

Practice

core topic "Chemical Bonding & Structure"

Targeted Practice Set: Chemical Bonding & Structure (Full Questions)

Pasir Ris Secondary School

Paper 1, Question 5

An element **Y** reacts with oxygen to form an ionic compound with the formula Y_2O_3 . Which group of the Periodic Table is element **Y** found in?

- A Group II
- B Group III
- C Group V
- D Group VII

[1 mark]

Paper 2, Question 3 (a, b)

[Note: This is a comprehensive question. Part (a) covers various aspects of ionic bonding, while part (b) requires a comparison with a covalent substance, linking structure to physical properties.]

3 (a) Magnesium chloride has a high melting point and is a conductor of electricity when molten.

(i) Name the type of chemical bonding present in magnesium chloride.

[1 mark]

(ii) Draw a 'dot and cross' diagram to show the arrangement of the outer shell electrons in magnesium chloride in the space provided. [Proton numbers: Mg, 12; Cl, 17]

[2 marks]

(iii) Explain why magnesium chloride is a conductor of electricity when molten but **not** in the solid state.

[2 marks]

(b) Chlorine, Cl_2 , has a much lower boiling point than magnesium chloride. Use your knowledge of the bonding in chlorine and magnesium chloride to explain the difference in their boiling points.

[2 marks]

Paper 2, Question 10 (a)

Phosphine, PH_3 , is a gas which has a smell of garlic. It is formed when white solid phosphorus is warmed with aqueous sodium hydroxide.



(a) (i) Draw a 'dot and cross' diagram to show the arrangement of the outer shell electrons in one molecule of phosphine. [Proton numbers: P, 15; H, 1]

[2 marks]

Chua Chu Kang Secondary School

Paper 1, Question 12

Which property best indicates that a substance is an ionic compound?

- A It is a crystalline solid at room temperature.
- B It is insoluble in water.
- C It can be synthesised from its element.
- D It conducts electricity in molten state.

[1 mark]

Paper 1, Question 13

The ion of metal X is represented by the symbol X^{3+} . What will the formula of its chloride be?

- A XCl_3
- B X_2Cl_3 .
- C X_3Cl
- D X_3Cl_2

[1 mark]

Paper 1, Question 15

Which molecule contains single covalent bonds only?

- A NH_3
- B O_2
- C N_2
- D CO_2

[1 mark]

Paper 1, Question 19

Which ions are present in chromium sulfate, $Cr_2(SO_4)_3$?

- A Cr^{2+} and SO_4^{2-}
- B Cr^{3+} and SO_4^{2-}
- C Cr^{2+} and SO_4^{3-}
- D Cr^{3+} and SO_4^{3-}

[1 mark]

Paper 2, Question 10 (a, b, c, d)

Chlorine is a non-metallic element.

(a) State the type of bond formed when chlorine reacts with sodium. Explain your answer.

type of bond

explanation

[2 marks]

(b) Draw 'dot and cross' diagrams to show the bonding of sodium with chlorine and hydrogen with chlorine. Show outermost electrons only.
sodium and chlorine

hydrogen and chlorine

[4 marks]

(c) Describe the differences in melting points between the compounds drawn in part (b). Explain, in terms of bonding, why this is so.

[3 marks]

(d) Explain why both substances drawn in part (b) can conduct electricity when dissolved in water.

[1 mark]

Meridian Secondary School

Paper 1, Question 7

What is the formula of the compound formed between the ions X^{3+} and Y^{2-} ?

A XY

B XY_2

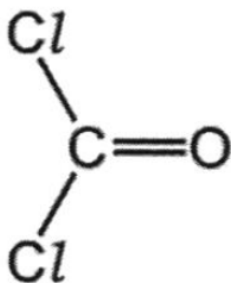
C X_2Y_3

D X_3Y_2

[1 mark]

Paper 1, Question 8

The diagram shows the structure of the molecule carbonyl dichloride.



How many bonding pairs of electrons are there in the molecule?

A 2

B 4

C 6

D 8

[1 mark]

Paper 2, Section C, Question 7(b)

Sodium oxide and carbon dioxide are both compounds.

(b) (i) Draw 'dot and cross' diagrams for sodium oxide and carbon dioxide. Only the outer shell electrons need to be shown.

[Proton numbers: C, 6; O, 8; Na, 11]

sodium oxide
carbon dioxide

[4 marks]

(ii) Explain, in terms of structure and bonding, why sodium oxide is a solid and carbon dioxide is a gas at room temperature and pressure.

[2 marks]

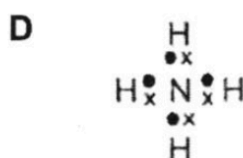
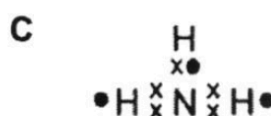
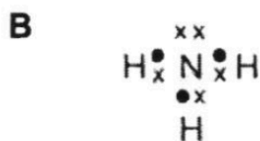
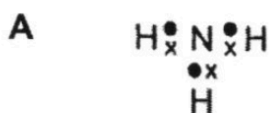
(iii) Sodium oxide has different electrical conductivities in solid and molten states. Use the structure in (b)(i) to explain this difference.

[2 marks]

Deyi Secondary School

Paper 1, Question 6

Which diagram shows the valence electron arrangement in a molecule of ammonia?



[1 mark]

Paper 1, Question 9

The elements **P** and **Q** form the compound **P₂Q**. What are the correct electronic configurations of the atoms of **P** and **Q**?

	atom of P	atom of Q
A	2, 1	2, 6
B	2, 2	2, 6
C	2, 1	2, 7
D	2, 2	2, 7

[1 mark]

Broadrick Secondary School

Paper 1, Question 7

Which particle is an ion?

	number of protons	number of neutrons	number of electrons
A	1	0	1
B	3	4	3
C	6	6	6
D	11	12	10

[1 mark]

Paper 1, Question 10

The table shows some properties of four substances. Which substance is an ionic compound?

	melting point / °C	dissolves in water	conducts electricity when solid	conducts electricity in aqueous state
A	- 102	✓	×	✓
B	801	✓	×	✓
C	842	✓	✓	✓
D	3000	×	✓	×

[1 mark]

Paper 1, Question 13

[Note: This question links the concept of chemical formula (XCl_2) and relative molecular mass (M_r) to identify an element, connecting bonding rules with stoichiometry.]

A metal chloride has the chemical formula of XCl_2 . Its relative molecular mass is 111. What is the identity of metal X?

- A argon
- B calcium
- C iridium
- D zirconium

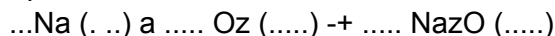
[1 mark]

Paper 3, Question 10 (a, b)

[Note: This question directly compares the formation, structure, and properties of an ionic oxide (Na₂O) and a covalent oxide (H₂O).]

10 Oxide compounds can be formed when an element burns in air.

(a) Sodium burns in air to form a white solid of sodium oxide, Na₂O, as shown in the following equation:



(i) Fill in the blanks above to balance the chemical equation and to provide the state symbols for each substance

(ii) Draw a 'dot and cross' diagram to show the arrangement of the outer shell electrons in sodium oxide.

[2 marks]

(iii) Explain why sodium oxide is able to conduct electricity in molten state but not in solid state.

[2 marks]

(b) Hydrogen burns in air to form hydrogen oxide, H₂O.

(i) Draw a 'dot and cross' diagram to show the arrangement of the outer shell electrons in one molecule of hydrogen oxide.

[2 marks]

(ii) In terms of structure and bonding, explain why hydrogen oxide exists as a liquid at room temperature and pressure.

[2 marks]

Peirce Secondary School

Paper 1, Question 11

What is the correct formula of ammonium sulfate?

- A NH₃SO₄
- B NH₄(SO₄)₂
- C (NH₃)₂SO₄
- D (NH₄)₂SO₄

[1 mark]

Paper 1, Question 12

[Note: This question requires using bonding rules (valency) to deduce the correct electronic configurations that would form a compound with the formula X₂Y.]

The elements **X** and **Y** form the compound **X₂Y**. What is the correct electronic configuration of the atoms **X** and **Y**?

	electronic configuration	
	atom of X	atom of Y

A	2, 1	2, 7
B	2, 2	2, 7
C	2, 1	2, 6
D	2, 2	2, 6

[1 mark]

Paper 3, Section B, Question 11 (a, b)

[Note: This is a comprehensive question comparing a covalent compound (CF_4) and an ionic compound (Na_3N), testing diagrams and property explanations for both.]

(a) Carbon reacts with fluorine to form a potent greenhouse gas called carbon tetrafluoride, CF_4 .

(i) Draw a 'dot and cross' diagram to show the bonding in carbon tetrafluoride. Show only the valence electrons.

[Proton (atomic) number: C, 6; F, 9]

[2 marks]

(ii) Explain whether the compound formed in (a)(i) has a high or low melting point.

[2 marks]

(b) Sodium reacts with nitrogen to form an extremely unstable compound, sodium nitride, Na_3N .

(i) Draw a 'dot-and-cross' diagram showing the bonding in sodium nitride. Show only the valence electrons.

[Proton (atomic) number: N, 7; Na, 11]

[2 marks]

(ii) Explain why compounds with this type of bonding have high melting points.

[2 marks]

(iii) State two other physical properties of compounds with this type of bonding.

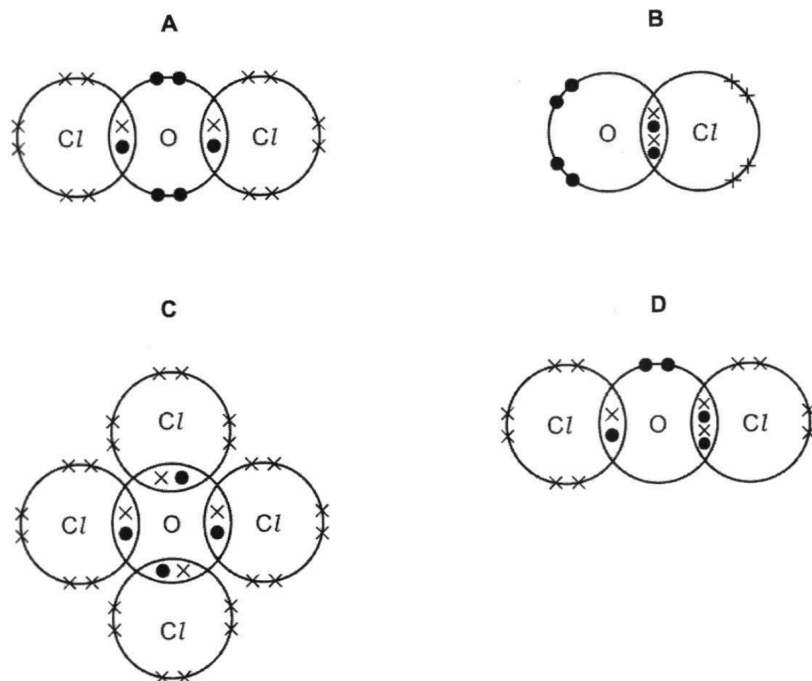
[2 marks]

Springfield Secondary School

Paper 1, Question 8

An atom of chlorine has seven outer electrons. An atom of oxygen has six outer electrons.

Which is the dot-and-cross diagram of the compound formed when oxygen reacts with chlorine?



[1 mark]

Paper 1, Question 9

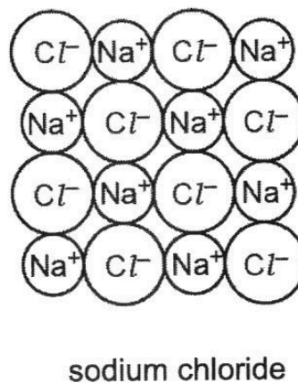
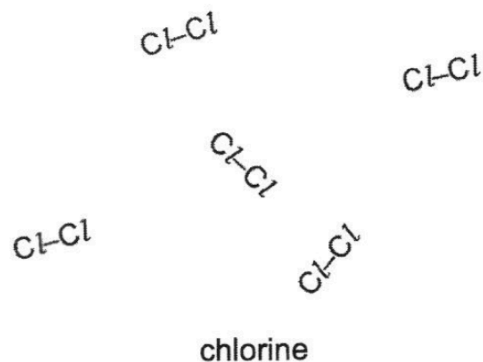
Why does molten calcium chloride conduct electricity?

- A Electrons completely transferred from calcium atoms to chlorine atoms.
- B Electrons in molten calcium chloride are free to move.
- C Calcium ions are strongly attracted to chloride ions.
- D The calcium ions and the chloride ions are free to move.

[1 mark]

Paper 3, Question 4

Part of the structures of chlorine gas and table salt, sodium chloride, are shown below.



(a) Explain why, in terms of structure and bonding, chlorine is a gas while sodium chloride is a solid at room temperature.

[2 marks]

(b) Draw the dot-and-cross diagram to show the electronic structure of sodium chloride. You are required to show all the electrons in the diagram.

[2 marks]

Bedok South Secondary School

Paper 1, Question 9

A metal **P** and a non-metal **Q** react together to form an ionic compound **P₂Q**. Which statement is correct when this compound is being formed?

A Each atom of **P** gives away one electron only.

B Each atom of **P** receives one electron only.

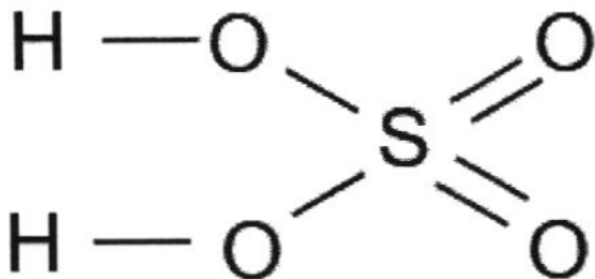
C Each atom of **Q** receives one electron only.

D Each atom of **Q** gives away one electron only.

[1 mark]

Paper 1, Question 10

The bonding in sulfuric acid can be represented as shown below.



How many electrons are involved in bonding in this molecule?

A 8

B 10

C 16

D 18

[1 mark]

Paper 1, Question 11

Which compound has ionic bonds only?

A ammonium chloride

B potassium bromide

C sodium carbonate

D carbon dioxide

[1 mark]

Paper 2, Section C, Question 8 (d)

[Note: This question, while primarily about isotopes and Group I properties, has a part that directly tests understanding of electrical conductivity in ionic compounds.]

8 In 1861, Bunsen and Kirchhoff found that Rubidium has two naturally occurring isotopes, rubidium-85 (^{85}Rb) and rubidium-87 (^{87}Rb).

(a) Define the term isotope.

(b) Both isotopes of rubidium react with chlorine to form rubidium chloride. This compound is commonly used as a biomarker as it dissolves very well in water and is readily absorbed by the human body.

(i) Rubidium is in Group I and its atomic symbol is Rb.

Suggest the chemical formula of rubidium chloride.

(ii) Explain why both isotopes form a compound of rubidium chloride with the same chemical formula.

(c) (i) Draw the electronic configuration of a chlorine atom.

(ii) Write the electronic configuration of a chlorine atom =

(d) Compare and predict the electrical conductivity of rubidium chloride in solid state and when dissolved in water. Explain your answer in terms of structure and bonding.

[Total 8 marks]

This concludes the complete, word-for-word extraction of all questions related to **"Chemical Bonding & Structure"** from the 8 school papers.