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B – 1440

Reg. No. :

Name :

Fifth Semester B.Sc. Degree Examination, November 2016
First Degree Programme Under CBCSS
CHEMISTRY
Core Course V
CH 1541 : Physical Chemistry – I
(2013 Admission Onwards)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer **all** questions. Answer in **one** word to maximum of **2** sentences. **Each** question carries **1** mark.

1. Define collision number.
2. Define Boyle temperature.
3. What is anisotropy ?
4. What are colligative properties ?
5. What are isotonic solutions ?
6. Write the Poiseuille's equation and explain the terms.
7. Define enthalpy of formation of a compound.
8. State the zeroth law of thermodynamics.
- ✓ 9. What is meant by efficiency of an engine ?
- ✓ 10. What is the criteria for spontaneity and equilibrium in terms of entropy of system and surrounding ?
(10×1=10 Marks)

P.T.O.



SECTION – B

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

11. Calculate RMS velocity of hydrogen gas at 0°C .
12. Calculate the Miller indices of crystal planes which pass through the crystal axes at $(2a, 3b, c)$.
13. Calculate the normality and molarity of an aqueous solution containing 15.5 g of anhydrous sodium carbonate in 2 litres.
- ✓ 14. Maximum work is obtained from a reversible process – substantiate.
15. State and explain Hess's law.
- ✓ 16. What is the significance of Helmholtz free energy ?
17. Distinguish between proper and improper rotation.
18. How will you classify a gas based on its compressibility factor ?
19. The diffraction of a crystal with X-rays of wavelength $2.9 \times 10^{-10} \text{ m}$ gives a first order diffraction at $27^\circ 8'$. What is the distance between the lattice planes ?
20. Calculate the osmotic pressure of a 0.1 M aqueous solution of an organic solute at 17°C - $R = 0.0821 \text{ L atm K}^{-1} \text{ mol}^{-1}$.
21. Explain why the heat of neutralisation of a strong acid by a strong base is a constant.
22. Identify the symmetry elements of NH_3^- . **(8×2=16 Marks)**

SECTION – C

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

23. Define critical temperature of a gas and explain how it can be determined. *N₂, CO₂*
24. Describe the rotating crystal method of determining the interplanar spacing for the different kinds of planes. *1/2 + 1/3 = 5/6*
- ✓ 25. Density determination of copper yields a value of $8.539 \times 10^3 \text{ Kg m}^{-3}$. The edge length of the fcc unit cell of copper is found to be 3.3 \AA from X-ray diffraction studies. Calculate the Avagadro number from the above data. [$\text{Cu} = 63.54 \text{ g mol}^{-1}$].



26. One mole of an ideal gas at 27° C expands adiabatically against a constant external pressure of 1 atm from a volume of 10 dm³ to 20 dm³. Calculate

i) q

ii) w

iii) Δu and

iv) ΔH . Assume that $C_v = \frac{3}{2} R$.

✓ 27. Derive the Gibbs Helmholtz equation.

28. Explain the different elements of symmetry.

29. Addition of 0.643 g of a compound to 50 ml of benzene ($d = 0.879$ g/ml) lowers the freezing point from 5.51° to 5.03° C. If K_f of benzene is 5.12 K kg mol⁻¹, calculate the molar mass of the compound.

30. Derive the Kirchoff's equation.

31. Give the group multiplication table for C_{2v} point group.

(6×4=24 Marks)

SECTION - D

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

32. Why do real gases deviate from ideal behaviour ? How did Van-der-Waal account for the deviations ?

33. What are liquid crystals ? Explain the different types of liquid crystals with examples. What are their applications ?

34. Give an account of the stoichiometric and non-stoichiometric defects of crystals.

35. a) How do abnormal molecular masses arise ?

b) How will you determine viscosity of a liquid using Ostwald's viscometer ?

(2×15=30 Marks)
