4.3 Intermolecular Forces & Metallic Bonding

Question Paper

Course	DP IB Chemistry
Section	4. Chemical Bonding & Structure
Topic	4.3 Intermolecular Forces & Metallic Bonding
Difficulty	Easy

Time allowed: 50

Score: /36

Percentage: /100

Question 1a

a)
There are a number of different types of intermolecular force possible between molecules.
Which types of forces can be classified as 'van der Waals' forces?

[2]

[2 marks]

Question 1b

b)
Methanol, CH_3OH, is a small alcohol molecule that forms hydrogen bonds with water.
Sketch 2 different hydrogen bonding interactions between methanol and water.

[2]

[2 marks]

Question 1c

c)
Methanol, CH_3OH can be oxidised to methanal, CH_2O and then to methanoic acid, HCOOH.

Identify the strongest type of intermolecular force between:

i)
Methanal molecules

ii)
Methanoic acid molecules

iii)
Water and methanal

iv)
Water and methanoic acid

[4]

[4 marks]

Question 1d

d)
Methanoic acid reacts with sodium hydroxide to form sodium methanoate:

$$HCOOH + NaOH \rightarrow HCOONa + H_2O$$

Explain why sodium methanoate is a solid at room temperature and methanoic acid is a liquid.

[3]

[3 marks]

Question 2a

a)
Group 17 of the Periodic Table contain non-metals that are often referred to as the halogens.

Iodine, I_2, is one of these halogens. At room temperature and pressure it exists as a grey-black solid.

Describe the bonding and forces present in I_2 in the solid state.

[2]

[2 marks]

Question 2b

b)

The state of the halogens changes down the group, with fluorine being a gas and astatine being a solid.
Explain why the melting point of the halogens increases down the group.

[2]

[2 marks]

Question 2c

c)
The halogens are all diatomic covalent molecules.
Predict the most probable physical properties shown by all of the elements in Group 17.

[3]

[3 marks]

Question 2d

d)
The halogens can also form interhalogen compounds, such as iodine monochloride, ICl.
Predict the state of iodine monochloride at room temperature and pressure, and explain your answer with reference to the intermolecular forces present.

[3]

[3 marks]

Question 3a

a)
Describe the bonding in solid sodium.

[2]

[2 marks]

Question 3b

b)
Potassium has a lower melting point than sodium does.
Explain why.

[2]

[2 marks]

Question 3c

c)
Magnesium is in the same period as sodium, but has a much higher melting point.
Explain why.

[2]

[2 marks]

Question 3d

d)
Predict whether magnesium is harder or softer than sodium and explain why.

[2]

[2 marks]

Question 4a

a)
Copper is a common metal used in wiring.
Explain the electrical conductivity of copper.

[2]

[2 marks]

Question 4b

b)
Explain why copper is also very malleable.

[2]

[2 marks]

Question 4c

c)
Copper is used in alloys such as brass and bronze.
Outline why copper alloys are usually less malleable than pure copper.

[1]

[1 mark]

Question 4d

d)
Copper is used for water pipes.
Suggest two properties of copper that make it suitable for this use, excluding malleability.

[2]

[2 marks]