

Exam. Code : 103203

Subject Code : 1294

B.A./B.Sc. 3rd Semester (Batch 2020-23)

CHEMISTRY

(Physical Chemistry—II)

Time Allowed—3 Hours] [Maximum Marks—35

Note :—Attempt **FIVE** questions in all, selecting at least **ONE** question from each section. The **fifth** question may be attempted from any section. All questions carry equal marks. Log Tables may be asked for.

SECTION—A

1. (a) For an ideal gas, show that :
 - (i) Joule-Thomson coefficient is zero.
 - (ii) dw is not an exact differential.
- (b) Show that work done in adiabatic expansion is less than the work done in isothermal expansion. 4,3
2. (a) Establish a relationship between heat capacities at constant volume and pressure.
- (b) Four moles of an ideal gas expand reversibly and isothermally at 27°C from a volume of 0.5 dm³ to 2.0 dm³. Calculate q , w , dU and dH for the process. ($R = 8.314 \text{ JK}^{-1}\text{mol}^{-1}$). 3,4

SECTION—B

3. (a) Derive Kirchoff equation and mention its importance.
(b) Calculate the bond energy of HCl if H-H and Cl-Cl bond energies are 433 and 242 kJ mol⁻¹ respectively and ΔH for the formation of HCl is -91 kJ mol⁻¹.
(c) Explain why the enthalpy of neutralization of strong acid with strong base is nearly the same in all the cases. 3,3,1
4. (a) State and explain Carnot theorem. What are the consequences of this theorem ?
(b) At N.T.P., 2.8 liters of oxygen were mixed with 19.6 liters of hydrogen. Calculate the increase in entropy. (R = 8.314 JK⁻¹mol⁻¹).
(c) Enlist limitations of first law of thermodynamics that lead to the emergence of second law of thermodynamics. 3,2,2

SECTION—C

5. (a) How will you evaluate absolute entropy from heat capacity data ?
(b) Deduce the following relationships :
- (i) $\left[\frac{\partial G}{\partial T} \right]_p = -\frac{H}{T^2}$
- (ii) $\left[\frac{\partial A}{\partial T} \right]_v = -\frac{E}{T^2}$
- (c) Establish a relationship between K_p, K_c and K_a. 2,3,2

6. Write notes on the following :

- (a) Nernst heat theorem
(b) Concept of residual entropy
(c) Clausius-Clapeyron equation. 2.5,2,2.5

SECTION—D

7. Sketch and explain the phase diagrams of the following systems :
- (a) Sulphur
(b) Pb-Ag
(c) FeCl₃ - H₂O. 2.5,2,2.5
8. (a) What are lower and upper consolute temperature ? Mention the effect of impurity on consolute temperature.
(b) Outline the principle of steam distillation. Enlist its advantages over ordinary distillation.
(c) Give an account of Nernst distribution law with special emphasis on its applications. 2,2,3