XI CHEMISTRY TEST — THERMODYNAMICS

M.M. : 30 **TIME : 1 HR.**

1. Predict change in internal energy for an isolated system at constant volume. **1**

2. Is ΔH a state function? What is ΔH for a cyclical process? **1**

3. Write a mathematical relation which relates heat, randomising influence and temperature. **1**

4. Enthalpy of atomisation for reaction $CH_4(g) \rightarrow C + 4H$ is 1665 kJ/mol. What is bond energy of C—H bond? **1**

5. Find which relation is correct if : **1**

i. $C(g) + 4H(g) \rightarrow CH_4(g)\ \Delta_r H = x$ kJ/mol **ii.** $C(\text{graphite}) + 2H_2(g) \rightarrow CH_4(g)\ \Delta_r H = y$ kJ/mol

a. x = y **b.** x = 2y **c.** x > y **d.** x < y

6. When water freezes in a glass beaker, what happens to ΔS (system) and ΔS (surroundings) and why? **2**

7. Value of $\Delta_f H$ for NH_3 is –91.8 kJ/mol. Find enthalpy change for : $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$ **2**

8. At 298 K, ΔH for reaction $2A + B \rightarrow C$, is 400 kJ/mol and ΔS is 0.2 kJ/k/mol. At what temperature will the reaction be spontaneous if ΔH and ΔS is constant over temperature range. **2**

9. Find enthalpy change of reaction at 298 K, is $\Delta U = -742.7$ kJ/mol at 298 K. **3**

$$NH_2CN(s) + \frac{3}{2}O_2(g) \rightarrow N_2(g) + CO_2(g) + H_2O(\ell)$$

10. Calculate $\Delta H^\circ_{\text{lattice}}$ for Na Br. ΔH_{sub} for sodium metal = 108.4 kJ/mol, ionisation enthalpy of sodium = 496 kJ/mol, e^- gain enthalpy of bromine = –325 kJ/mol, bond dissociation enthalpy of bromine = 192 kJ/mol, $\Delta_f H^\circ$ for NaBr (s) = –360.1 kJ/mol. **3**

11. Find $\Delta_r H$ for $H_2(g) + Br_2(g) \rightarrow 2HBr(g)$ **3**

a. Given that B.E. of H_2, Br_2, HBr is 435 kJ/mol, 192 kJ/mol and 368 kJ/mol respectively.

b. What is the enthalpies of all elements in their standard state?

12. Find enthalpy change on freezing 1 mol of water at 10.0° C to ice at –10°C. **4**

$$\Delta_{fus} H = 6.03 \text{ kJ/mol at } 0^\circ C$$

$$C_p[(H_2O)\ \ell] = 75.3 \text{ J/mol / k}$$

$$C_p[(H_2O)\ S] = 36.8 \text{ J/mol / k}$$

13. **a.** Given : $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)\ \Delta_r H = -92.4$ kJ/mol. What is $\Delta_f H$ of NH_3 gas? **1**

b. What are signs of ΔH and ΔS for reaction : $2Cl(g) \rightarrow Cl_2(g)$. **2**

c. For reaction, $2A(g) + B(g) \rightarrow 2D(g)\ \Delta U^\circ = -10.5$ kJ

$\Delta S = -44.10$ J/k. Calculate Δg° for reaction and predict whether reaction is spontaneous or not. **3**