B.A./B.Sc. 3rd Semester

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. Each question carries **7** marks. Log Tables may be asked for.

SECTION—A

1. Explain the difference between the following :

    (a) State and path functions.

    (b) Dependent and independent variables.

    (c) Extensive and intensive properties.

    (d) Open, closed and isolated systems.

    1.5,1.5,2,2

2. (a) For an ideal gas, show that $C_p - C_v = R$.

    (b) How will you calculate w, q, dU and dH for the expansion of an ideal gas under isothermal conditions for reversible process ?   3,4
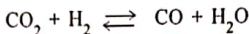
SECTION—B

3. (a) State and explain Hess's law of constant heat summation.

   (b) Derive Kirchhoff's equation.

   (c) Calculate the heat of reaction :
   $$CO_2 + H_2 \rightleftharpoons CO + H_2O$$
   The heats of formation of CO, CO_2 and H_2O are 25.4, 90.5 and 55.0 kcal respectively.   2,2,3

4. (a) Derive an expression for entropy change upon mixing of two ideal gases.

   (b) Taking entropy as a function of P and T, show that
   $$\left(\frac{\partial S}{\partial P}\right)_T = -\left(\frac{\partial V}{\partial T}\right)_P.$$

   (c) Heat supplied to a Carnot engine is 450 kcal. How much useful work can be done by the engine between 0°C and 100°C ?   2,3,2

SECTION—C

5. (a) State and explain third law of thermodynamics. How will you evaluate the absolute entropy by using this law ?

   (b) Deduce the relationships :

   (i) $dA = - PdV - SdT$

   (ii) $dG = - SdT + VdP$

(iii) $\left[\dfrac{\partial(G/T)}{\partial T}\right]_P = -\dfrac{H}{T^2}$

(iv) $\left(\dfrac{\partial G}{\partial P}\right)_T = V$ 　　　　3,4

6. (a) Establish the relationship between :

   (i) Equilibrium constant and free energy

   (ii) Kp, Kc and Ka.

   (b) Derive Clausius-Clapeyron equation. 　2,2,3

SECTION—D

7. Explain the difference between the following :

   (a) Eutectic and compound

   (b) Congruent and incongruent melting points

   (c) Lower and upper consulate temperatures

   (d) Steam distillation and ordinary distillation.

   　　　　　　　　　　　1.5,2.5,1.5,1.5

8. Sketch and explain the phase diagrams of the following systems :

   (a) CO_2

   (b) Pb-Ag eutectic

   (c) $FeCl_3 - H_2O$. 　　　　2,2,3