1st End Semester Examination-2021

Physical Chemistry-I, CH-403, Full Marks: 50, Time: 2 h

Group A [10x2]

1. The spatial part of the wave function of the atom in ground state is 1s(1)1s(2), then write down the spin part.
2. The operation of the commutator [x, d/dx] on a function f(x) is equal to-------?
3. Write down the values of the magnetic quantum numbers for p_x, p_y and p_z orbital if the field is applied in z-direction.
4. Draw the first four wave functions of a harmonic oscillator.
5. Define Chemical potential.
6. What is Activity and Activity Coefficient
7. Discuss the Flux -Force relationship with examples
8. Calculate number of ways of distributing two indistinguishable particles in three boxes.
9. What are the characteristics of fermions?
10. Calculate electronic partition function of chlorine atom if it is assumed that energy of first and higher excited states are large.

Group B

11. Show that the most probable distance (r) of finding an electron in H-atom is a_0, *where the a_0 is Bohr's radius*. [5]

    Or

    Show that $[P_x, L_y]=i(h/2\pi)P_z$

12. Simplify $L_z\ Y_{l,m}(\theta,\varphi)$ = [5]

    Or

    Show that the first order non degenerate perturbation energy can be expressed by $E^1=\langle\psi^0 I\psi^0\rangle$, *where the terms have their usual meanings*.

13. Determine the Partial Molar Free energy using Apparent molar property [5]

    OR

    What is Fugacity. Determine the Fugacity using Graphical method

14. Differentiate between Reversible and Irreversible processes and discuss the thermodynamic criteria of Irreversible processes [5]

    OR

    Show that:

    $L_{ii}\ L_{jj} - L_{ij}^2 > 0$, where L_{ii}, L_{jj} are diagonal phenomenological coefficient (direct effect) L_{ij} is off diagonal phenomenological coefficient (indirect effect)

15. a. Derive translational partition function of a diatomic molecule as $Q_t = (2\pi mkT)^{3/2}/h^3.\ (RT/P)$ [5]

    b. Show that $S = R[\ln(Q/n)+T(d\ln Q/dT)_v+1]$ [5]

    Or

    Derive $n_i=g_i/(e^{\alpha+\beta\varepsilon i}+1)$, and name this relationship [5+1]

    Prove $T(d\ln Q/dT)_v=3/2$ [4]

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