## **Stage 2 Chemistry**

## **Birdwood**

HIGH SCHOOL **Topic 2: Elemental & Environmental Chemistry**

**Secondary interactions, molecular shape,**

**Review Paper 3 cycles in nature**

**DUE DATE:**

**Question 1**

The chloro-fluoro carbon CCl2F2, commercially called Freon II, and ammonia are both used extensively as refrigerant gases. Freon II boils at –300C and ammonia boils at a very similar temperature of –330C.

1. Predict which molecule, Freon II or ammonia, would have the larger molar mass. Freon (1 mark)
2. Write the sub-shell electronic configuration for the fluorine atom. 1s2 2s2 3p5 (2 marks)
3. On the basis of their molar masses, which molecule would have the greater dispersion forces operating between the molecules, Freon II or ammonia? Freon (1 mark)
4. Draw a diagram to show the molecular structure of Freon II.

Name the shape of the Freon II molecule. Tetrahedral (2 marks)

1. Both Freon II and ammonia are polar molecules.

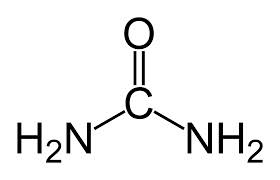
State the main type of secondary bonding found in the *ammonia* molecule. Hydrogen Bonding (1 mark)

f) State the conditions that lead to the formation of ammonia when animal matter decays. Anaerobic (1 mark)

**Question 2**

Listed below are some common nitrogen containing fertilizers. The structural formula of urea is shown below.

|  |  |
| --- | --- |
| ammonium sulfate | (NH4)2SO4 |
| urea | (NH2) 2CO |
| ammonium di-hydrogen phosphate | NH4H2PO4 |



1. State the oxidation number of the carbon atom in urea. +4 (2 marks)
2. Nitrogen in the soil is necessary for strong and healthy plant growth. One factor that determines the effectiveness of a fertilizer is its percentage nitrogen.

Calculate the percentage nitrogen in ammonium di-hydrogen phosphate. (3 marks)

14.01 + 1.008 x 5 + 30.97 + 4 x 16 = 114.02

14.01/114.02 x 100 = 12.3% **Question 3**

Write an equation for aerobic respiration. (2 marks)

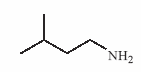
C6H12O6 + 6O2 -> 6CO2 + 6H2O

**Question 4**

Plants can obtain nitrogen through the decomposition of organic matter or the addition of a synthetic fertiliser.

a) The structural formula of one molecule produced in the decomposition of organic matter is

shown in the diagram below:



(i) State whether this molecule is the product of aerobic or anaerobic decomposition. (1 mark)

Anerobic. (no oxygen)

(ii) State the systematic name of this molecule. (2 marks)

3 – methyl – but – 1 – amine

b) Ammonium sulfate is a synthetic fertiliser commonly used to provide nitrogen needed by plants.

(i) State the important physical property of ammonium sulfate that enables it to provide nitrogen in a

form suitable for use by plants. (1 mark)

Water soluble

(ii) Aqueous solutions of ammonium ions, NH4+, are acidic.

(1) Write an equation for the reaction of the ammonium ion with water to form an acidic solution.

NH4+ + H2O -> NH3 + H3O+

An acidic solution should not be stored in an iron container.

(2) Write the electronic configuration of iron, using subshell notation.

1s2 2s2 2p6 3s2 3p6 4s2 3d6

(3) Write an ionic equation for the reaction of iron with an acidic solution. (7 marks) 2Fe + 6H+ -> 2Fe3+ + 3H2  *or* Fe + 2H+ -> Fe2+ + H2

**Question 5**

Glass manufactured from limestone may be coloured by adding compounds containing cations such as Co2+ and Cr3+, (chromium (III) ion).

1. Write the sub-shell electronic configuration for Co2+. 1s2 2s2 2p6 3s2 3p6 3d5 (2 marks)

b) Explain, referring to their electronic configurations, why the elements such as cobalt and chromium are

placed in the d-block of the periodic table. Last subshell written (ie highest energy) is the d shell (1 mark)

c) Given the formula of chromium (III) oxide is Cr2O3,

State the oxidation number of chromium in chromium (III) oxide. (2 marks)

+3

**TOTAL MARK = 31**