Assignment-II

B.Sc. Chem(Hons) Ist year

Semester II (2020)

Unit-I &II

1. (i) A function ϕ is defined as $\phi(x, y) = x^2y^3 + x$. Write its partial derivatives and total differential $d\phi$. Test whether $d\phi$ is an exact differential or not.
   (ii) Prove that in the equation
   $dz = (52\ x^3y + 10\ y^5)\ dx + (13\ x^4 + 50\ xy^4)\ dy$,
   dz is an exact differential.

2. One mole of ideal gas is expanded isothermally and reversibly at 27°C from a volume of 2.28 m^3 to 4.56 m^3. Calculate *q*, *w*, ΔE and ΔH.

3. An ideal gas ($C_{P,m}$ = 29.1 JK-1mol-1) is expanded reversibly and adiabatically from a volume of 1.43 dm^3 at a pressure of 303975 Pascal and temperature 298 K, until the volume is 2.86 dm^3. Calculate (i) the final temperature and pressure of the gas, (ii) *q*, *w*, ΔE and ΔH.

4. One mole of benzene is converted reversibly into vapour as its boiling point 80.2°C by supplying heat. The vapour expands against the pressure of 1atm. The heat of vaporization of benzene is 395 *J/g*. Calculate *q*, *w*, ΔE and ΔH of the process.

5. Two mole of an ideal gas ($C_{V,m}$ = 2.5 R) are maintained in a volume of 11.2 dm^3 at 273 K. The temperature of the gas is raised to 373 K at (i) constant volume, and (ii) at constant pressure. Calculate *q*, *w*, ΔE and ΔH of the two processes separately.

6. If $X = f(T, V)$ and $V = f(T, P)$, then show that
   (i) $\left(\frac{\partial X}{\partial P}\right)_T = \left(\frac{\partial X}{\partial V}\right)_T \left(\frac{\partial V}{\partial P}\right)_T$
   (ii) $\left(\frac{\partial X}{\partial T}\right)_P = \left(\frac{\partial X}{\partial V}\right)_T \left(\frac{\partial V}{\partial T}\right)_P + \left(\frac{\partial X}{\partial T}\right)_V$