Practice Question Set For A-Level
Subject : Chemistry
Paper-1 Topic: Inorganic 2

Merit Minds
www.merit-minds.com
Exam Preparation and Free Resources

Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Q1.

The equation for the reaction between ammonia and oxygen is shown.

$$4NH_3(g) + 5O_2(g) \rightleftharpoons 4NO(g) + 6H_2O(g) \qquad \Delta H = -905 \text{ kJ mol}^{-1}$$

Some standard entropies are given in the table.

Gas	**S^o / J K^{-1} mol^{-1}**
$NH_3(g)$	193
$O_2(g)$	205
$NO(g)$	211
$H_2O(g)$	189

(a) Calculate the entropy change for the reaction between ammonia and oxygen.

Entropy change _____ J K^{-1} mol^{-1}

(2)

(b) Calculate a value for the Gibbs free-energy change (ΔG), in kJ mol^{-1}, for the reaction between ammonia and oxygen at 600 °C

(If you were unable to obtain an answer to part (a), you should assume that the entropy change is 211 J K^{-1} mol^{-1}. This is not the correct answer.)

Downloaded from www.merit-minds.com

ΔG _____ kJ mol^{-1}

(2)

(c) The reaction between ammonia and oxygen was carried out at a higher temperature.

Explain how this change affects the value of ΔG for the reaction.

_____

_____

_____

_____

_____

(2)

(d) Platinum acts as a heterogeneous catalyst in the reaction between ammonia and oxygen. It provides an alternative reaction route with a lower activation energy.

Describe the stages of this alternative route.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(e) Deduce the change in oxidation state of nitrogen, when NH_3 is oxidised to NO

_____

(1)

(f) When ammonia reacts with oxygen, nitrous oxide (N_2O) can be produced instead of NO

Give an equation for this reaction.

_____

(1)

(Total 11 marks)

Downloaded from www.merit-minds.com

Q2.

This question is about vanadium compounds and ions.

(a) Use data from Table 4 to identify the species that can be used to reduce VO_2^+ ions to VO^{2+} in aqueous solution and no further.

Explain your answer.

Electrode half-equation	$E^{\ominus}$ / V
$VO_2^+(aq) + 2H^+(aq) + e^- \rightarrow VO^{2+}(aq) + H_2O(l)$	+1.00
$VO^{2+}(aq) + 2H^+(aq) + e^- \rightarrow V^{3+}(aq) + H_2O(l)$	+0.34
$Cl_2(aq) + 2e^- \rightarrow 2Cl^-(aq)$	+1.36
$Fe^{3+}(aq) + e^- \rightarrow Fe^{2+}(aq)$	+0.77
$Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$	–0.76

Reagent _____

Justification _____

_____

_____

(2)

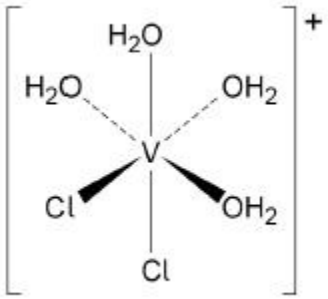
(b) Give the oxidation state of vanadium in $[VO(H_2O)_5]^{2+}$

_____

(1)

(c) The $[V(H_2O)_4Cl_2]^+$ ion exists as two isomers. One isomer is shown.

Draw the structure of the other isomer and state the type of isomerism.



Type of isomerism _____

(2)

(d) Heating NH_4VO_3 produces vanadium(V) oxide, water and one other product.

Give an equation for the reaction.

Downloaded from www.merit-minds.com

_____

(1)

(e) Vanadium(V) oxide is the catalyst used in the manufacture of sulfur trioxide.

Give **two** equations to show how the catalyst is used and regenerated.

_____

_____

(1)

(Total 7 marks)

Downloaded from www.merit-minds.com