**Covalent compounds Solutions**

**SECTION A: Multiple-choice questions (1 mark each)**

**Question 1**

*Answer:* B

*Explanation:*

Most covalent bonds form when non-metal atoms share electrons. As non-metals their outer shells are easier to fill by sharing than by electron transfer.

**Question 2**

*Answer:* C

*Explanation:*

Oxygen requires two electrons to complete its outer shell. Chlorine requires one. Therefore one oxygen atom can share with two chlorine atoms.

**Question 3**

*Answer:* A



*Explanation:*

Easy to count from the diagram provided.

**Question 4**

*Answer:* D

*Explanation:*

The size of the dipoles dictates the boiling point. Oxygen gas has no dipoles at all, HI has weak dipoles and water has strong dipoles and a relatively high boiling point.

**Question 5**

*Answer:* A

*Explanation:*

The format of the diagram matches a ball-and-stick model. Ammonia has a trigonal pyramid shape.

**Question 6**

*Answer:* C

*Explanation:*

The difference in electronegativity between nitrogen and hydrogen atoms leads to dipoles. The dipoles do not cancel so the molecule is polar.

**Question 7**

*Answer:* D

*Explanation:*

Molecular compounds have low melting points. They do not conduct electricity in any form at all.

**Question 8**

*Answer:* A

*Explanation:*

Oxygen forms molecules. As a solid, these oxygen molecules are held together by dispersion forces. They will form a solid that has a particular arrangement.

**Question 9**

*Answer:* B

*Explanation:*

A triple covalent bond can form between two atoms that have five electrons in their outer shell – nitrogen being a typical example.

**Question 10**

*Answer:* B

*Explanation:*

Covalent molecular compounds have the same covalent bonds as network lattices, the difference is that the entire structure of a network lattice is covalently bonded. There is no need for dispersion forces or dipoles between molecules.

**SECTION B: Short-answer questions**

**Question 1** (9 marks)

**a**.  **i**. nitrogen: 1s22s22p3 1 mark

 **ii**. hydrogen: 1s1 1 mark

 **iii**. Nitrogen will require three more electrons and hydrogen one.\* The formula will be NH3

 as this enables nitrogen to complete an outer shell sharing with three hydrogen atoms.\*

 2 mark

 **iv**. 1 mark

**b. i**. A bond formed when electrons from each atom are shared 1 mark

 **ii**. Covalent bonds are very strong 1 mark

**c**. The octet rule reflects the observation that main group elements tend to combine in such a

 way that each atom has eight electrons in its valence shell . 2 marks

Total 9 marks

**Question 2 (5 marks)**

**a. i**. How many non-bonding electrons does this molecule have? 8 1 mark

 **ii**. How many bonding electrons does this molecule have? 8 1 mark

**b**. The carbon atom has two sets of electrons to get as far from each other as possible. A linear

 arrangement will do this. 1 mark



**c. i**. Both oxygen atoms are slightly negative, and the carbon is

 slightly positive. 1 mark

 **ii**. Carbon dioxide will be non-polar as the effect of the two dipoles is to cancel each other

 1 mark

**Question** **3** (6 marks)

**a. i**. 1 mark

 **ii**. tetrahedral 1 mark

**b**. Intermolecular bonds are bonds between one molecule of methane and other molecules of

 methane\*. Intramolecular bonds are the bonds within the molecule, the covalent bonds.\*

 2 marks

**c**. Methane has a low boiling point. This is due to weak forces between molecules.\* The only

 intermolecular forces are weak dispersion forces hence the boiling point is low 2 marks

**Question 4**

**a**.

3 marks

**b**. chlorine

1 mark

**c**. dispersion forces

1 mark

Total 5 marks

**Question 5** (8 marks)

**a**.

 **i**.  1 mark

 **ii**. Is HCl polar? Yes 1 mark

**b**. i. 1 mark

 

 **ii**. Trigonal pyramid 1 mark

 **iii**. yes 1 mark

**c. i**. Several answers possible, H2, Cl2  1 mark

 **ii**. CO2, CCl4  1 mark

 **iii**. H2O, NH3 1 mark

**Question 6** (7 marks)

**a. i**. Allotrope: an element that can form more than one structure 1 mark

 **ii**. Each carbon atom can form a single covalent bond with four other carbon atoms. The structure around each carbon atom is tetrahedral. The carbons can keep joining to further carbons. 1 mark

 **iii**. Diamond has a high melting point because it is made entirely from covalent bonds\*. For it to melt, the strong covalent bonds need to break. There are no intermolecular bonds.\* 2 marks



**b**. Graphite contains strongly bonded layers but

there are only weak bonds between layers. Graphite can

act as a lubricant due to this structure. Nor is it as hard as

diamond. Graphite also has delocalised electrons.

3 marks