Electrons, Bonding & Structure AS & A Level

Question Paper 2

Level	A Level
Subject	Chemistry
Exam Board	OCR
Module	Foundations in Chemistry
Topic	Electrons, Bonding & Structure
Paper	AS & A Level
Booklet	Question Paper 2

Time allowed: **55 minutes**

Score: **/41**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E
>85%	73%	60%	47%	34%	21%

Solids exist as lattice structures.

(a) Giant metallic lattices conduct electricity. Giant ionic lattices do not. If a giant ionic lattice is melted, the molten ionic compound will conduct electricity.

Explain these observations in terms of bonding, structure and particles present. [3]

(b) The solid lattice structure of ammonia, NH_3, contains hydrogen bonds.

(i) Draw a diagram to show hydrogen bonding between **two** molecules of NH_3 in a solid lattice.

Include relevant dipoles and lone pairs. [2]

(ii) Suggest why ice has a higher melting point than solid ammonia. [2]

(c) Solid SiO_2 melts at 2230 °C. Solid $SiCl_4$ melts at –70 °C. Neither of the liquids formed conducts electricity.

Suggest the type of lattice structure in solid SiO_2 and in solid $SiCl_4$ and explain the difference in melting points in terms of **bonding** and **structure**.

In your answer you should use appropriate technical terms, spelled correctly. [5]

[Total: 12 Marks]

This question compares the bonding, structure and properties of sodium and sodium oxide.

(a) Sodium, Na, is a metallic element.

Explain, with the aid of a labelled diagram, what is meant by the term *metallic bonding*. [3]

(b) Sodium reacts with oxygen to form sodium oxide, Na_2O, which is an ionic compound.

(i) Write the equation for the reaction of sodium with oxygen to form sodium oxide. [1]

(ii) State what is meant by the term *ionic bond*. [1]

(iii) Draw a '*dot-and-cross*' diagram to show the bonding in Na_2O.

Show **outer** electrons only. [2]

(c) Compare and explain the electrical conductivities of sodium and sodium oxide in the solid and liquid states. [5]

[Total: 12 Marks]

Linus Pauling was a Nobel prize winning chemist who devised a scale of electronegativity.

Some Pauling electronegativity values are shown in the table.

element	electronegativity
B	2.0
Br	2.8
N	3.0
F	4.0

(a) What is meant by the term *electronegativity*? [2]

(b) Show, using δ+ and δ– symbols, the permanent dipoles on each of the following bonds.

[1]

N—F N—Br

(c) Boron trifluoride, BF_3, ammonia, NH_3, and sulfur hexafluoride, SF_6, are all covalent compounds. The shapes of their molecules are different.

(i) State the shape of a molecule of SF_6. [1]

(ii) Using outer electron shells only, draw '*dot-and-cross*' diagrams for molecules of BF_3 and NH_3.

Use your diagrams to explain why a molecule of BF_3 has bond angles of 120° and NH_3 has bond angles of 107°.

[5]

BF_3	**NH_3**

(iii) Molecules of BF_3 contain polar bonds, but the molecules are non-polar. [2]

Suggest an explanation for this difference.

[Total: 11 Marks]

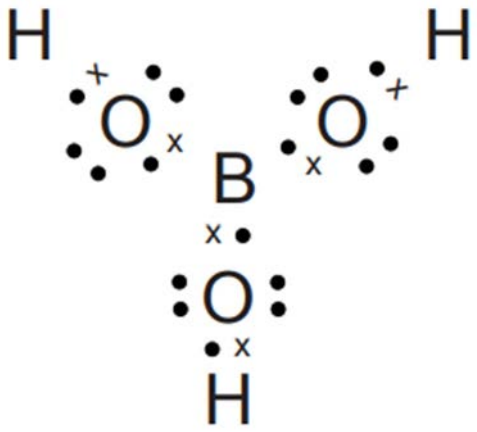
Simple molecules are covalently bonded.

(a) State what is meant by the term *covalent bond*. [1]

(b) Chemists are able to predict the shape of a simple covalent molecule from the number of electron pairs surrounding the central atom.

(i) Explain how this enables chemists to predict the shape. [2]

(ii) The '*dot-and-cross*' diagram of the simple covalent molecule, H_3BO_3, is shown below.



Predict the O–B–O and B–O–H bond angles in a molecule of H_3BO_3. [2]

(c) Give an example of a simple covalent molecule which has all bond angles equal to 90°. [1]

[Total 6 Marks]