:

- melting point above 500°C
- insoluble in water
- conducts electricity only when molten.

What would substance X be?

- A** aluminium oxide
B copper
C graphite
D sodium chloride

- 6 A metal Y forms a sulfate salt with the formula, YSO₄ while a non-metal Z forms an ammonium salt with the formula, (NH₄)₃Z.

What is the formula of the substance formed between Y and Z?

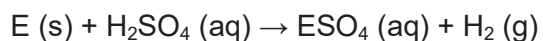
- A** YZ
B Y₃Z
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- 7 Solid iodine readily forms iodine vapour when heated.

What can be deduced about the nature of the particles in these two states of iodine?

	solid	vapour
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- 8 The equation below shows the reaction between a metal E and dilute sulfuric acid.



A test on electrical conductivity showed that both the reagents and the resulting solution are good conductors of electricity.

Which particles are responsible for the electrical conductivity in metal E, sulfuric acid and ESO_4 ?

	Metal E	Sulfuric acid	ESO_4 (aq)
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B	Electrons	Cations and anions	Cations and anions
C	Cations	Electrons	Anions
D	Cations and anions	Cations	Electrons

- 9 Element **M** forms an oxide with a chemical formula of M_2O_3 , which exists as a white crystalline solid at room temperature with a high melting point.

An ion of element **M** has 14 neutrons and two electron shells. Which of the following chemical symbols represents an atom of **M**?

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-

IONIC BONDING STRUCTURED QUESTIONS

Paper 2

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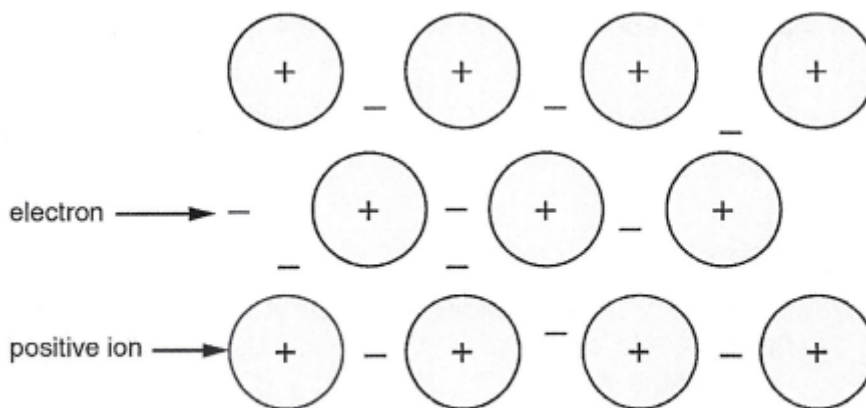


Fig. 2A

Tungsten metal is used to make the filament of light bulbs as it is malleable. It forms tungsten(VI) oxide only when burnt in air under high temperatures.

With reference to Fig. 2A,

(i) Explain, with reference to the bonding and structure of tungsten, why it is malleable.

- Rows of metallic ions can be shifted after a force is applied
- Strong electrostatic forces can be re-established between positive metallic ions and surrounding delocalised electrons even after force is applied

MR: Poorly attempted as forces of attraction not correctly identified, and no concept of malleability shown [2]

(ii) Suggest one way in which Fig. 2A is a poor representation for the bonding and structure of tungsten.

ANY ONE

- Not very closely packed like for solid particles
- Charge of metallic ion should be 6+ (ACCEPT OWTTE)
- There should be a proportional number of electrons to the correct charge of W^{6+}

[1]

- (b) Sodium burns in chlorine gas to form sodium chloride as the only product. Sodium chloride has a melting point of 800 °C. Fig. 28 shows the bonding and structure of sodium chloride.

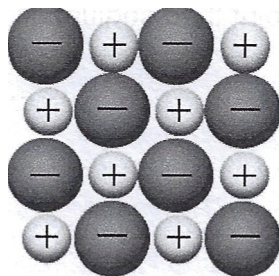
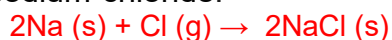


Fig. 28

- (i) Write the balanced chemical equation with state symbols for the reaction to form sodium chloride.



NOTE: 1st [B1] for all correct formulae and for correct stoichiometric ratio;

2nd [B1] for all correct state symbols

MR: Some candidates did not recall that chlorine is diatomic [2]

- (ii) State how Fig. 28 is both a good and poor presentation of the structure of sodium chloride at room temperature.

good representation (ANY ONE)

- Shows regular arrangement
- Shows very closely packed
- Shows very strong attractive forces between particles

poor representation (ANY ONE)

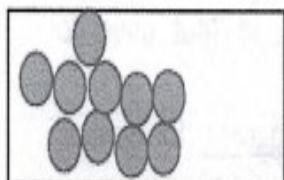
- Two dimensional structure does not show three dimensional nature of electrostatic force of attraction
- Unable to show motion of solid particles OR vibration about fixed positions
- Unable to show low energy of solid particles

NOTE: Answers must make clear reference to FAME descriptors for solid particles

MR. A mixture of good and poor responses were received

[2]

- (iii) In the box provided, draw a diagram to show how the particles of sodium chloride are arranged at 1000 °C.



Note: Award [B1] iff 9-12 particles are shown close together with no regular arrangement. Labelling of ions not important here.

[1]

- (iv) Although magnesium oxide has the same structure as sodium chloride, it has a melting point of about 2850 °C.

Suggest and explain, in terms of bonding, why magnesium oxide has a higher melting point than sodium chloride.

- Stronger electrostatic forces between Mg^{2+} and O^{2-} ions in MgO than Na^+ and Cl^- in NaCl.
 - Mg^{2+} and O^{2-} have higher/larger charges than Na^+ and Cl^-
- MR: Candidates were able to identify that there is stronger forces of attraction. n .go co .red t . Cl, but did not make an attempt to infer the reason.

[2]

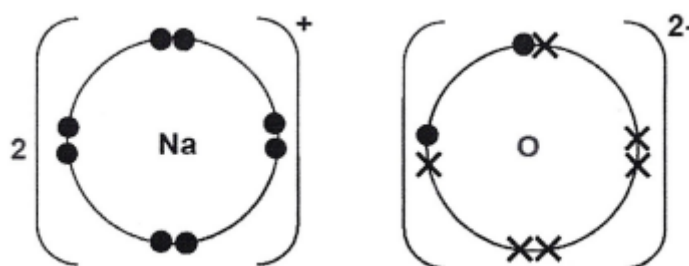
[Total: 10 marks]

- 2 Melting point and boiling point data of the oxides of elements in period 3 of the Periodic Table is provided in the table below.

name	sodium oxide	magnesium oxide	aluminium oxide	silicon dioxide	phosphorus(III) oxide	sulfur dioxide	dichlorine monoxide
melting point /°C	1132	2852	2072	1710	24	-72	-121
boiling point /°C	1950	3600	2977	2230	173	-10	2

- (a) Draw 'dot-and-cross' diagrams to show the bonding in the following substances. Show only the outermost electrons.

- (i) Sodium oxide

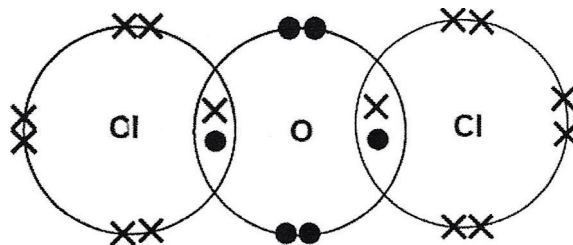


[1] - valence electrons correctly displayed

[1] - ionic charges and coefficients correctly displayed

[2]

- (ii) Dichlorine monoxide



[1] - valence electrons correctly displayed

[1] - shared electrons correctly displayed

[2]

(b) Explain why argon, also a period 3 element, does not form oxides like the rest of the period 3 elements.

..It has a fully filled valence electron shell/it is a noble gas

[1]

(c) (i) Explain why sodium oxide has a lower melting point than magnesium oxide.

Magnesium ions have a higher charge sodium ions. [1]

Stronger electrostatic forces of attraction exist between magnesium and oxide ions as opposed to sodium and oxide ions. [1]

It would take a larger amount of energy to overcome the stronger electrostatic

forces of attraction between magnesium and oxide ions. [1]

[3]

(ii) With reference to information provided in the table above, suggest if your explanation in (c)(i) applies to all ionic compounds.

No. Even though aluminium has a higher charge than magnesium, aluminium oxide has a lower melting point than magnesium oxide. [1]

(d) Silicon dioxide and sulfur dioxide are both covalent substances.

With reference to the structure and bonding in both covalent substances, explain why silicon dioxide has a higher melting point than sulfur dioxide.

Silicon dioxide has a giant molecular structure with a network of strong covalent bonds between adjacent atoms. [1]

Sulfur dioxide has a simple molecular structure with weak intermolecular forces of attraction (between molecules). [1]

It would take more energy to break the many strong covalent bonds in silicone dioxide than to overcome the weak. intermolecular forces of attraction in sulfur dioxide. [1]

(c) Chlorine exists as a gas at room temperature while bromine exists as a liquid at room temperature. Explain your answer in terms of bonding.

Bromine has higher relative molecular mass than chlorine;
 so bromine has stronger intermolecular forces between the molecules than chlorine so more energy is required to separate the molecules; [2]

[Total: 8]

4 Calcium and sulfur are two elements in the Periodic Table.

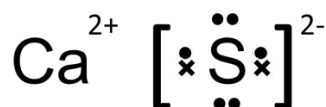
(a) State the number of protons and valence electrons of a sulfur atom. [2]

number of protons 16.....

number of valence electrons 6.....

(b) The two elements react to form calcium sulfide.

(i) Draw a Lewis diagram to show the bonding in calcium sulfide. [1]



Not penalized although not recommended:
 -Brackets for calcium/no brackets for sulfide
 -not pairing of "dot" with "cross" for transferred electrons

(ii) Explain if you would expect calcium sulfide to conduct electricity at room temperature, referring to its bonding and structure. [2]

No.
 Calcium sulfide has a giant ionic crystal lattice [1] at room temperature.
 Its ions are held in fixed positions/are not mobile [1].

Note: Penalty for any contradictory terms e.g. use of "atoms"/"molecules" interchangeably with "ions".

Not penalised although not recommended: Use of "mobile charged particles" instead of "mobile ions".