02 Chemical Bonding

Set A Foundations

Name	Time 1 hour	Total 35 marks	Score ____ / 35

A Data Booklet may be used.

A From the lesson

11 MARKS

1 Explain why the melting point of potassium (63 °C) is lower than that of sodium (98 °C).

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

/2

Source: Learners' Alley, Chemical Bonding slides

2 COMMON Explain why NaF (993 °C) has a higher melting point than NaCl (801 °C).

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

/2

Source: Learners' Alley, Chemical Bonding slides

3 State the shape and bond angle of

(a) PCl_3

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

(b) SF_6

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

(c) XeF_4

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

/3

Source: Learners' Alley, Chemical Bonding slides

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

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

/2

Source: Learners' Alley, Chemical Bonding slides

5 Why is CO_2 non-polar although the C=O bond is polar?

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

/1

Source: Learners' Alley, Chemical Bonding slides

6 Why does ice float on water?

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

/1

Source: Learners' Alley, Chemical Bonding slides

B Practice

24 MARKS

7 COMMON The boiling point of water (100 °C) is greater than that of HF (20 °C). Which statement is a correct explanation of the above?

A Each hydrogen bond formed between water molecules is stronger than that formed between HF molecules.

B There are more atoms in a water molecule than there are in an HF molecule, resulting in stronger intermolecular forces in water.

C There are, on average, more hydrogen bonds between water molecules than there are between HF molecules.

D The water molecule has stronger permanent dipole–dipole interactions than the HF molecule.

Answer ☐ **[1]**

/1

Source: 2025 EJC J2 Prelim P1 Q4

8 The element tin exists in two forms, grey tin and white tin. Some properties of grey tin and white tin are shown.

	grey tin	white tin
boiling point	2543 °C	2533 °C
electrical conductivity	none in solid or liquid	good in solid and liquid
malleability	brittle	malleable

Which structural change might take place when grey tin changes to white tin?

A giant covalent to giant ionic

B giant covalent to giant metallic

C giant ionic to giant covalent

D giant ionic to giant metallic

Answer [ ] [1]

/1

Source: 2025 ASRJC J2 Prelim P1 Q4

9 Explain why sulfur can form sulfur hexafluoride but oxygen cannot form oxygen hexafluoride, though both elements are in the same group.

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

/2

Source: EJC 2022 JC1 Chemical Bonding Tutorial, A3

10 **(a)(i)** Describe the bonding present in solid krypton, $_{36}Kr$.

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

(ii) Describe the bonding present in solid rubidium, $_{37}Rb$.

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

(b) Use your descriptions of their bonding to explain why the boiling point of krypton is −152 °C whereas that of rubidium is 686 °C, despite their having nearly the same relative atomic mass, A_r.

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

/4

Source: A Level 2017 P2 Q3, via EJC 2022 JC1 Chemical Bonding Tutorial, A12

11 COMMON Explain each of the following observations as fully as you can in terms of chemical bonding and structure.

(a) The boiling points of the halogens show a trend.

element	Cl_2	Br_2	I_2
boiling point / °C	−35	+59	+184

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

(b) Hydrogen fluoride has a higher boiling point than hydrogen chloride.

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

(c) The boiling point of ammonia (−33 °C) is higher than that of phosphine, PH_3 (−87 °C).

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

/6

Source: EJC 2022 JC1 Chemical Bonding Tutorial, A13(a), (c) and (d)

12 COMMON This question is about the bond angles in some simple molecules.

(a)(i) State the bond angle in a molecule of BF_3.

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

(ii) State whether the bond angle in NH_3 is larger than, smaller than, or equal to that in BF_3. Give an explanation for your answer.

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

(b) Which of the species CH_4 and NH_3 has the larger bond angle? Give an explanation for your answer.

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

/5

Source: RJC H2 Chemistry Tutorial 3a (Chemical Bonding I), Q4(a) and (b)

13 Both calcium oxide and sodium chloride have the same solid structure and similar ionic distances, yet calcium oxide melts at 2973 K whereas sodium chloride melts at 1074 K. Explain this observation in terms of structure and bonding.

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

/2

Source: RJC H2 Chemistry Tutorial 3b (Chemical Bonding II), Q5(a)

14 CHALLENGE Dichloromethane, CH_2Cl_2, is a solvent used to extract caffeine from coffee. Carbonated water contains H^+ ions from carbonic acid.

(a) Suggest whether the Cl–C–Cl bond angle in CH_2Cl_2 is smaller than, equal to, or larger than the H–C–H bond angle.

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

(b) H^+ ions do not exist in isolation in water. They bond to water molecules to form hydronium ions, H_3O^+. Predict and explain the shape of the hydronium ion.

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

/3

Source: 2018 RI J1 Promo Section B Q3(d)(ii) and (e)(i)