AVIRAL CLASSES
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CHEMISTRY
CRASH COURSE

LECTURE - 04

TOPICS : Thermodynamics

1. C_v values for monoatomic and diatomic gases respectively are

(a) $\frac{1}{2}R, \frac{3}{2}R$ (b) $\frac{3}{2}R, \frac{5}{2}R$

(c) $\frac{5}{2}R, \frac{7}{2}R$ (d) $\frac{3}{2}R, \frac{3}{2}R$

2. In a reversible process $\Delta S_{sys} + \Delta S_{surr}$ is

(a) > 0 (b) < 0

(c) ≥ 0 (d) $= 0$

3. Which of the following relationship is correct?

(a) $\Delta G° = -RT \ln K$

(b) $K = e^{-\Delta G°/RT}$

(c) $K = 10^{-\Delta G°/2.303RT}$

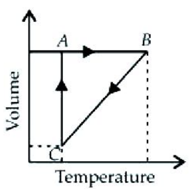
(d) All are correct

4. ΔH and ΔS for the reaction $Ag_2O_{(s)} \rightarrow 2Ag_{(s)}$ are 30.56 KJ mol^{-1} and 66.00 JK^{-1} respectively. The temperature at which the free energy change for the reaction will be zero is

(a) 463 K (b) 35440 K

(c) 20 K (d) 483 K

5. Five moles of a gas is put through a series of changes as shown graphically in a cyclic process. The process A → B, B → C and C→ A respectively are



(a) isochoric, isobaric, isothermal

(b) isoboric, isochoric, isothermal

(c) isothermal, isobaric, isochoric

(d) isochoric, isothermal, isobaric

6. A certain reaction has a ΔH of 12 KJ and a ΔS of 40 J K^{-1} .The temperature above which the reaction becomes spontaneous is

(a) 27°C (b) 27 K

(c) 300°C (d) 30°C

7. The standard Gibbs free energy change($\Delta G°$) at 25°C for the dissociation of $N_2O_{4(g)}$ to $NO_{2(g)}$ is (given, equilibrium cont. = 0.15, R= 8.314 J K/mol)

(a) 1.1 kJ (b) 4.7 kJ

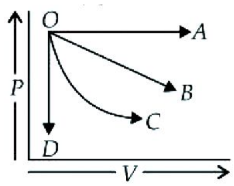
(c) 8.1 kJ (d) 38.2 kJ

8. Identify the state quantity among the following

(a) q (b) $q - \omega$

(c) $q + \omega$ (d) q/ω

9. For which of the following process $q = \Delta U$?



(a) O → A (b) O → D

(c) O → B (d) O → C

10. For which of the following process $\Delta G° - \Delta H°$ is almost equal to zwero ?

(a) $CaCO_{3(s)} \rightarrow CaO + CO_{2(g)}$

(b) $FeSO_{4(s)} + Zn_{(s)} \rightarrow ZnSO_{4(s)} + Fe_{(g)}$

(c) $Zn_{(s)} + H_2SO_{4(g)} \rightarrow ZnSO_{4(s)} + H_{2(g)}$

(d) $H_{2(g)} + Cl_{2(g)} \rightarrow 2HCL_{(g)}$

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LECTURE - 4

TOPICS : Thermodynamics (SOLUTION)

1. **(b) :** For monoatomic gas, $C_v = \frac{3}{2}R$
For diatomic gas, $C_v = \frac{5}{2}R$

2. **(d) :** For a reversible process, $\Delta S_{sys} + \Delta S_{surr} = 0$.

3. d

4. **(a) :** According to Gibb's-Helmholtz equation,
$\Delta G = \Delta H - T\Delta S$
At equilibrium, $\Delta G = 0$
so that $0 = \Delta H - T\Delta S$ or $\Delta H = T\Delta S$
or $T = \frac{\Delta H}{\Delta S}$
Here, $\Delta H = 30.56$ kJ mol^{-1} = 30560 J mol^{-1}
$\Delta S = 66.0$ J K^{-1} mol^{-1}
$\therefore \quad T = \frac{30560}{66.0} = 463$ K

5. **(a) :** Process $A \longrightarrow B$ is isochoric, *i.e.*, volume remains constant.
Process $B \longrightarrow C$ is isobaric, *i.e.*, pressure remains constant.
Process $C \longrightarrow A$ is isothermal, *i.e.*, temperature remains constant.

6. **(a) :** At equilibrium, $\Delta H = T\Delta S$
$T = \frac{\Delta H}{\Delta S} = \frac{12 \times 10^3}{40} = 300$ K
Above 27°C, the reaction becomes spontaneous.

7. **(b) :** $\Delta G° = -RT \ln K$

8. **(c) :** $\because q_{abs} = \Delta U + (-w)$
$\therefore \quad \Delta U = q + w$; ΔU is state function.

9. **(b) :** The process at $O - D$ completed at constant volume so, $\Delta V = 0$

as $W = P\Delta V = 0$, then

$\Delta U = q - W$

$\Delta U = q - 0 = q$

10. **(b) :** $\Delta G° = \Delta H° - T\Delta S°$

Change in entropy for solid reactants and products is almost equal to zero

$\Delta G° = \Delta H° - 0$

$\Delta G° - \Delta H° = 0$

In (b) all reactants and products are solids.

$\therefore$ (b) is correct answer.