NATIONAL INSTITUTE OF TECHNOLOGY PATNA

MID SEMESTER EXAMINATION, Mar 2022

Session: 2021-22, Odd Semester

Program: **B. Tech** Batch: **CSE - I** Semester: **1st**

Subject Code: **CH14101** Time: **2 hr**

Subject Name: **Engineering Chemistry** Full Marks: **30**

*Answer **all** questions. Symbols and abbreviations have their usual meanings.*

1. The percentage composition of a sample of coal by weight was found to be: C = 75%, H = 5%, O = 12%, N = 3%, S = 2%, rest = Ash. If 50% excess air (having 23% oxygen) is supplied to ensure complete combustion, how much air is required for complete combustion of 1 kg coal (in kg)? Now calculate the percentage composition of dry product of combustion (w/w). *[6]*

2. (a) Describe the simple operating procedure for four stroke automoblile engine and then explain the engine knocking phenomenon. Define octane number and explain its significance. *[6]*
   (b) What is unleaded petrol? How does it offer even better solution for pollution control? *[3]*

3. (a) What is formal potential? Show that for oxidation of bromide to bromine by dichromate solution, the pH of the solution has to be less than 2. Given: $E^0_{Cr_2O_7^{2-}/Cr^{3+}}$ = 1.33 V and $E^0_{Br_2/Br^-}$ = 1.07 V. [4]
   (b) A student has accidentally added 5 drops more of $KMnO_4$ solution (strength = N/20) after the equivalence point is reached for the titration with 25 ml of N/20 Fe(II) solution. If 1 ml of burette reading is equal to 20 drops, then calculate the redox potential (i) at equivalence point and (ii) after the addition of excess permanganate. Given: $E^0_{MnO_4^-/Mn^{2+}}$ = 1.51 V, $E^0_{Fe^{3+}/Fe^{2+}}$ = 0.77 V, pH = 0. [5]

4. (a) State Kohlrausch's law of independent migration of ions and then establish the relation between ion conductance and transport number. [3]
   (b) Calculate the equivalent conductance at infinite dilution (Λ^0_{eq}) for sodium potassium tartrate (NaKTa) at 25°C using following data: [3]

Compund	Λ^0_{eq} (25°C), ohm^{-1}
NaCl	127
KCl	149
HCl	426
Tartaric acid (H_2Ta)	730

If tartrate (Ta^{2-}) ions transport only 20% current for NaKTa, then calculate the ion conductance (at infinite dilution) of this anion.

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