

Engineering Chemistry
CYC01
End Semester Examination

Full Marks:60

Time: 120 min

Answer all the questions

Instructions:

- 1. All the parts of a question must be written in same place. Otherwise, the answers will not be considered for marking.**
 - 2. Please send your scanned answer script in the following email ids:**
Students of Section A: btech.a20@gmail.com
Students of Section B: btech.b20@gmail.com
Students of Section C: btech.c201@gmail.com
Students of Section D: btech.d20@gmail.com
Students of Section E: btech.e20@gmail.com
Backlog Students only: tanmoy.saha@ch.nitdgp.ac.in
 - 3. Your scanned answer script must be named as “Roll no”. For example, “20A80010”.
Don't use any other file name.**
 - 4. Do not forget to write your name and roll number in each page of your answer script.**
 - 5. Strictly maintain the given time frame. Otherwise, your copy will not be accepted beyond the time limit.**
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Group-A

1. (a) “Oxygen gas shows Joule-Thomson cooling effect at any temperature” - Comment and justify in details.

(b) Why paraffin and ice show exactly opposite effect in their change in melting point during the change of pressure? Justify your answer mathematically.

[5+5=10]
2. (a) Calculate the half-life for N_2O_5 at 25°C and fraction decomposed after 8 hours. (Given $k=3.38\times 10^{-5} \text{ s}^{-1}$)

(b) What is ‘steady state approximation’? When it is valid? Why it is required?

(c) Taking any example, show the importance of Nernst equation in determining the course of a reaction.

[3+3+4=10]

Group-B

3. (a) Δ_o values of the given complexes are as follows:

$[\text{Co}(\text{NH}_3)_6]^{+3}$ ($\Delta_o = 24800 \text{ cm}^{-1}$); $[\text{Rh}(\text{NH}_3)_6]^{+3}$ ($\Delta_o = 34000 \text{ cm}^{-1}$); $[\text{Ir}(\text{NH}_3)_6]^{+3}$ ($\Delta_o = 41000 \text{ cm}^{-1}$). Explain the observation.

(b) For CuF_2 , two Cu–F bond distances are greater than other four Cu–F bond distances. Explain.

(c) Taking any d^n ion show that when (i) $\Delta > P$ then low spin state and when (ii) $\Delta < P$ then high spin state is energetically stable (P is the pairing energy, Δ is crystal field splitting parameter).

(d) HgCl_2 is white in colour but HgI_2 is red- Explain the fact.

[2+3+3+2=10]

4. (a) Calculate the number of M–M bond(s) in the following complexes (M = metal) (Show the detailed calculation):

$[\text{Ir}_4(\text{CO})_{12}]$; $[(\eta^5\text{-C}_5\text{H}_5)\text{Fe}(\text{CO})_2]_2$; $[\text{Fe}_2(\text{CO})_9]$; $[\text{Co}_2(\text{CO})_8]$;

(b) Draw the catalytic cycle for hydrogenation of alkene mentioning all the steps involved in it.

(c) What are the main characteristics of Mg^{+2} ion in chlorophyll? Explain the role of Mg^{+2} ion during oxygenic photosynthesis.

(d) Singlet oxygen is more toxic than the triplet form-Explain using molecular orbital theory.

[4+2+2+2=10]

Group-C

5. (a) Between O–H and O–D bonds which one is having higher stretching frequency and why?

(b) How would you differentiate between cyclohexanone and methyl phenyl ketone?

(c) Define the followings with example:

Red shift, hyperchromic shift

(d) Give the mechanism of Wittig reaction. How geometry of alkene does depend on stability of Wittig ylide?

[3+2+3+2=10]

6. (a) Write brief discussion on:

(i) Conducting polymers; (ii) Polymethyl methacrylate

(b) How the crude petroleum oil is purified into different fractions? What are various fractions obtained from crude petroleum oil? Mention the industrial uses to which they are put.

[5+5 =10]
