Traditional exam style questions on Covalent bonding

1. The electronegativities of four different elements are given below (the letters are not their chemical symbols).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Element | W | X | Y | Z |
| Electronegativity | 0.9 | 1.2 | 3.4 | 4.0 |

Based on this information which statement is correct?

1. W is a non-metal.
   1. W and X form an ionic compound.
   2. Y is a metal.
   3. Y and Z form a covalent compound.

(Total 1 mark)

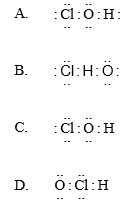
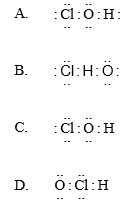
1. Which is the best description of the bonding present in the ammonium ion, NH4+?
   1. Sharing of electrons between atoms
   2. Electrostatic attraction between ions
   3. Electrostatic attraction between positive ions and delocalized electrons
   4. Sharing of electrons between atoms and electrostatic attraction between ions

(Total 1 mark)

1. Which compound forms hydrogen bonds in the liquid state?
   1. C2H5OH
   2. CHCl3
   3. CH3CHO
   4. (CH3CH2)3N

(Total 1 mark)

1. What is the correct Lewis structure for hypochlorous acid, a compound containing chlorine, hydrogen and oxygen?



(Total 1 mark)

1. How do the bond angles in CH4, NH3 and H2O compare?
   1. CH4 = NH3 = H2O
   2. CH4 < NH3 < H2O
   3. NH3 < CH4 < H2O
   4. H2O < NH3 < CH4

(Total 1 mark)

1. The Lewis structure of SO2 is given below.

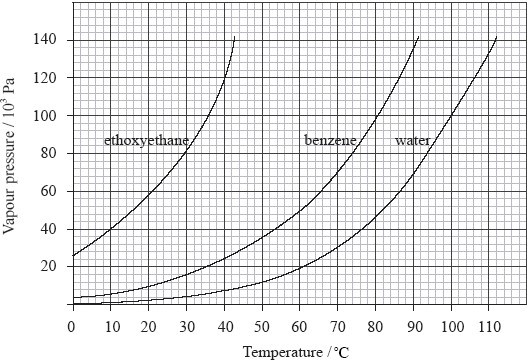


What is the shape of the SO2 molecule?

* 1. Bent (V-shaped)
  2. Linear
  3. T-shaped
  4. Triangular planar

(Total 1 mark)

1. The graph below illustrates how the vapour pressures of ethoxyethane, CH3CH2OCH2CH3, benzene, C6H6, and water, H2O, change with temperature.



* 1. Using data from the graph, explain the difference in vapour pressure of ethoxyethane, benzene and water at 30 °C.

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

(4)

* 1. Use the graph to determine the boiling point of benzene at standard pressure.

......................................................................................................................................

(1)

(Total 5 marks)

1. Which molecule has a non-bonding (lone) pair of electrons on the central atom?
   1. BF3
   2. SO2
   3. CO2
   4. SiF4

(Total 1 mark)

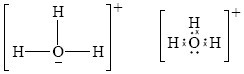
1. The number of electrons in the valence shell of elements A and B, are 6 and 7 respectively. What is the formula and type of bonding in a compound formed by these elements?
   1. A2B, covalent
   2. AB2, covalent
   3. A2B, ionic
   4. AB2, ionic

(Total 1 mark)

1. Which order is correct when the following compounds are arranged in order of increasing melting point?
   1. CH4 < H2S < H2O
   2. H2S < H2O < CH4
   3. CH4 < H2O < H2S
   4. H2S < CH4 < H2O

(Total 1 mark)

1. Lewis structures are represented in different ways in different parts of the world. Two ways of drawing the Lewis structure for H3O+ are shown below.



Which statement is correct about H3O+? A. The ion has a tetrahedral shape.

* 1. The H–O–H bond angle is 120°.
  2. The H–O–H bond angle is 90°.
  3. The ion has a trigonal pyramidal shape.

(Total 1 mark)

1. Which substance can form intermolecular hydrogen bonds in the liquid state?
   1. CH3OCH3
   2. CH3CH2OH
   3. CH3CHO
   4. CH3CH2CH3

(Total 1 mark)

1. Which pair of compounds is arranged in correct order of relative boiling points?

|  |  |
| --- | --- |
| Lower Boiling Point | Higher Boiling Point |
| CH3OCH3 | CH3CH2OH |
| CH3CHO | CH3CH2CH3 |
| CH3CH2OH | CH3CHO |
| CH3COOH | CH3CH2OH |

A.

B.

C.

D.

(Total 1 mark)

1. What is the shape of the ammonia molecule, NH3?
   1. Trigonal planar
   2. Trigonal pyramidal
   3. Linear
   4. V-shaped (bent)

(Total 1 mark)

1. Which pair of compounds is arranged in correct order of relative boiling points?

|  |  |
| --- | --- |
| Lower Boiling Point | Higher Boiling Point |
| H2S | H2O |
| NH3 | PH3 |
| HF | HCl |
| CH3COOH | CH3CH2OH |

A.

B.

C.

D.

(Total 1 mark)

1. Methoxymethane, CH3OCH3, and ethanol, C2H5OH, have the same relative molecular mass. Explain why methoxymethane has a much lower boiling point than ethanol.

................................................................................................................................................

................................................................................................................................................

................................................................................................................................................

................................................................................................................................................

................................................................................................................................................

(Total 3 marks)

1. Which molecule is polar?
   1. CH2Cl2
   2. BCl3
   3. Cl2
   4. CCl4

(Total 1 mark)

1. Which combination of intermolecular forces, boiling point and enthalpy of vaporization is correct?

|  |  |  |
| --- | --- | --- |
| Intermolecular forces | Boiling point | Enthalpy of vaporization |
| strong | low | low |
| strong | high | low |
| weak | low | high |
| weak | low | low |

A.

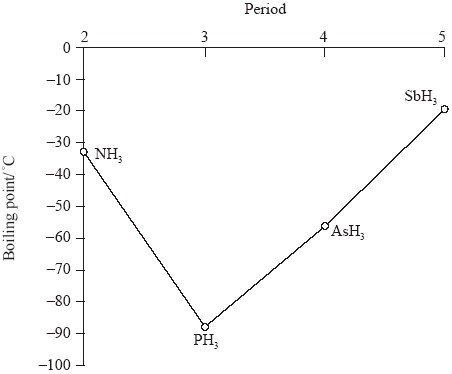
B.

C.

D.

(Total 1 mark)

1. The graph below shows the boiling points of the hydrides of group 5. Discuss the variation in the boiling points.



(Total 4 marks)