CHEMISTRY ONLINE
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CHEMISTRY

Physical Chemistry

Level & Board	AQA (A-LEVEL)
TOPIC:	BONDING
PAPER TYPE:	QUESTION PAPER -3
TOTAL QUESTIONS	10
TOTAL MARKS	53

Bonding

1. Nickel is a metal.

(a) Nickel has high melting point.

i. State the block in the Periodic Table that contains nickel.

(1)

ii. Explain, in terms of its structure and bonding, why nickel has a high melting point.

(2)

iii. Draw a labelled diagram to show the arrangement of particles in a crystal of nickel.

(2)

iv. Explain why nickel is ductile (can be stretched into wires).

(1)

(b) Nickel forms the compound nickel(II) chloride ($NiCl_2$).

i. Give the full electron configuration of the Ni^{2+} ion.

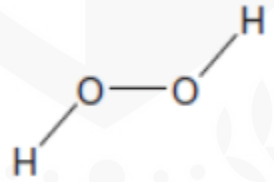
(1)

ii. Balance the following equation to show how anhydrous nickel(II) chloride can be obtained from the hydrated salt using $SOCl_2$
Identify one substance that could react with both gaseous products.

.....$NiCl_2.6H_2O(s)$ + ... $SOCl_2(g)$ → .....$NiCl_2(s)$ + ...$SO_2(g)$ + ...$HCl(g)$

(2)

2. A hydrogen peroxide molecule can be represented by the structure shown.



(a) Suggest a value for the H−O−O bond angle.

(1)

(b) Hydrogen peroxide dissolves in water.

i. State the strongest type of interaction that occurs between molecules of hydrogen peroxide and water.

(1)

ii. Draw a diagram to show how one molecule of hydrogen peroxide interacts with one molecule of water.

Include all lone pairs and partial charges in your diagram.

(3)

(c) Explain, in terms of electronegativity, why the boiling point of H_2S_2 is lower than H_2O_2.

(2)

3. This question is about structure and bonding.

(a) Draw a diagram to show the strongest type of interaction between two molecules of acetic acid (CH_3COOH) in the liquid phase.

Include all lone pairs and partial charges in your diagram.

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(3)

(b) Dimethyl ether (CH_3OCH_3) is an isomer of acetic acid.

The table shows the boiling points of acetic acid and dimethyl ether:

Compound	Boiling point / °C
acetic acid	118
dimethyl ether	−23

In terms of the intermolecular forces involved, explain the difference in boiling points.

(3)

(c) Draw the shape of the SO_2 molecule and the shape of the ClF_4^- ion.

Include any lone pairs of electrons that influence the shapes.

In an SO_2 molecule, the oxygen atom is attached to the sulfur atom by a double bond that uses two electrons from sulfur.

Name each shape.

Suggest a value for the bond angle in ClF_4^-.

(5)

4. Which change occurs when water is vaporised?

A. An exothermic change occurs.
B. Covalent bonds are broken.
C. Intermolecular forces are overcome.
D. The total energy of the molecules decreases.

(Total 1 mark)

5. Which compound has the highest boiling point?

A. $CH_3CH_2CH_2Br$
B. $CH_3CH_2CH_2F$
C. CH_3CH_2CHO
D. CH_3CH_2COOH

(Total 1 mark)

6. This question is about compounds that contain oxygen.

(a) Magnesium oxide contains magnesium ions (Mg^{2+}) and oxide ions (O^2).
Mg^{2+} and O^{2-} have the same electron configuration.

Explain why an oxide ion is larger than a magnesium ion.

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(2)

(b) Explain, in terms of structure and bonding, why the melting point of magnesium oxide is high.

(2)

(c) Perchloric acid contains ion, ClO_4^-.

Draw the shape of the ClO_4^- ion.

Include any lone pairs that influence the shape.

Name the shape of ion.

(4)

7. This question is about hexan-3-one and but-1-ene.
The boiling point of hexan-3-one is 150 °C.
The boiling point of but-1-ene is -6 °C.
Explain why hexan-3-one has a higher boiling point than but-1-ene.

(3)

8. This question is about shapes of molecules and ions.

Draw the shape of SO_2 and of SO_3^{2-}.

Include any lone pairs of electrons that influence the shape.

Name the shape of SO_2.

State and explain the bond angle in SO_3^{2-}.

(Total 5 marks)

9. Which substance has delocalised electrons?

A. Graphite
B. Iodine
C. Sodium chloride

D. Tetrachloromethane

(Total 1 mark)

10. Describe the bonding in, and the structure of, sodium chloride.

Draw a diagram showing how structure can be represented.

Explain by reference to the types of bonding present, why the melting point is very high.

I am Sorry !!!!!

(6)

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