(6 pages)

Reg. No. : .....

Code No. : 5874 **Sub. Code : PCHM13**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2020.

First Semester

Chemistry — Core

PHYSICAL CHEMISTRY — I

(For those who joined in July 2017 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL the questions.

Choose the correct answer :

1. Fugacity is most helpful in ————————

   (a) Representing actual behaviour of real gases

   (b) Representing actual behaviour of ideal gases

   (c) The study of chemical equilibria involving gases at atmospheric pressure

   (d) None of these

2. Gibbs-Duhem equation ————————

(a) Applies only to binary systems

(b) Finds no application in gs-liquid equilibria involved in distillation

(c) States that $n_1 d\mu_1 + n_2 d\mu_2 + ... n_j d\mu_j = 0$, for a system of definite composition at constant temperature and pressure

(d) None of these

3. In an irreversible process, there is a ————————

(a) Loss of heat (b) No loss of heat

(c) Gain of heat (d) No gain of heat

4. Melting of wax is accompanied with ————————

(a) Decrease (b) Increase

(c) No change (d) None of these

5. The corresponding eigen value equals to ————————

(a) 0 (b) hk

(c) ihk (d) h^2k^2

6. For the hydrogen atom, which of the following orbitals has the lowest energy ————————

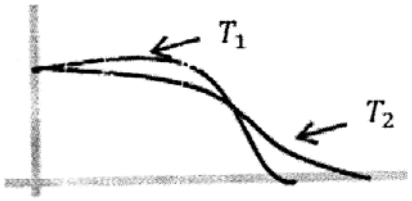
(a) $4s$

(b) $4p$

(c) $4f$

(d) They all have the same energy

7. The following FD-distributions correspond to two different temperatures, T_1 and T_{2-}. Which one of these correct?



(a) $T_1 > T_2$

(b) $T_1 < T_2$

(c) $T_1 > T_2$

(d) Cannot be said definitely

8. Consider Maxwell-Boltzmann distribution. How can the fluctuation in velocity be related to temperature?

(a) αT (b) αT^2

(c) αT^3 (d) $\alpha T^{1/2}$

9. The region of electromagnetic spectrum for nuclear magnetic resonance is ————————

(a) Microwave (b) Radiofrequency

(c) Infrared (d) UV-rays

10. Which of the following molecules show rotational spectra?

(a) H_2O (b) N_2O

(c) $CHCl_3$ (d) All of the above

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Explain the concepts of fugacity and activity.

Or

(b) The activity of 2.5 moles of a substance changes from 0.05 to 0.35. What would be the change in its free energy at 27°C?

12. (a) How will you derive the phase rule from the concept of chemical potential?

Or

(b) Comment on the statement, "Entropy of the universe is always increasing".

13. (a) Explain the photoelectric effect by Quantum theory.

Or

(b) Write the Planck's quantum concept.

14. (a) Describe the Ergodic hypothesis.

Or

(b) Write the Maxwell-Boltzmann distribution law.

15. (a) Write a note on Doppler broadening.

Or

(b) Explain the effect of isotopic substitution.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Describe the Activity and Activity Coefficients of non-electrolytes.

Or

(b) Derive the Gibbs-Duhem-Margules equation.

17. (a) Give a brief account on entropy production in simple chemical reactions.

Or

(b) Discuss the validity verification of Onsager reciprocal relations.

18. (a) Explain the postulates of quantum mechanics.

Or

(b) Derive the Schrodinger equation.

19. (a) Discuss the Debye theory of heat capacities of solids.

Or

(b) Derive the Bose-Einstein [B.E.] and Fermi-Dirac [F.D.] distribution equations.

20. (a) Demonstrate diatomic molecules as rigid rotors.

Or

(b) Discuss the Rotational Spectra Polyatomic molecules.

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