

U.G. 2nd Semester Examination - 2019

CHEMISTRY**[HONOURS]**

Course Code : CEMH/CC-T-03

Course Title : Inorganic and Physical

Full Marks : 40

Time : $2\frac{1}{2}$ Hours*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.***GROUP-A**

1. Answer any **one** question: 1×1=1
 - a) Write one important difference between oxidation number and valency.
 - b) Define superacid with an example.
2. Answer any **two** questions: 2×2=4
 - a) In the titration of 0.1M Fe^{2+} solution with 0.1(M) Ce^{4+} which indicator is suitable and why?
 - b) Explain with reason whether the p^{H} scale can be extended beyond 14 or not.
 - c) Does metallic copper dissolve in HCl? Give reasons. [Given $E_{\text{Cu}^{2+}/\text{Cu}}^0 = 0.34\text{V}$].

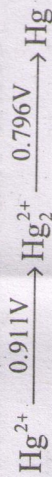
[Turn Over]

- ii) Relying upon Lindemann's theory, arrive at the expression for differential rate equation of a gas phase unimolecular reaction. Also mention the order of the reaction at low and high pressure. 4
- iii) The half life of decomposition of a compound is found to be 50 mins. When the concentration to start with is halved, the half life becomes 100 mins. What is the order of the reaction? 3

- d) State the theory by which the reaction
 $6 \text{CaO} + \text{P}_4\text{O}_{10} \rightarrow 2\text{Ca}_3(\text{PO}_4)_2$ may be regarded
 as acid base reaction.

3. Answer any **one** question: $5 \times 1 = 5$

- a) Draw the Frost diagram for mercury in acid
 solution from the given Latimer diagram.



Determine the slope of each line and comment
 on the tendency of any of the species to undergo
 disproportionation. 5

- b) What do you mean by buffer capacity? Show that
 the buffer capacity is maximum at the half-
 neutralization point and then prove that for an
 acidic buffer p^{H} at the half-neutralization point
 is equal to pK_a . $1+3+1$

4. Answer any **one** question: $10 \times 1 = 10$

- a) i) Explain the role of Zimmermann-
 Rienhardt solution (Z-R solution) during
 the titration of Fe^{2+} with MnO_4^- in HCl
 medium.

- ii) Show that the equilibrium constant (k) for
 the following reaction can be represented
 by the equation

$$\log k = 17 n_1 n_2 (E_1^0 - E_2^0)$$



- iii) A solution of $\text{Fe}(\text{CN})_6^{3-}$ cannot oxidise
 I^- to I_2 but it can do so in presence of
 Zn^{2+} ion. Explain.

[Given: $E_{\text{Fe}(\text{CN})_6^{3-}/\text{Fe}(\text{CN})_6^{4-}}^0 = 0.36\text{V}$ and

$$E_{\frac{1}{2}\text{I}_2/\text{I}}^0 = 0.54\text{V}]$$

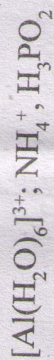
- iv) State two major differences between
 standard and formal potential. $3+3+2+2$

- b) i) H_2S is the group reagent for both group II
 and group III B. Why do the metal sulphides
 of group III B not precipitate in group II?

- ii) A particular solvent may act as a
 differentiating as well as levelling
 solvent—Justify with an example.

- iii) Define Gas phase acidity with example.

- iv) Classify the following species into acids and bases and write their conjugate bases or acids respectively.



3+2+2+3

GROUP-B

5. Answer any **one** question: $1 \times 1 = 1$
- a) What will be the value of ΔG for the process of vaporization of H_2O at 100°C and 1 atm. pressure?
- b) Give an example of pseudo first order reaction.
6. Answer any **two** questions: $2 \times 2 = 4$
- a) Give an example of a natural process with +ve ΔG value with equation.
- b) Define the rate constant of a reaction.
- c) Define 'primary kinetic salt effect' with an example.

7. Answer any **one** question: $5 \times 1 = 5$
- a) i) Justify or criticize: 'A zero order reaction must be multistep'. 2
- ii) A gas is found to be 50% decomposed in 30 mints. and 75% decomposed in 90 mints. at certain temperature and pressure. Show that the reaction is of second orders. 3

- b) i) Justify or Criticize:

'Adiabatic process is always isentropic'.

3

- ii) One mole of an ideal monatomic gas at 27°C is expanded from 27.0L to 54.0L. Initial pressure was 1 atm. Calculate ΔG and ΔS of the process. 2

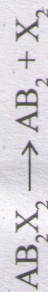
8. Answer any **one** question: $10 \times 1 = 10$

- a) i) "The entropy of the Universe is increasing through the energy remains constant"—Comment on the statement. 3

- ii) Write the differences between Adiabatic cooling and Joule-Thomson cooling. 3

- iii) Calculate the change in Gibb's free energy (ΔG) when 36 g of water, initially at 100°C and 10 atm. is converted to vapour at 100°C and 0.01 atm. pressure. 4

- b) i) A first order gaseous reaction:



has $K_1 = 2.28 \times 10^{-5}$. What % of AB_2X_2 will be decomposed when heated for 2 hrs? Symbols have usual meaning. 3