

(This Question Paper contains 2 printed pages)

Sr. No. of Question Paper: 883

Roll No:

Unique Paper Code: 219256

Name of the course: B.Sc.(H) Geology, II Semester

Name/ Title of the paper: GEHT 203 -Physical Chemistry

Semester: II

Duration: 3 Hours

Max Marks: 75

Instructions for candidates:

Attempt any five questions. Each question carry 15 marks

E

SET B

1.

- Derive Schrodinger's wave equation and explain various terms involved in it.
- What is the significance of Ψ and Ψ^2
- What are Eigen values?
- Explain Heisenberg's Uncertainty Principle.
- Explain why there cannot be more than one s, three p, five d and seven f-orbitals. Explain as to why no more than two electrons can be accommodate in an orbital.

2.

- Explain the main postulates of Arrhenius theory of ionization? What are the factors on which degree of dissociation depends?
- What is Ostwald's Dilution law? What is its importance?
- A base has a dissociation constant of 1.8×10^{-5} at 298K. Calculate its degree of dissociation at a concentration of 0.1M at the same temperature.
- The pH of rainwater collected in a certain region of Delhi on a particular day was 3.70. Calculate the H^+ ion concentration of the rainwater.
- Calculate the pH of 4.8×10^{-4} M NaOH solution.

3.

- Write notes on the following
 - Fajan's rules
 - Born Haber's cycle
- Calculate the lattice energy of NaCl crystal from the following data by the use of Born Haber cycle

Sublimation energy(S)	=108.7 kJ/mol
Dissociation energy for $Cl_2(D)$	= 225.9 kJ/mol
Ionization energy for $Na(g)(I)$	= 489.5kJ/mol
Electron affinity for $Cl(g)E$	= -351.4 kJ/mol
Heat of formation of $NaCl(\Delta H_f)$	= -414.2 kJ/mol

- Give reasons why
 - $BaSO_4$ is insoluble in water
 - Melting point of BaO is high
 - KCl_2 is not formed
- What do you understand by Hund's rule of maximum multiplicity? Apply this rule in writing the electronic configurations of oxygen and nitrogen.
- Calculate the value of Z^2 , using Born - Lande equation for lattice energy, in CaF_2 given that

$$A = 2.519, r_0 = 2.35 \text{ \AA}, n = 7, N = 6.02 \times 10^{23}, e = 4.8 \times 10^{-10} \text{ esu}, U_0 = -2550 \text{ kJ/mol}$$

Where the symbols have their usual meanings

4.

- At absolute zero, the entropy of all pure elements and compounds is zero. Explain.
- What is the relationship between the change in entropy and the change in order for a

system going from one state to another?

- c) Explain the term free energy and work function. Why Δ is called work function?
- d) The dipole moment of HX is 1.92D and bond distance 1.2 Å. Calculate the ionic character of HX
- e) Arrange the following acids in increasing order of their percentage ionic character HCl, HBr, HI (Electronegativity of Cl, Br, I, H are 3.00, 2.8, 2.4, 2.1 respectively)

5.

- a) Explain the following:
 - i. A nodal point.
 - ii. Orthogonality of wave functions.
- b) Which of the orbitals are not possible 1p, 2s, 3p, 3f? Give reasons.
- c) Draw radial probability function for $n = 3$ for hydrogen atom.
- d) How many degenerate d-orbitals are present in 3d-subshell?
- e) What is the difference between 3d, 4d, 5d orbitals?

6.

- a) List the quantum numbers of electrons in the following orbitals:
 - (i) 3d
 - (ii) 4f
- b) What does the term degenerate orbital mean?
- c) Draw the shapes of orbitals with (i) $l = 0$ and (ii) $l = 1$
- d) An electron is in a 4f orbital. What possible values for quantum numbers n , l and m ?
- e) What is $(n + 1)$ rule? Explain with one example.

7.

- a) What is the difference between Helmholtz free energy function and Gibbs free energy function? Under what condition, ΔG becomes equal to ΔA ?
- b) What is the enthalpy of formation of the *most* stable form of an element in its standard state?
- c) State and explain enthalpy of neutralization. Why it is less than $- 57.32 \text{ kJ mol}^{-1}$ when either acid or the base is weak?
- d) What is the state of a chemical reaction when i) $\Delta G = 0$ ii) $\Delta G > 0$ iii) $\Delta G < 0$
- e) Write the mathematical statement of second law of thermodynamics.