03 Chemical Bonding and Structure

Set A Concept Practice

Name	Time 50 minutes	Total 43 marks	Score ____ / 43

A From the lesson

26 MARKS

1 What is the formula of aluminium sulfate?

A $AlSO_4$ **B** Al_2SO_4 **C** $Al_2(SO_4)_3$ **D** $Al_3(SO_4)_2$

/1

Answer ☐ [1]

Learners' Alley, Bonding and Structure slides

2 Which compound has the highest melting point?

A NaCl **B** MgO **C** KCl **D** NaBr

/1

Answer ☐ [1]

Learners' Alley, Bonding and Structure slides

3 How many σ and π bonds are in one molecule of ethene, $H_2C{=}CH_2$?

A 4 σ, 2 π **B** 5 σ, 1 π **C** 6 σ, 0 π **D** 4 σ, 1 π

/1

Answer ☐ [1]

Learners' Alley, Bonding and Structure slides

4 Which molecule is polar?

A CCl_4 **B** BF_3 **C** CO_2 **D** $CHCl_3$

/1

Answer ☐ [1]

Learners' Alley, Bonding and Structure slides

5 Which has the highest boiling point?

A CH_4 **B** NH_3 **C** H_2O **D** HF

/1

Answer ☐ [1]

Learners' Alley, Bonding and Structure slides

6 **(a)** Use the Periodic Table to give the number of shells and of valence electrons in a magnesium atom.

.....

[1]

(b) Do the same for a sulfur atom.

.....

[1]

(c) Does a calcium atom reach an octet more easily by losing or by gaining electrons? Explain.

.....

/4 ..... **[2]**

Learners' Alley, Chemical Bonding and Structure slides

7 Write the formulae of potassium oxide, iron(III) chloride and ammonium sulfate.

/3 ..... **[3]**

Learners' Alley, Chemical Bonding and Structure slides

8 Which has the higher melting point, NaF or CsCl? Explain.

.....

.....

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

Learners' Alley, Chemical Bonding and Structure slides

9 Draw dot-and-cross diagrams for these molecules. Show outer electrons only.

(a) H_2O

[1]

(b) N_2

/2 **[1]**

Learners' Alley, Chemical Bonding and Structure slides

10 State the shape and bond angle of each molecule.

(a) BF_3

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

(b) H_2O

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

(c) SF_6

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

(d) XeF_4

/4

.....

[1]

Learners' Alley, Chemical Bonding and Structure slides

11 **(a)** Which bond is more polar, C–Cl or C–F? Explain.

.....

[1]

(b) Why is CCl_4 non-polar although its bonds are polar?

.....

/2

.....

[1]

Learners' Alley, Chemical Bonding and Structure slides

12 **(a)** Which of CH_4, CH_3OH, HCl and NH_3 form hydrogen bonds between their own molecules?

.....

[1]

(b) Put Cl_2, Br_2 and I_2 in order of increasing boiling point. Explain.

.....

/2

.....

[1]

Learners' Alley, Chemical Bonding and Structure slides

13 Explain why SiO_2 melts at 1710 °C but CO_2 is a gas at room temperature.

.....

.....

/2

.....

[2]

Learners' Alley, Chemical Bonding and Structure slides

B Practice

17 MARKS

14 Sodium is a grey solid. Chlorine is a yellowish-green gas. When sodium is heated and mixed with chlorine, a reaction takes place and a white crystalline substance called sodium chloride is formed. Which statement about sodium chloride is correct?

A It is a compound of sodium and chlorine.

B It is a mixture of sodium and chlorine.

C It is a new element.

D It is an alloy of sodium and chlorine.

/1

Answer ☐ [1]

2024 Zhenghua O Prelim P1-P3 Q8

15 The electronic configurations of three particles, X, Y and Z, are shown.

particle	electronic configuration

X	2.1
Y	1
Z	2.8.7

Which statement is true about these three particles?

A X forms covalent bonds with Z.

B X forms ionic bonds with Y.

C Y can only form ionic bonds.

D Y forms ionic bonds with Z.

Answer [1]

/1

2025 FHSS O Prelim P1 Q8

16 Elements X and Y react to form an ionic compound of formula XY_2. Which row correctly shows the electronic configurations of atoms X and Y? Each option gives X, then Y.

A X 2.1, Y 2.5

B X 2.4, Y 2.6

C X 2.8.1, Y 2.8.6

D X 2.8.8.2, Y 2.8.7

Answer [1]

/1

2025 CHIJ O Prelim P1 Q6

17 The electronic configurations of elements X and Y are X: 2.8.3 and Y: 2.6. Element X and element Y react together to form a compound. Which row shows the electron transfer that takes place and the type of compound formed?

	element X	element Y	type of compound
A	2 atoms each lose 3 electrons	3 atoms each receive 2 electrons	covalent
B	2 atoms each lose 3 electrons	3 atoms each receive 2 electrons	ionic
C	2 atoms each receive 3 electrons	3 atoms each lose 2 electrons	covalent
D	2 atoms each receive 3 electrons	3 atoms each receive 2 electrons	ionic

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

Answer [1]

/1

2024 SKSS O Prelim P1 Q7

18 Which statement best explains why potassium chloride has a lower melting point than calcium oxide?

A Potassium chloride is a covalent compound but calcium oxide is an ionic compound.

B Potassium is more reactive than calcium.

C The forces of attraction between K^+ and Cl^- are weaker than those between Ca^{2+} and O^{2-}.

D The melting point of potassium is lower than that of calcium.

Answer [1]

/1

2025 Compassvale O Prelim P1 Q12

19 Both calcium chloride and potassium chloride are ionic compounds. Which statement about these compounds is correct?

A Potassium chloride has a higher melting point than calcium chloride because the potassium ion has a greater charge than the calcium ion.

B Calcium chloride and potassium chloride conduct electricity because positive and negative ions flow through the solid material.

C Molten calcium chloride has a greater electrical conductivity than molten potassium chloride because calcium contributes more electrons to the delocalised 'sea of electrons' than potassium.

D In the calcium chloride lattice, the ratio of calcium ions to chloride ions is half that of the ratio of potassium ions to chloride ions in the potassium chloride lattice.

/1

Answer [1]

2024 USS O Prelim P2 Q7

20 The table shows four elements P, Q, R and S with their atomic numbers.

element	P	Q	R	S
atomic number	6	12	13	8

What are the likely formulae of an ionic compound and a covalent compound formed from P, Q, R and S? Each option gives the ionic compound, then the covalent compound.

A QS_2, Q_2P **B** Q_3R_2, R_2S_3 **C** R_2S_3, PS_2 **D** S_2, Q_2P

/1

Answer [1]

2024 Zhonghua O Prelim P1 Q9

21 What is the number of electrons and neutrons in a hydroxide ion? Each option gives the electrons, then the neutrons.

A 9 electrons, 8 neutrons

B 9 electrons, 9 neutrons

C 10 electrons, 8 neutrons

D 10 electrons, 9 neutrons

/1

Answer [1]

Source: 2024 SJI O Prelim P1 Q4

22 Which substance contains both ionic and covalent bonds?

A ammonium chloride

B hydrogen chloride

C lithium oxide

D silicon dioxide

/1

Answer [1]

2025 CCHY O Prelim P1 Q11

23 A substance Y

- has a high melting point
- is a good conductor of electricity
- is malleable.

What could Y be?

A graphite **B** iron **C** potassium chloride **D** silicon dioxide

/1

Answer [1]

2025 CCHY O Prelim P1 Q12

24 Brass is an alloy made by adding zinc to copper. Brass is harder than pure copper, and the higher the percentage of zinc in the brass, the harder it is. Which statement best explains why brass is harder than

pure copper?

A The copper atoms are bonded strongly to the valence electrons of zinc atoms.

B The copper atoms form strong metallic bonds with zinc atoms in brass.

C The zinc atoms are bonded strongly to the 'sea of electrons' and prevent the electrons from moving freely in the lattice.

D The zinc atoms disrupt the orderly arrangement of copper atoms and prevent the layers of copper atoms from sliding over one another easily.

Answer ☐ [1]

/1

2024 Zhonghua O Prelim P1 Q25

25 Which statement about metals is correct?

A A giant metallic lattice consists of metal atoms in a 'sea of electrons'.

B All metals have high melting points.

C Electrons in a metal move randomly through the giant metallic lattice.

D Metals are malleable as the atoms in a metal are mobile.

Answer ☐ [1]

/1

2024 SJI O Prelim P1 Q8

26 Which row shows the correct number of electrons used in covalent bonding in each molecule?

	ammonia	carbon dioxide	fluorine	nitrogen
A	6	4	2	4
B	6	8	2	6
C	6	4	2	6
D	6	8	2	4

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

Answer ☐ [1]

/1

2025 Compassvale O Prelim P1 Q11

27 Silicon dioxide has a giant covalent structure. Each silicon atom is joined to four oxygen atoms by covalent bonds. Which property would silicon dioxide be expected to have?

A a good conductor of electricity

B a high melting point

C reacts with dilute hydrochloric acid

D soluble in water

Answer ☐ [1]

/1

2026 KSS O Prelim P1 Q11

28 At room temperature and pressure, carbon dioxide is a gas while silicon dioxide is a solid. Which statement explains this?

A Attractive forces between carbon dioxide molecules are weaker than the attractive forces between ions in silicon dioxide.

B Both substances have different covalent structures.

C The covalent bonds in carbon dioxide are weaker than those in silicon dioxide.

D There are fewer covalent bonds in carbon dioxide than in silicon dioxide.

/1

Answer ☐ [1]

2024 SJI O Prelim P1 Q9

29 Which two substances have similar three-dimensional arrangements of their atoms?

A diamond and silicon dioxide

B graphite and diamond

C carbon dioxide and graphite

D silicon dioxide and carbon dioxide

/1

Answer ☐ [1]

2024 YSS O Prelim P1 Q8

30 Which structure corresponds to its description of physical properties?

	structure	physical properties
1	giant covalent	high melting point, conducts electricity when in solution but not when solid
2	simple molecular	low melting point, does not conduct electricity in any state
3	giant metallic	variety of melting points, conducts electricity when solid and when molten

A 1 and 2 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

/1

Answer ☐ [1]

2025 TKGS O Prelim P1 Q9

10 The Periodic Table of Elements

Group																	
1	2											13	14	15	16	17	18
							1 H hydrogen 1.0										2 He helium 4.0
3 Li lithium 6.9	4 Be beryllium 9.0											5 B boron 10.8	6 C carbon 12.0	7 N nitrogen 14.0	8 O oxygen 16.0	9 F fluorine 19.0	10 Ne neon 20.2
11 Na sodium 23.0	12 Mg magnesium 24.3	3	4	5	6	7	8	9	10	11	12	13 Al aluminium 27.0	14 Si silicon 28.1	15 P phosphorus 31.0	16 S sulfur 32.1	17 Cl chlorine 35.5	18 Ar argon 39.9
19 K potassium 39.1	20 Ca calcium 40.1	21 Sc scandium 45.0	22 Ti titanium 47.9	23 V vanadium 50.9	24 Cr chromium 52.0	25 Mn manganese 54.9	26 Fe iron 55.8	27 Co cobalt 58.9	28 Ni nickel 58.7	29 Cu copper 63.5	30 Zn zinc 65.4	31 Ga gallium 69.7	32 Ge germanium 72.6	33 As arsenic 74.9	34 Se selenium 79.0	35 Br bromine 79.9	36 Kr krypton 83.8
37 Rb rubidium 85.5	38 Sr strontium 87.6	39 Y yttrium 88.9	40 Zr zirconium 91.2	41 Nb niobium 92.9	42 Mo molybdenum 95.9	43 Tc technetium –	44 Ru ruthenium 101.1	45 Rh rhodium 102.9	46 Pd palladium 106.4	47 Ag silver 107.9	48 Cd cadmium 112.4	49 In indium 114.8	50 Sn tin 118.7	51 Sb antimony 121.8	52 Te tellurium 127.6	53 I iodine 126.9	54 Xe xenon 131.3
55 Cs caesium 132.9	56 Ba barium 137.3	57–71 lanthanoids	72 Hf hafnium 178.5	73 Ta tantalum 180.9	74 W tungsten 183.8	75 Re rhenium 186.2	76 Os osmium 190.2	77 Ir iridium 192.2	78 Pt platinum 195.1	79 Au gold 197.0	80 Hg mercury 200.6	81 Tl thallium 204.4	82 Pb lead 207.2	83 Bi bismuth 209.0	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –	113 Nh nihonium –	114 Fl flerovium –	115 Mc moscovium –	116 Lv livermorium –	117 Ts tennessine –	118 Og oganesson –

Key

atomic number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 138.9	58 Ce cerium 140.1	59 Pr praseodymium 140.9	60 Nd neodymium 144.2	61 Pm promethium –	62 Sm samarium 150.4	63 Eu europium 152.0	64 Gd gadolinium 157.3	65 Tb terbium 158.9	66 Dy dysprosium 162.5	67 Ho holmium 164.9	68 Er erbium 167.3	69 Tm thulium 168.9	70 Yb ytterbium 173.1	71 Lu lutetium 175.0
actinoids	89 Ac actinium –	90 Th thorium 232.0	91 Pa protactinium 231.0	92 U uranium 238.0	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –