M. SC. (ANALYTICAL CHEMISTRY) / M. SC. (ORGANIC CHEMISTRY) /M. SC. (INORGANIC CHEMISTRY) SEM-I (CHOICE BASED CREDIT & GRADE SYSTEM) : SUMMER - 2018

SUBJECT: PHYSICAL CHEMISTRY-I

03.00 PM TO 06.00 PM

Day : **Tuesday**
Date : **10/04/2018**

S-2018-0867

Time : —
Max. Marks : 60.

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) Discuss vapour-temperature method for measurement of dipole moment.

b) What are Helmholtz and Gibb's functions? Show that Helmholtz function is related to maximum work.

c) Obtain the equation for entropy change of an ideal gas at constant volume and constant pressure.

d) Elaborate on induced polarization.

e) Give different assumptions of Langmuir theory.

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

a) Discuss any two applications of dipole moment.

b) Explain the viscosity measurement technique to calculate the molecular weight of a polymer.

c) Write a note on the determination of surface area of adsorbents by using BET equation.

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

a) Calculate the entropy change involved in the isothermal reversible expansion of 5 moles of an ideal gas from a volume of 5 dm^3 to a volume 50 dm^3 at 300K. ($R = 8.314\ Jk^{-1}\ mol^{-1}$)

b) Dielectric constant of oxygen at 0^0C and 1 atm pressure is 1.00523. Calculate the induced polarization and molecular polarizability. (molecular weight of $O_2 = 32$)

SECTION – II

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

a) Draw and explain a typical two component system involving two metals which are immiscible in solid state but miscible in molten state.

b) Elaborate with suitable examples, the phenomenon of photosynthesis and photosensitization.

c) What is 'lever rule'? How it is used in finding the composition of 'vapour + liquid' mixture?

d) For two component system involving two miscible liquids, obtain the mathematical relation between total pressure and mole fractions of two liquids in vapour phases, using Roult's law and Dalton's law of partial pressure.

e) Write a note on photolysis.

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

a) Give a detailed account of transition state theory and hence elaborate the significance of Eyring equation.

b) Obtain the mathematical expression for the rate constant of a diffusion controlled reaction.

c) Elaborate the role of 'Energy factor' and 'Steric factor in the collision theory.

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

a) Calculate the magnitude of the diffusion controlled constant at 25^0C for a species in the medium A and B. The viscosities for which are 9.9×10^{-4} $kg\ m^{-1}\ s^{-1}$ and $1.98 \times 10^{-3}\ kgm^{-1}\ s^{-1}$ respectively.

b) Calculate the fraction of molecular collision having at least kinetic energy Ea along the line of flight from the following data:

i) Ea = 14.8 kJ mol^{-1} **ii)** Ea = 148 kJ mol^{-1} at 27^0C and 527^0C.

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