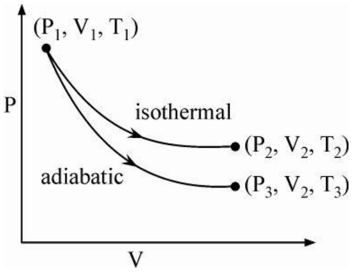
Date Planned : __ / __ / __	**Daily Tutorial Sheet-3**	**Expected Duration : 90 Min**
Actual Date of Attempt : __ / __ / __	**JEE Advanced (Archive)**	**Exact Duration :________**

31. The reversible expansion of an ideal gas under adiabatic and isothermal conditions is shown in the figure. Which of the following statement(s) is(are) correct? **(2012)**



(A) $T_1 = T_2$

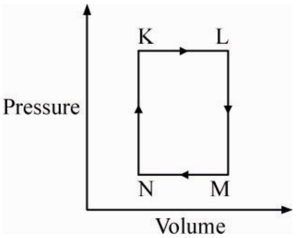
(B) $T_3 > T_1$

(C) $w_{\text{isothermal}} > w_{\text{adiabatic}}$

(D) $\Delta U_{\text{isothermal}} > \Delta U_{\text{adiabatic}}$

Paragraph for Question No. 32 – 33 **(2013)**

A fixed mass 'm' of a gas is subjected to transformation of states from K to L to M to N and back to K as shown in the figure.



32. The succeeding operations that enable this transformation of states are :

(A) heating, cooling, heating, cooling **(B)** cooling, heating,

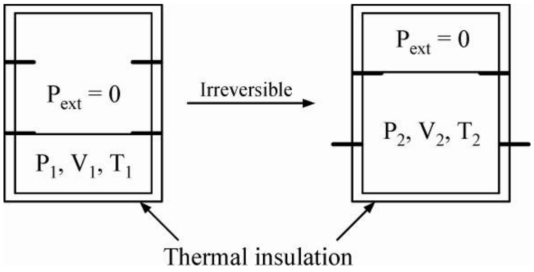
(C) heating, cooling, cooling, heating **(D)** cooling, heating, heating, cooling

33. The pair of isochoric processes among the transformation of states is :

(A) K to L and L to M **(B)** L to M and N to K

(C) L to M and M to N **(D)** M to N and N to K

34. An ideal gas in a thermally insulated vessel at internal pressure $= P_1$, volume $= V_1$ and absolute temperature $= T_1$ expands irreversibly against zero external pressure, as shown in the diagram. The final internal pressure, volume and absolute temperature of the gas are P_2, V_2 and T_2, respectively. For this expansion, **(2014)**



(A) $q = 0$ **(B)** $T_2 = T_1$

(C) $P_2V_2 = P_1V_1$ **(D)** $P_2V_2^{\gamma} = P_1V_1^{\gamma}$

35. For the process, $H_2O(\ell) \longrightarrow H_2O(g)$ at T = 100°C and 1 atmosphere pressure, the correct choice is: **(2014)**

(A) $\Delta S_{\text{system}} > 0$ and $\Delta S_{\text{surrounding}} > 0$

(B) $\Delta S_{\text{system}} > 0$ and $\Delta S_{\text{surrounding}} < 0$

(C) $\Delta S_{\text{system}} < 0$ and $\Delta S_{\text{surrounding}} > 0$

(D) $\Delta S_{\text{system}} < 0$ and $\Delta S_{\text{surrounding}} < 0$

Paragraph for Question No. 36 - 37 **(2016)**

Thermal decomposition of gaseous X_2 to gaseous X at 298 K takes place according to the following equation:

$$X_2(g) \rightleftharpoons 2X(g)$$

The standard reaction Gibbs energy, $\Delta_r G°$, of this reaction is positive. At the start of the reaction, there is one mole of X_2 and no X. As the reaction proceeds, the number of moles of X formed is given by β. Thus, $\beta_{\text{equilibrium}}$ is the number of moles of X formed at equilibrium. The reaction is carried out at a constant total pressure of 2 bar. Consider the gases to behave ideally. (Given : $R = 0.083$ L bar K^{-1} mol^{-1})

36. The equilibrium constant K_P for this reaction at 298 K, in terms of $\beta_{\text{equilibrium}}$, is :

(A) $\dfrac{8\beta^2_{\text{equilibrium}}}{2-\beta_{\text{equilibrium}}}$ **(B)** $\dfrac{8\beta^2_{\text{equilibrium}}}{4-\beta^2_{\text{equilibrium}}}$

(C) $\dfrac{4\beta^2_{\text{equilibrium}}}{2-\beta_{\text{equilibrium}}}$ **(D)** $\dfrac{4\beta^2_{\text{equilibrium}}}{4-\beta^2_{\text{equilibrium}}}$

37. The **INCORRECT** statement among the following, for this reaction, is

(A) Decrease in the total pressure will result in formation of more moles of gaseous X

(B) At the start of the reaction, dissociation of gaseous X_2 takes place spontaneously

(C) $\beta_{\text{equilibrium}} = 0.7$

(D) $K_c < 1$

38. The standard state Gibbs free energies of formation of C(graphite) and C(diamond) as T = 298 K are :

$\Delta_f G°[\text{C(graphite)}] = 0 \text{ kJ mol}^{-1}$; $\Delta_f G°[\text{C(diamond)}] = 2.9 \text{ kJ mol}^{-1}$. **(2017)**

The standard state means that the pressure should be 1 bar, and substance should be pure at a given temperature. The conversion of graphite [C(graphite)] to diamond [C(diamond)] reduces its volume by $2 \times 10^{-6} \text{m}^3\text{mol}^{-1}$. If C(graphite) is converted to C(diamond) isothermally at T = 298 K, the pressure at which C(graphite) is in equilibrium with C(diamond), is : [Useful information: $1 \text{J} = 1 \text{kg m}^2\text{s}^{-2}$; $1 \text{ Pa} = 1 \text{kg m}^{-1}\text{s}^{-2}$; $1 \text{ bar} = 10^5 \text{Pa}$]

(A) 14501 bar **(B)** 29001 bar

(C) 1450 bar **(D)** 58001 bar

***39.** For a reaction taking place in a container in equilibrium with its surroundings, the effect of temperature on its equilibrium constant K in terms of change in entropy is described by : **(2017)**

(A) With increase in temperature, the value of K for exothermic reaction decreases because the entropy change of the system is positive

(B) With increase in temperature, the value of K for endothermic reaction increases because unfavourable change in entropy of the surroundings decreases

(C) With increase in temperature, the value of K for endothermic reaction increases because the entropy change of the system is negative

(D) With increase in temperature, the value of K for exothermic reaction decreases because favourable change in entropy of the surroundings decreases

40. An ideal gas is expanded from (p_1, V_1, T_1) to (p_2, V_2, T_2) under different conditions. The correct statement(s) among the following is (are) **(2017)**

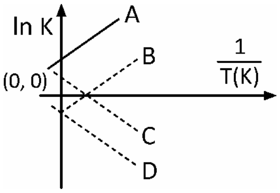
(A) The work done on the gas is maximum when it is compressed irreversibly from (p_2, V_2) to (p_1, V_1) against constant pressure p_1

(B) The change in internal energy of the gas is (i) zero, if it is expanded reversibly with $T_1 = T_2$, and (ii) positive, if it is expanded reversibly under adiabatic conditions with $T_1 \neq T_2$.

(C) If the expansion is carried out freely, it is simultaneously both isothermal as well as adiabatic.

(D) The work done by the gas is less when it is expanded reversibly from V_1 to V_2 under adiabatic conditions as compared to that when expanded reversibly from V_1 to V_2 under isothermal conditions.

41. Which of the following lines correctly show the temperature dependence of equilibrium constant, K, for an exothermic reaction? **(2018)**



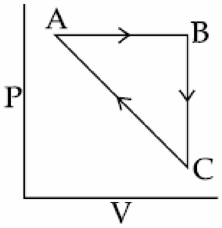
(A) C and D **(B)** A and D **(C)** A and B **(D)** B and C

42. An ideal gas undergoes a cyclic process as shown in figure. **(2018)**

$\Delta U_{BC} = -5 \text{ kJ mol}^{-1}$, $q_{AB} = 2 \text{ kJ mol}^{-1}$;

$W_{AB} = -5 \text{ kJ mol}^{-1}$, $W_{CA} = 3 \text{ kJ mol}^{-1}$

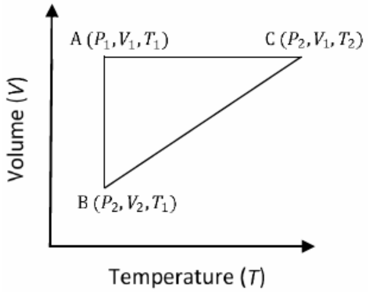
Heat absorbed by the system during process CA is :



(A) -5 kJ mol^{-1} **(B)** 5 kJ mol^{-1}

(C) 18 kJ mol^{-1} **(D)** -18 kJ mol^{-1}

***43.** A reversible cyclic process for an ideal gas is shown below. Here, P, V, and T are pressure, volume and temperature, respectively. The thermodynamic parameters q, w, H and U are heat, work, enthalpy and internal energy, respectively . The correct option(s) is (are) : **(2018)**



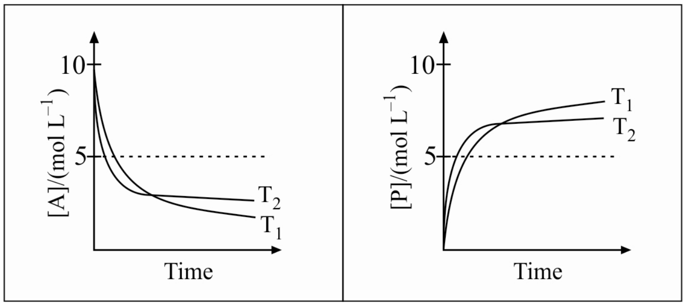
(A) $q_{AC} = \Delta U_{BC}$ and $w_{AB} = P_2(V_2 - V_1)$

(B) $w_{BC} = P_2(V_2 - V_1)$ and $q_{BC} = \Delta H_{AC}$

(C) $\Delta H_{CA} < \Delta U_{CA}$ and $q_{AC} = \Delta U_{BC}$

(D) $q_{BC} = \Delta U_{AC}$ and $\Delta H_{CA} > \Delta U_{CA}$

***44.** For a reaction, $A \rightleftharpoons P$, the plots of [A] and [P] with time at temperatures T₁ and T₂ are given below.



If $T_2 > T_1$, the correct statement(s) is (are) : **(2018)**

(Assume $\Delta H^\ominus$ and $\Delta S^\ominus$ are independent of temperature and ratio of $\ln K$ at T_1 to $\ln K$ at T_2 is greater than $\frac{T_2}{T_1}$. Here H, S, G and K are enthalpy, entropy, Gibbs energy and equilibrium constant, respectively)

(A) $\Delta H^\ominus < 0, \Delta S^\ominus < 0$

(B) $\Delta G^\ominus < 0, \Delta H^\ominus > 0$

(C) $\Delta G^\ominus < 0, \Delta S^\ominus < 0$

(D) $\Delta G^\ominus < 0, \Delta S^\ominus > 0$