BAS 15

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B. Tech
Year 1st Semester: I
Major Examination-2016-2017
Subject Name: Applied Engineering Chemistry

Time: 3 hrs. Max. Marks: 40

Note: Attempt all questions. Each question carries equal marks.

Q.1 Attempt any three of the following from question 1(a) is compulsory.

(a) Calculate W and ΔU for the conversion of one mole of water at 100°C to steam at 1 atm pressure. Heat of vaporization of water at 100°C is 40670 Jmol^{-1}. 4 Marks

(b) One mole of an ideal gas (mono atomic) at 27°C expands adiabatically against a const. external pressure of 1 atm from a volume of 20 dm^3. Calculate (i) q, (ii) W, (iii) ΔU and (iv) ΔH for this process. Assume that Cv=3/2 R. 3 Marks

(c) What is meant by efficiency of a heat engine? Derive an expression for the same. 3 Marks

(d) Discuss in details the phenomenon of hydrolysis of salts. Illustration your answer taking examples of the salts of weak acid and weak base. 3 Marks

Q.2 Attempt any three of the following from question 2(a) is compulsory.

(a) 20 mL of 0.2 M HCl solution is being titrated against 0.1 M solution of NaOH using a hydrogen electrode as the indicator electrode as the reference electrode. What would be the EMF of the cell initially and the after the addition of 5.0, 10.0, 19.9, 19.95, 20.0, 20.05, 20.10 and 25 mL of NaOH solution. 4 Marks

(b) The EMF of the standard cell written as: 3 Marks

$Cd(Hg), CdSO_4.8/3\ H_2O\ (s) \| CdSO_4\ (sat.), HgSO_4\ (s), Hg$

In which the cell reaction is

$$Cd\ (Hg) + HgSO_4(s) + 8/3\ H_2O(s) \longrightarrow CdSO_4.8/3\ H_2O\ (s) + 2Hg(l)$$

is 1.0185 V at 25°C. Calculate ΔG°, ΔS° and ΔH° for the cell reaction if $(\Delta E°/\Delta T)_p$ for the cell is $5.00 \times 10^{-5} VK^{-1}$.

(c) What is corrosion? and its types. How can it be prevented? 3 Marks

(d) The following kinetic data (r_o is the initial rate) were obtained for the reaction. 3 Marks

$$2ICl(g) + H_2(g) \longrightarrow I_2(g) + 2HCl\ (g)$$

Experiment	$[ICl]_o$ mmoldm^{-3}	$[H_2]_o$mmol dm^{-3}	$r_o$mol dm^{-3}S^{-1}
1	1.5	1.5	3.7×10^{-7}
2	3.0	1.5	7.4×10^{-7}
3	3.0	4.5	2.2×10^{-7}
4	4.7	2.7	?

(i) Write the rate for the reaction. (b) from the data, determine the value of the rate constant. (c) Use the data to predict the reaction rate for experiment 4.

Q.3 Attempt any three of the following from question 3(a) is compulsory.

(a) Complete this reaction with suitable mechanism and explain. 4 Marks

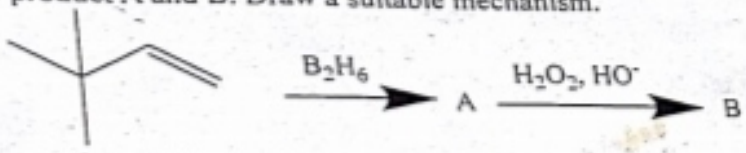
(i) Nitration of Naphthalene

(ii) Nitration of Anthracene

(b) What is electrophilic substitution reaction? Discuss the reactivity and orientation of Chlorobenzene, Toluene and Nitro-Toluene on electrophile attack. 3 Marks

(c) Discuss the hydroxylation of alkenes (But-2-ene) by syn and anti-addition with suitable reagent. Discuss the optical activity of product 3 Marks

(d) Find the product A and B. Draw a suitable mechanism. 3 Marks



Q.4 Attempt any three of the following from question 4(a) is compulsory.

(a) Draw energy level diagram and indicate the occupancy of the orbitals in the following complex: 4 Marks

(i) d^6, octahedral

(ii) d^9, octahedral with tetragonal distortion

(iii) d^9, square planar

(iv) d^6, tetrahedral

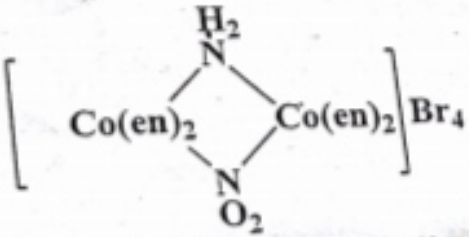
(b) Calculate the crystal field stabilization energy for a d^8 ion such as Ni^{2+} in octahedral and tetrahedral complexes. Use unit of Δ_o in both cases. Which is most stable? 3 Marks

(c) Name of complexes of each of the following? 3 Marks

(i) $[Pt(NH_3)_2Cl_2]$

(ii) $[Co(NH_3)_5NO_2](NO_3)_2$

(iii)



(d) Describes and explain the Jahn-Teller effects in octahedral complexes of Cr^{2+} and Cu^{2+}. 3 Marks