**ATN – 17**

# B.Sc. (Semester – V) Examination, October/November 2018
## CHEMISTRY (Paper – I) (Six Units)
## Physical Chemistry

Duration : 2 Hours | Total Marks : 80

***Instructions :*** 1) *Answer to the **two** Sections should be written in **separate** answer books.*
2) *Figures to the **right** indicate **full** marks.*
3) ***Use** of non-programmable **calculator** is allowed.*
4) *Log tables will be **supplied** on request.*
5) ***All** questions are compulsory, however **internal** choice is available.*

*Physical constants :*
$N = 6.023 \times 10^{23}$ molecules/mole, $h = 6.626 \times 10^{-34}$ Js, 1 a.m.u. = 931.5 MeV, F = 96500 Coulombs, $m = 9.109 \times 10^{-31}$ Kg.

### SECTION – I
### (Physical Chemistry)

1. Answer **any four** questions from the following : **(4×4)**
   a) How Nucleus can be explained using liquid drop model ?
   b) With the help of neat diagram, explain Daniel cell.
   c) What is sine wave ? What is sinusoidal wave equation ?
   d) Explain orientation polarisation for polar molecules.
   e) Explain Born's interpretation of wave function.
   f) Explain "To every observable there corresponds an operator".

2. A) i) What does Azimuthal quantum number signifies ? **2**
   ii) Write a short note on composition of nucleus. **4**

   OR

   iii) What do you understand by zero point energy ? **2**
   iv) Define half life of a radioelement. Derive an expression for decay constant. **4**

**P.T.O.**

B) i) Write different conventions for representation of an electrochemical cell. 4

ii) Calculate the e.m.f of the following cell at 25°C

$Sn/Sn^{2+}//Pb^{2+}/Pb$

Given : SOP of $Sn/Sn^{2+} = +0.140V$

SOP of $Pb/Pb^{2+} = -0.126V$

Also calculate the standard free energy change. 2

3. A) i) Using dipole moment, explain molecular structure of $NH_3$ and $CH_4$. 4

ii) What are magic numbers ? 2

OR

iii) Explain the determination of dipole moment by refractivity method. 4

iv) Explain binding energy per nucleon. 2

B) i) Derive the expression for energy for the particle in a one dimensional box. 4

ii) What is an operator ? Explain Hamiltonian operator. 2

## SECTION – II

4. Answer **any four** of the following : **(4×4=16)**

a) What are concentrations cells ? Derive an expression for emf of the following concentration cell.

$Ag \mid AgCl_{(s)}, Cl^-(a_1) \parallel Cl^-(a_2), AgCl_{(s)}, \mid Ag$

b) Show that the frequency between 2 consecutive spectral lines in rotational spectrum is always constant.

c) With a neat diagram explain the ionisation chamber.

d) Find the emf of the following cell at 298K,

$Pt \mid H_{2(g,\ 1\ atm)}, H_2SO_{4(m = 0.005,\ \gamma = 0.640)} \parallel H_2SO_4(m = 2.0, \gamma = 0.125), H_{2\ (g,\ 1\ atm)} \mid Pt.$

The transport number of $H^+$ ions in the given range of temperature is 0.83.

e) The pure rotational spectrum of carbon monoxide CO has lines at $3.84\times10^2$, $7.68\times10^2$ and $11.52\times10^2 m^{-1}$. Calculate the equilibrium internuclear distance in the molecule. (C = 12, O = 16).

f) Write a short note on proportional counters (Diagram not expected).

5. a) What is decomposition potential ? Describe with a labelled diagram the measurement of decomposition potential. 6

OR

5. a) What is overvoltage ? Describe with a labelled diagram the measurement of overvoltage. 6

b) i) Explain the working of a scintillation counter with a diagram. 4

ii) What is its selection rule for microwave spectroscopy ? 2

6. a) i) Describe isotope effect in rotational spectra with an example. 3

ii) Write any 3 characteristics of an ideal GM counter. 3

OR

6. a) i) Write a short note on intensity of spectral lines using Boltzmann distribution. 3

ii) What is multiplicative ion collection ? 3

b) i) The emf of the cell,

$Pt \mid H_{2(g,\ 1atm)},\ 0.1m\ KOH \parallel 0.1m\ HCl,\ H_{2(g,\ 1atm)} \mid Pt$

$(\gamma = 0.760) \qquad (\gamma = 0.798)$

is 0.6975 volt. Calculate the ionic product of water. 3

ii) What is Liquid junction potential ? How does the salt bridge minimise the liquid junction potential ? 3

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