04-05 Chemical Bonding and Materials

Set A Foundations

Name

Time 1 hour | Total 36 marks | Score ____ / 36

Use a copy of the Periodic Table where you need one.

A From the lesson

8 MARKS

1 What type of bonding holds magnesium and oxygen together in magnesium oxide?

A covalent bonding **B** ionic bonding **C** metallic bonding **D** intermolecular forces

/1

Answer ☐ [1]

Source: Learners' Alley, Chemical Bonding and Materials slides

2 Which substance conducts electricity in the solid state?

A sodium chloride **B** graphite **C** diamond **D** iodine

/1

Answer ☐ [1]

Source: Learners' Alley, Chemical Bonding and Materials slides

3 Why is diamond very hard?

A Its atoms are held together by weak forces.

B Each carbon atom is bonded to four others by strong covalent bonds.

C It has a sea of delocalised electrons.

D It contains positive and negative ions.

/1

Answer ☐ [1]

Source: Learners' Alley, Chemical Bonding and Materials slides

4 How many pairs of electrons are shared between the two atoms in an oxygen molecule, O_2?

A 1 **B** 2 **C** 3 **D** 4

/1

Answer ☐ [1]

Source: Learners' Alley, Chemical Bonding and Materials slides

5 A sodium atom has the electronic configuration 2.8.1 and a chlorine atom has the electronic configuration 2.8.7. They react to form sodium chloride.

(a) Describe what happens to the electrons when sodium reacts with chlorine.

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

(b) Name the type of bond in sodium chloride and explain how it holds the ions together.

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

/4

Source: Learners' Alley, Chemical Bonding and Materials slides

B Practice

28 MARKS

6 Which of the following pairs of elements forms covalent bonds?

A bromine and calcium

B phosphorus and oxygen

C strontium and sulfur

D zinc and chlorine

Answer ☐ **[1]**

/1

Source: 2023 GESS Sec 3 End-of-Year P1 Q13

7 Which of the following correctly describes metallic bonding?

A electrostatic forces of attraction between positive metal ions surrounded by a 'sea of delocalised electrons'

B electrostatic forces of attraction between negative metal ions surrounded by a 'sea of delocalised electrons'

C intermolecular forces of attraction between positive metal ions surrounded by a 'sea of delocalised electrons'

D intermolecular forces of attraction between negative metal ions surrounded by a 'sea of delocalised electrons'

Answer ☐ **[1]**

/1

Source: 2023 GESS Sec 3 End-of-Year P1 Q14

8 Copper is used in electrical wiring to conduct electricity. Why is copper able to conduct electricity?

A Copper has a 'sea' of delocalised electrons.

B Copper has free-moving ions.

C Copper has a 'sea' of delocalised ions.

D Copper has free-moving atoms.

Answer ☐ **[1]**

/1

Source: 2022 XMS Sec 3 WA2 Q1

9 Calcium phosphate is the main mineral found in human bones and teeth. What is the chemical formula of calcium phosphate?

A $CaPO_3$ **B** $CaPO_4$ **C** $Ca_3(PO_3)_2$ **D** $Ca_3(PO_4)_2$

/1

Answer [1]

Source: 2022 XMS Sec 3 WA2 Q2

10 A solid substance was found to be unable to conduct electricity. When pure water was used to dissolve the substance, the solution could conduct electricity. What could be the structure of the substance, and why can the solution conduct electricity?

	structure	reason for being able to conduct electricity
A	giant metallic structure	Water can conduct electricity.
B	giant metallic structure	It has free-moving electrons.
C	giant ionic structure	It has free-moving ions.
D	giant ionic structure	Water can conduct electricity.

/1

Answer [1]

Source: 2022 XMS Sec 3 WA2 Q4

11 Which of the following groups consists of a metallic element, an ionic compound and a gaseous mixture?

A bronze, sodium chloride, sea water

B air, tungsten, sodium bromide

C sodium, bronze, air

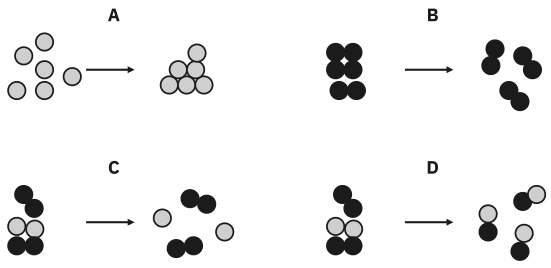
D silicon, aluminium oxide, sea water

/1

Answer [1]

Source: 2020 XMS Sec 3 WA1 P1 Q3

12 Which diagram represents a chemical change?



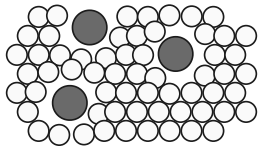
A A **B** B **C** C **D** D

/1

Answer [1]

Source: 2024 CHS Sec 3 End-of-Year Section A Q4

13 The diagram shows the structure of an alloy.



Which statement about alloys is correct?

A Alloys can only be formed by a metal with other metals.

B High carbon steel alloys are soft and easily shaped.

C In an alloy there is attraction between positive ions and a 'sea of delocalised electrons'.

D The alloy brass has a chemical formula.

Answer [ ] [1]

/1

Source: Broadrick Sec 4 Prelim P1 Q32

14 Use this list of substances to answer the questions: sulfur dioxide, graphite, oxygen, sodium sulfate, dry ice.

(a)

(i) Which substance is ionic?

..... [1]

(ii) Which substance has a giant molecular structure?

..... [1]

(iii) Which two substances contain two elements from Group 16?

..... [1]

(iv) If the substances were mixed, which substance can be obtained by sublimation?

..... [1]

(v) Which substance can conduct electricity in the solid state?

..... [1]

(vi) Write down the chemical formula for one of the compounds.

..... [1]

(b) Draw the dot-and-cross diagram for ammonia. Show outer electrons only.

/8

[2]

Source: 2022 XMS Sec 3 WA2 B1, adapted

15 Scandium is a metallic element with the symbol Sc and atomic number 21.

(a) Describe the structure of a piece of scandium.

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

(b) Scandium oxide has the chemical formula Sc_2O_3. Write the chemical formula of

(i) scandium sulfate

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

(ii) scandium hydroxide

/4

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

Source: 2023 XMS Sec 3 WA2 Q7

16 The table shows some information about the properties of compounds Li_2O and CH_4.

compound	melting point / °C	boiling point / °C	solubility in water	electrical conductivity at room temperature and pressure
Li_2O	1438	2600	soluble	poor
CH_4	−182	−162	insoluble	poor

(a) Draw a dot-and-cross diagram for Li_2O. Show outer electrons only.

[2]

(b) What are the physical states of Li_2O and CH_4 at room temperature and pressure?

.....

.....

[2]

(c) Explain, in terms of structure and bonding, why

(i) Li_2O is unable to conduct electricity at room temperature and pressure.

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[2]

(ii) CH_4 has a low melting point and a low boiling point.

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[2]

/8

Source: 2023 XMS Sec 3 WA2 Q10