ZIMBABWE SCHOOL EXAMINATIONS COUNCIL
General Certificate of Education Advanced Level

CHEMISTRY
PAPER 2 Theory

9189/2

NOVEMBER 2014 SESSION   1 hour 15 minutes

Candidates answer on the question paper.
Additional materials:
    Data Booklet
    Mathematical Tables and/or Calculator

TIME 1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES
The number of marks is given in brackets [ ] at the end of each question or part question.

FOR EXAMINER'S USE	
1	
2	
3	
4	
5	
TOTAL	

This question paper consists of 8 printed pages.

[Turn over

1 A mixture of nitrogen and hydrogen was allowed to come to an equilibrium at 400 K. The initial amounts of nitrogen and hydrogen were 2.0 moles. At equilibrium 0.20 moles of nitrogen had reacted.

(a) Write an expression for K_p.

_____ [1]

(b) Calculate the number of moles of $N_{2(g)}$, $H_{2(g)}$ and $NH_{3(g)}$ at equilibrium.
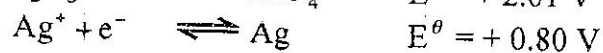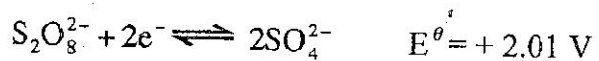
N_2

H_2

NH_3

[3]

(c) Given that the equilibrium constant at 400 K is 40.7 atm^{-2}, calculate the total pressure.

[3]
[Total: 7]

2 **(a)** Define the term *standard electrode potential*.

_____

_____ [1]

(b) The standard electrode potentials for two half cells are given below

$$S_2O_8^{2-} + 2e^- \rightleftharpoons 2SO_4^{2-} \qquad E^\theta = +2.01 \text{ V}$$
$$Ag^+ + e^- \rightleftharpoons Ag \qquad E^\theta = +0.80 \text{ V}$$

(i) State the **three** conditions for which the term *standard* refers.

1. _____

2. _____

3. _____

(ii) Write down a chemical equation for the overall reaction of the cell.

_____

(iii) Calculate the cell potential, E^θ cell, for the reaction.

(iv) Sketch a diagram of the peroxodisulphate half cell.

[7]

(c) State and explain, the effect, on the magnitude of E^θ cell of adding concentrated ammonia to the Ag^+/Ag half cell.

effect:

_____

_____

explanation:

_____

_____

_____

[3]
[Total: 11]

3 Sulphur dioxide is a poisonous gas with adverse environmental effects.

(a) **(i)** Give any **one** source of sulphur dioxide.

_____

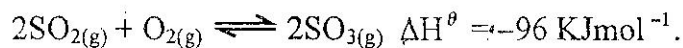**(ii)** State any **two** adverse effects of sulphur dioxide on the environment.

1. _____

2. _____

(iii) Explain how sulphur dioxide preserves food.

_____

_____

[4]

5

(b) Sulphur dioxide can be converted to sulphuric acid by the contact process. The reaction is

$$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)} \quad \Delta H^{\theta} = -96 \text{ KJmol}^{-1}.$$

Give reasons for

(i) cooling the reaction mixture,

_____

_____

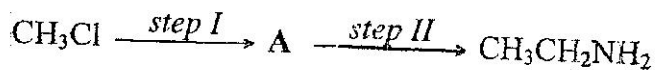**(ii)** using a low pressure even though high pressure produces a high yield,

_____

_____

(iii) pumping an excess of air,

_____

_____

(iv) using vanadium (V) oxide.

_____

_____

[4]

[Total: 8]

(a)   Ethylamine can be prepared from chloromethane as shown.

$$CH_3Cl \xrightarrow{\ step\ I\ } A \xrightarrow{\ step\ II\ } CH_3CH_2NH_2$$

(i)   State the reagents and conditions for *steps I* and *II*.

step I: reagent _____

      condition(s) _____

step II: reagent _____

      condition(s) _____

(ii) Draw the displayed structural formula of the intermediate A.

[5]

(b) (i) Dimethylamine and ethylamine are isomers. Give the structural formulae of the two isomers.

(ii) Explain why dimethylamine is more basic than ethylamine.

_____

_____

_____

[3]

(c) (i) State any **two** industrial uses of halogenated hydrocarbons.

1. _____

2. _____

(ii) Describe the environmental consequences of the uncontrolled use of halogenated compounds.

_____

_____

_____

[4]

[Total: 12]

5. **Fig.5** shows the structure of fluorescamine, a reagent for the detection of primary amines.
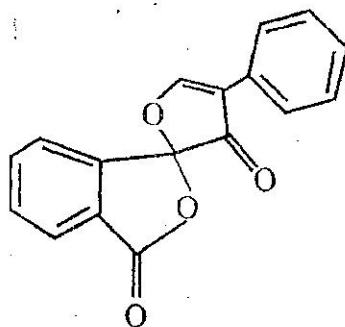

Fig.5

(a) Identify any **two** functional groups present in this compound.

1. _____

2. _____

[2]

(b) Draw the structure of the organic product formed when fluorescamine reacts with

(i) NaOH under reflux,

(ii) $NaBH_4$,

(iii) Br_2 in the presence of $FeBr_3$,

(iv)   hot concentrated $KMnO_4$.

[4]

(c)   Suggest explanations for the following observations:

(i)   hexanedioic acid and 1,6-diaminohexane are formed when sulphuric
acid is added to a fabric made of nylon-6,6

_____

_____

(ii)   terylene is a better sweat absorber than nylon-6,6,

_____

_____

(iii)   commercial fertilisers use urea, NH_2CONH_2, to promote plant
growth

_____

_____

[4]
[Total: 10]