## **Stage 2 Chemistry**

## **Birdwood**

HIGH SCHOOL **Topic 1: Monitoring the Environment**

**Review of electronic config. periodic trends, oxide nature, molecular shape**

**Review Paper 2**

**DUE DATE:**

**Question 1**

Ammonia NH3, and hydrogen sulfide H2S are often the products of the anaerobic decomposition of organic matter.

1. Predict whether these two substances are likely to be gases, liquids or solids at normal temperatures and pressures.
2. The shape of the H2S molecule is V-shaped. Briefly explain why it has this shape.

1. Draw the structural formulae of NH3.

Show any *non-bonding pairs* of electrons in each formula and *name the shape* of the molecule.

1. Explain why the ammonia molecule is *polar*. (8 marks)

**Question 2**

Carefully consider the information given below about two substances, hydroxylamine and phosphine

|  |  |  |  |
| --- | --- | --- | --- |
| Substance | Molar mass (g/mol) | Melting pt (0C) | Formula |
| **hydroxylamine** | 33 | 34 | NH2OH |
| **phosphine** | 34 | –1330C | PH3 |

1. Select one piece of information in the table that suggests these two substances are molecular compounds?
2. Which of the two substances has the higher melting point?
3. State the main type of secondary interaction operating between molecules of phosphine.
4. A molecule of hydroxylamine is drawn below.

Molecules of hydroxylamine are able to display hydrogen bonding

Draw two molecules of hydroxylamine to show the hydrogen bonding between the molecules.

[Indicate the positive and negative dipoles on the atoms in hydrogen bond you draw.]

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**N**

**H H O H**

(6 marks)**Question 3**

Consider the following oxides

\*water, \*sodium oxide, \*aluminium oxide, \*phosphorus (V) oxide, \*sulfur (VI) trioxide.

1. Write the molecular formula for sulfur trioxide.
2. State the shape of the sulfur trioxide molecule.
3. Show, by writing equations, how aluminium oxide can react with both acids and bases.
4. Select a basic oxide from the list above, and write the equation for its reaction with water.

(6 marks)

**Question 4**

The table below shows some boiling temperatures (Tb) for three different substances:

|  |  |  |  |
| --- | --- | --- | --- |
| **Substance** | H2 | CH4 | HCl |
| **Tb (0C)** | -253 | -161.5 | -85 |

1. The atoms in a hydrogen molecule are held together by primary *covalent bonds*.
   1. Explain the meaning of the term *covalent bond*.
   2. In what state would you find hydrogen at 250C?
   3. State the *type of secondary interactions* that hold the hydrogen molecules together.
2. Despite both methane and hydrogen being non-polar molecules, methane has a higher boiling point than hydrogen. Explain why they have different boiling points.
3. Using the idea of molecular polarity, explain why the boiling temperature of hydrogen chloride is higher than that of methane.

(8 marks)

**Question 5**

Certain oxides can be used to reduce soil acidity.

Two such oxides are CaO and SiO2.

a) Of the two elements calcium and silicon, state which atom has the higher electronegativity.

b) Hence state the nature of the oxides of calcium and silicon.

c) Hence explain why CaO will reduce soil acidity but SiO2 will not.

(5 marks)

**TOTAL MARK = 33**