

### Assignments for Week-5

1. Calculate the entropy change involved in an isothermal reversible expansion of 5 moles of an ideal gas from 10 litres to 100 litres at 300 K.

Answer options:

(A)  $96 \text{ J K}^{-1}$

(B)  $48 \text{ J K}^{-1}$

(C)  $24 \text{ J K}^{-1}$

(D)  $192 \text{ J K}^{-1}$

2. Calculate  $\Delta S$  for the isobaric heating of 1 mole of nitrogen from  $300^\circ$  to  $1000^\circ \text{ K}$ .

$$C_p = (6.45 + 1.4 \times 10^{-3} T) \text{ cal K}^{-1} \text{ mol}^{-1}$$

Answer options:

(A)  $10.5 \text{ cal K}^{-1}$

(B)  $8.75 \text{ cal K}^{-1}$

(C)  $5.25 \text{ cal K}^{-1}$

(D)  $100.5 \text{ cal K}^{-1}$

3. Calculate  $\Delta S$  for the process

1 mole water ( l,  $20^\circ\text{C}$ , 1 atm)  $\rightarrow$  1 mole water ( g,  $250^\circ\text{C}$ , 1 atm)

$$C_{p, \text{H}_2\text{O}(l)} = 75.3 \text{ J K}^{-1} \text{ mol}^{-1}; \quad C_{p, \text{H}_2\text{O}(g)} = 36.0 \text{ J K}^{-1} \text{ mol}^{-1}$$

$$\Delta_{\text{vap}}H(\text{H}_2\text{O}) \text{ at } 100^\circ\text{C and 1 atm} = 40.688 \text{ kJ mol}^{-1}$$

Answer options

(A)  $240 \text{ J K}^{-1} \text{ mol}^{-1}$

(B)  $439 \text{ J K}^{-1} \text{ mol}^{-1}$

(C)  $390 \text{ J K}^{-1} \text{ mol}^{-1}$

(D)  $139 \text{ J K}^{-1} \text{ mol}^{-1}$

4. A block of copper (500 g) initially at  $20^\circ\text{C}$  is in thermal contact with a electric heater of resistance  $1000 \ \Omega$  and negligible mass. An electric current of 1 amp is passed for 15 sec. What is the entropy change of copper? ( For copper,  $C_{p, m} = 24.4 \text{ JK}^{-1} \text{ mol}^{-1}$  ).

Answer options:

(A)  $90 \text{ J K}^{-1}$

(B)  $45 \text{ J K}^{-1}$

(C)  $80 \text{ J K}^{-1}$

(D)  $200 \text{ J K}^{-1}$

5. The entropy of vaporization of water is higher than that predicted by Trouton's Rule because

(A) water cannot form hydrogen bonds in liquid form

(B) there is extensive hydrogen bonding in liquid water

(C) vaporization of water is endothermic

(D) volume of ice is higher than volume of liquid water

6. At 5 K, the heat capacity at constant pressure of a substance will be approximately [ $\alpha$  depends on property of the material]

(A)  $125 \alpha$

(B)  $625 \alpha$

(C)  $25 \alpha$

(D)  $250 \alpha$

7. According to Third Law of Thermodynamics

- (A) The entropy of a substance is always zero at absolute zero
- (B) The entropy of a substance can be negative at absolute zero
- (C) The entropy-temperature curves of two perfectly crystalline substances will coincide at absolute zero
- (D) The entropy of an isolated system increases during the course of a spontaneous process

8. Most frequently used criterion of spontaneity is

- (A)  $\Delta G$  (at constant T, P)  $> 0$
- (B)  $\Delta A$  (at constant T, P)  $> 0$
- (C)  $\Delta G$  (at constant T, P)  $< 0$
- (D)  $\Delta U$  (at constant T, P)  $> 0$

9. One of the criterion of spontaneity in terms of the properties of the system alone is  $\Delta U$  (at constant S and V)  $< 0$

- (A) This criterion does not obey Second Law because entropy of the system remains constant
- (B) This criterion obeys Second Law because entropy of the surroundings increases
- (C) This criterion does not obey Second Law because internal energy of the system decreases
- (D) This criterion obeys Second Law because entropy of the surroundings increases due to decrease in the internal energy of the system

10. Maximum work obtainable from a system is given by

- (A)  $\Delta G$
- (B)  $\Delta H$
- (C)  $\Delta A$
- (D)  $\Delta S$

