M. SC. (ANALYTICAL CHEMISTRY) / M. SC. (ORGANIC CHEMISTRY) /M. SC. (INORGANIC CHEMISTRY) SEM-I (CHOICE BASED CREDIT & GRADE SYSTEM) : WINTER - 2017

SUBJECT : PHYSICAL CHEMISTRY-I

Day : Tuesday
Date : 24/10/2017

Time : 03.00 PM TO 06.00 PM
Max. Marks : 60.

W-2017-0767

N.B.:

1) All questions are **COMPULSORY.**
2) Both the sections should be written in **SEPARATE** answer books.
3) Figures to the **RIGHT** indicate full marks.
4) Draw neat labeled diagrams **WHEREVER** necessary.
5) Use of logarithmic tables/ calculator is **ALLOWED.**
6) Graph papers will be provided.

Physico-Chemical Constants

1.	Avogadro Number	$N = 6.022 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	$k = 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
		$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	$h = 6.626 \times 10^{-27}$ erg s
		$= 6.626 \times 10^{-34}$ J s
4.	Electronic Charge	$e = 4.803 \times 10^{-10}$ esu
		$= 1.602 \times 10^{-19}$ C
5.	1 eV	$= 23.06$ k cal mol^{-1}
		$= 1.602 \times 10^{-12}$ erg
		$= 8065.5$ cm^{-1}
6.	Gas Constant	$R = 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
		$= 8.314$ J K^{-1} mol^{-1}
		$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	$F = 96487$ C equiv^{-1}
8.	Speed of light	$c = 2.997 \times 10^{10}$ cm s^{-1}
		$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal	$= 4.184 \times 10^{7}$ erg
		$= 4.184$ J
10.	1 amu	$= 1.673 \times 10^{-27}$ kg
11.	Bohr magneton	$\beta_e = 9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	$\beta_n = 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	$m_e = 9.11 \times 10^{-31}$ kg
14.	Mass of proton	1.672×10^{-27} kg

P.T.O.

SECTION – I

Q.1 Attempt **ANY THREE** of the following: **[15]**

a) What are inadequacies of first law of thermodynamics? Give various statements of second law of thermodynamics.

b) What is Gibb's free energy? How one can evaluate the temperature and pressure dependence of Gibb's free energy?

c) What is adsorption isotherm? Derive Langmuir adsorption isotherm.

d) Explain Maxwell's relation of free energy and entropy of mixing of ideal solution.

e) What do you mean by state and non-state functions? Which of the following are state functions?

U, H, G, S, q, w.

Q.2 A) Attempt **ANY TWO** of the following: **[10]**

i) Explain the sedimentation equilibrium method to determine $\overline{M}_w$ of macromolecules.

ii) Describe determination of surface area of adsorbents by using Harkins and Jura method.

iii) Discuss induced polarization with respect to non-polar molecule.

B) Solve **ANY ONE** of the following: **[05]**

i) Dipole moment of water is 1.84D, while O – H bond moment 1.5D. Calculate H – O – H bond angle in H_2O.

ii) What will be change in entropy of 2 moles of an ideal gas when it is heated from a volume of $50dm^3$ at 323K to a volume of $120dm^3$ at 423K? ($R = 8.314J$, $C_v = 32.97\ JK^{-1}\ mol^{-1}$).

SECTION – II

Q.3 Attempt **ANY THREE** of the following: **[15]**

a) Explain how phase diagram can be drawn for a three component system.

b) Discuss the use of Eyring equation in studying the rate of bimolecular reactions.

c) Explain the phenomenon of chemiluminescnce with suitable examples.

d) Write a note on diffusion controlled reactions.

e) Give detailed account of photolysis of ammonia.

Q.4 A) Attempt **ANY TWO** of the following: **[10]**

i) Explain the process of fractional distillation with the help of Temperature – Composition diagram.

ii) Write a note on flash photolysis.

iii) Draw and explain a potential energy diagram for the reaction.

$$^{\alpha}H_2 + ^{\beta}H \rightarrow {}^{\alpha}H + {}^{\alpha}H - H^{\beta}$$

B) Solve **ANY ONE** of the following: **[05]**

i) Calculate the magnitude of diffusion controlled rate constant at 298 K for species in (a) dicylbenzene and (b) sulphuric acid, the viscosities of which are 3.36 cP and 27cP respectively.

ii) In a photochemical reaction A → 2B + C, the quantum efficiency with 500nm light is 2.1×10^2 mole $Einstein^{-1}$. After exposure of 300 mili mole of A to light, 2.28 m mol of B is formed. How many photons were absorbed?

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