Solutions (Assignment Week-5)

A-1: By Clausius inequality \[ ds > \frac{dq}{T} \]

For reversible change: \[ ds = \frac{dq_{rev}}{T} \]

Since \( dq_{rev} = 0 \), \( ds = 0 \). \( \therefore \) (D)

A-2

\[ S = k \ln W = k \ln 2^N = nR \ln 2 = 5.76 \text{ JK}^{-1} \text{ mol}^{-1} \]

\( \therefore \) (B)

A-3 Freezing of water is exothermic, hence if walls of the container are diathermic, heat passes out and increases entropy of surroundings.

\( \therefore \) (B)

A-4

For adiabatic change, \( dq = 0 \)

\[ \therefore \ du = dw \]

Hence work is done at the cost of internal energy.

\( \therefore \) (B)

A-5 Water has extensive hydrogen bonding in liquid form, hence more disorder is generated when it evaporates.

\( \therefore \) (B)
A-7

At very low temperature, \( C_p \propto T^3 \)

\[ \therefore C_p \propto 5^3 \text{ or } C_p \propto 125 \]  \hspace{1cm} (A)

A-8

Most widely used criterion is \( \Delta G_{T,p} \leq 0 \)

\[ TdS \geq dH_p \]  \hspace{1cm} (By definition)

\[ G = H - TS; \ dG = dH - TdS - SdT, \text{ Hence } dG_{T,p} \leq 0 \]

A-9

by Clausius Inequality: \( dS \geq \frac{dq}{T} \)

\[ TdS \geq dq \]

at constant \( V, \ TdS \geq dU \ ... \text{ const } V \)

\[ \therefore (dU)_{S,V} \leq 0 \]

Hence options (B) and (D) are correct.

A-10

Maximum work is given by \( \Delta A \).

\( (C) \)