Reg. No. : ....

Name : ....

Fifth Semester B.Sc. Degree Examination, October 2015
First Degree Programme under CBCSS
CHEMISTRY
Core Course – V
CH 1541 – Physical Chemistry – I
(2013 Admissions)

Time : 3 Hours　　　　　　　　　　　　　　Max. Marks : 80

SECTION – A

Answer **all** questions. Answer in **one** word to maximum of **two** sentences. **Each** question carries **1** mark.

1. Give the values of R in litre atmosphere and in Joule.

2. Define collision frequency.

3. What is radius ratio of an ionic solid ?

4. What is Joule Thomson effect ?

5. What is a colligative property ?

6. What is osmosis ?

7. Give the relation between C_p and C_v.

8. What do you mean by inversion temperature ?

9. Define chemical potential.

10. Name the elements of symmetry.

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SECTION – B

Short answer type (**Not** to exceed **one** paragraph). Answer **any 8** questions. **Each** question carries **2** marks.

11. Calculate the average velocity of O_2 molecule at $0°C$.

12. Define mean free path.

13. Define surface tension and coefficient of viscosity of a liquid.

14. Calculate the angle at which first order reflection will occur in an X-ray spectrometer when X-rays of wavelength 1.54 Å are diffracted by the atoms of a crystal given that the interplanar distance is 4.04 Å·

15. Calculate the molefraction of water in a mixture containing 9.0 g water (μ_m = 18 g mole^{-1}), 120 g acetic acid (μ_n = 60 g mol^{-1}) and 115 g ethanol (μ_m = 46 g mol^{-1}).

16. Explain what is Vant Hoff factor.

17. What are extensive and intensive properties ?

18. Give two different statements of second law of thermodynamics.

19. 5 moles of an ideal gas expand reversibly from a volume of 8 dm^3 to 80 dm^3 at a temperature of 27°C. Calculate the change in entropy - R = 8.314 JK^{-1} mol^{-1}.

20. In a certain process 6000 J of heat is added to the system while the system does work equivalent to 9000 J by expanding against the surrounding atmosphere. Calculate the internal energy of the system.

21. Calculate the efficiency of an engine working between 27°C and 110°C.

22. What are proper and improper axis of symmetry ?   **(8×2 = 16 Marks)**

SECTION – C

Answer **any 6** questions. **Each** question carries **4** marks.

23. Explain the significance of Helmholtz and Gibbs free energy.

24. What are liquid crystals ? Give an account of the different types of liquid crystals.

25. Iron (II) oxide (FeO) crystal has a cubic structure and each edge of the unit cell is 5.0 Å. Taking density of the oxide as 4.0 g cm^{-3}, calculate the number of Fe^{3+} and O^{2-} ions present in each unit cell.

26. What are the conditions for symmetry operations to form a point group.

27. Calculate ΔH for the reaction

$C_{(graphite)} + 2H_{2(g)} \rightarrow CH_{4(g)}$ from the following data.

$CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(l)}$ $\Delta H = -890.35$ KJ mol^{-1}

$H_{2(g)} + \frac{1}{2} O_{2(g)} \rightarrow H_2O_{(l)}$ $\Delta H = -285.84$ KJ mol^{-1}

$C_{(graphite)} + O_{2(g)} \rightarrow CO_{2(g)}$ $\Delta H = -393.51$ KJ mol^{-1}

28. Derive the Gibbs-Duhem equation.

29. At 25°C, the osmotic pressure of human blood due to the presence of various solutes is 7.65 atm. Assuming that molarity equals molality. Calculate the freezing point of blood. ($K_f = 1.86$ K kg mol^{-1}).

30. Explain the stoichiometric defects of a crystal.

31. Calculate q, w, Δu and ΔH for the isothermal expansion of one mole of an ideal gas at 27°C from a volume of 10 dm^3 to a volume of 20 dm^3 against a constant external pressure of 1 atm. **(6×4 = 24 Marks)**

SECTION – D

Answer **any 2** questions. **Each** question carries **15** marks.

32. Define the critical constants of a gas. Explain how you would determine them.

33. Derive the Bragg equation. How is the interplanar spacing determined by the powder method ?

34. a) Explain how abnormal molecular mass arises.

    b) Derive Gibbs-Helmholtz equation.

35. a) Show that for a cyclic process the total work done is equal to the heat absorbed.

    b) Give the group multiplication table for C_{3v} point group. **(2×15 = 30 Marks)**