CHEMISTRY

BOOKS - PRADEEP CHEMISTRY (HINGLISH)

EQUILIBRIUM IN PHYSICAL AND CHEMICAL PROCESSES

Sample Problem

1. At $700K$, the equilibrium constant K_p for the reaction

$2SO_3(g) \Leftrightarrow 2SO_2(g) + O_2(g)$

is $1.80 \times 10^{-3} kPa$. What is the numerical value of K_c in moles per litre for this reaction at the same temperature?

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2. At 773 K, the equilibrium constant K_c for the reaction,

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ is $6.02 \times 10^{-2} L^2 mol^{-2}$.

Calculate the value of K_p at the same temperature.

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3. For the equilibrium

$2NOCl(g) \Leftrightarrow 2NO(g) + Cl_2(g)$

the value of the equilibrium constant, K_c is 3.75×10^{-6} at $1069K$. Calcualate the K_p for the reaction at this temperature?

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4. K_p for the reaction $,N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3$ is 49 at a certain temperature. Calculate the value K_p at the same temperature for the reaction

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5. The following concentrations were obtained for the formation of NH_3 from N_2 and H_2 at equilibrium at $500K$. $[N_2] = 1.5 \times 10^{-2}M$, $[H_2] = 3.0 \times 10^{-2}M$, and $[NH_3] = 1.2 \times 10^{-2}M$. Calculate the equilibrium constant.

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6. For an equilibrium reaction, the rate constants for the forward and the backward reaction are 2.38×10^{-4} and 8.15×10^{-5}, respectively. Calculate the equilibrium constant for the reaction.

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7. In a reaction between H_2 and I_2 at a certain temperature, the amounts of H_2, I_2 and HI at equilibrium were found to be 0.45 mol, 0.39 mol, and 3.0 mol respectively. Calculate the equilibrium constant for the reaction at the given temperature.

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8. Two moles of PCl_5 were heated to $327^\circ C$ in a closed two-litre vessel, and when equilibrium was achieved, PCl_5 was found to be 40% dissociated into PCl_3 and Cl_2. Calculate the equilibrium constant K_p and K_c for this reaction.

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9. For the reaction,

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$

the partial pressure of N_2 and H_2 are 0.80 and 0.40 atmosphere, respectively, at equilibrium. The total pressure of the system is 2.80 atm. What is K_p for the above reaction?

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10. $0.1mol$ of PCl_5 is vaporised in a litre vessel at $260^\circ C$. Calculate the concentration of Cl_2 at equilibrium, if the equilibrium constant for the dissociation of PCl_5 is 0.0414.

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11. At 1,000 K in the reaction $CO_2(g) + C(s) \rightarrow 2CO(g)$

The value of $P_{CO_2} = 0.48$ bar and$P_{CO} = 0$bar. Pure graphite is present. The equilibrium partial pressures of CO and CO_2 are 0.66 bar and 0.15 bar respectively. Calculate K_P of the reaction.

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12. A vessel at $1000K$ contains carbon dioxide with a pressure of $0.5atm$. Some of the carbon dioxide is converted to carbon monoxide on addition of graphite. Calculate the value of K_p if total pressure at equilibrium is $0.8atm$.

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13. The value of K_c for the reaction, $2A \Leftrightarrow B + C$ is $2 \cdot 0 \times 10^{-3}$ AT a given time, th

In which direction, the reaction will proceed ?

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14. In the equilibrium, $CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g)$, at 1073 K, the pressure of CO_2 is four

What is the equilibrium constant of this reaaction at 1073 K ?

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15. AB_2 dissociates as $AB_2(g) \Leftrightarrow AB(g) + B(g)$. If the initial pressure is 500 mm of Hg and the total pressure at equilibrium is 700 mm of Hg. Calculate K_p for the reaction.

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16. The degree of dissociation of PCl_5 ata certain temperature and atmospheric pressure is $0 \cdot 2$. Calculate the pressure at which it will be half (50 %) dissociated at the same temperature .

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17. Determine the concentration of CO_2 which will be in equilibrium with 2.5×10^{-2} mol $L^{-1} of CO at 100^\circ C$ for the reaction

$FeO(s) + CO(g) \Leftrightarrow Fe(s) + CO_2, K_c = 5.0$

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18. The value of $K_c = 4.24$ at $800K$ for the reaction.

$CO(g) + H_2O(g) \Leftrightarrow CO_2(g) + H_2(g)$

Calculate equilibrium concentration of CO_2, H_2, CO and H_2O at $800K$. If only CO and H_2O are present initially at concentrations of $0.10M$ each.

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19. 3.00 mol of PCl_5 kept in 1 L closed reaction vessel was allowed to attain equilibrium at 380K. Calculate the composition of the mixture at equilibrium. $K_c = 1.80$.

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20. At $700K$, hydrogen and bromine react to form hydrogen bromine. The value of equilibrium constant for this reaction is 5×10^8. Calculate the amount of the H_2, Br_2 and HBr at equilibrium if a mixture of $0.6mol$ of H_2 and $0.2mol$ of Br_2 is heated to $700K$.

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21. 13.8 g of N_2O_4 was placed in 1 L reaction vessel at 400K and allowed to attain equilibrium :$N_2O_4(g) \Leftrightarrow 2NO_2(g)$.

the total pressure at equilibrium was found to be 9.15 bar. Calculate K_c, K_p and partial pressure at equilibrium .

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22. The value of $\Delta G^{\ominus}$ for the phosphorylation of glycose in glycolysis is $13.8 kJ mol^{-1}$. Find the value of K_c at $298 K$

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23. K_p for the reaction $N_2 + 3H_2 \Leftrightarrow 2NH_3$ at $400^{\circ} C$ is 1.64×10^{-4}. Find K_c. Also find $\Delta G^{\ominus}$ using K_p and K_c values and interpret the difference.

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24. The vapour density of PCl_5 at $43 K$ is is found to be 70.2. Find the degree of dissociation of PCl_5 at this temperature.

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25. At $627^\circ C$ and 1 atm SO_3 is partially dissociated into SO_2 and O_2 by the reaction

$SO_3(g) \Leftrightarrow SO_2(g) + 1/2O_2(g)$

The density of the equilibrium mixture is $0.925 gL^{-1}$. What is the degree of dissociation?

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26. $20\ \%\ N_2O_4$ molecules are dissociated in a sample of gas at $27^\circ C$ and 760 torr. Calculate the density of the equilibrium mixture.

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Problems For Practice

1. K_p for the reaction :

$N_2O_4(g) \Leftrightarrow 2NO_2(g)$ is 0.157 atm at $27^\circ C$ and 1 atm pressure . Calculate K_c for the reaction.

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2. For the reaction $A(g) + B(s) \Leftrightarrow C(g) + D(g)$, $K_c = 49 moldm^{-3}$ at $127^\circ C$. Calculate K_p.

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3. At equilibrium, the concentrations of $N_2 = 3 \cdot 0 \times 10^{-3} M, O_2 = 4 \cdot 2 \times 10^{-3} M$ and $No = 2 \cdot 8 \times 10^{-3} M$ in a sealed vessel at 800 K. What will be K_c for the raction $N_2(g) + O_2(g) \Leftrightarrow 2NO(g)$?

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4. PCl_5, PCl_3 and Cl_2 are at equilibrium at $500K$ and having concentration $1.59MPCl_3$, $1.59MCl_2$ and $1.41MPCl_5$. Calculate K_c for the reaction,

$PCl_5 \Leftrightarrow PCl_3 + Cl_2$

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5. Calculate the equilibrium constants K_p and K_c for the reaction ,

$CO(g) + 1/2O_2(g) \Leftrightarrow CO_2$

Given that the partial pressures at equilibrium in a vessel at 3000 K are

$p_{co} = 0.4 \text{ atm}$. $p_{co_2} = 0.6 \text{ atm}$ and $p_{o_2} = 0.2 \text{ atm}$

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6. $1.5mol$ of PCl_5 are heated at constant temperature in a closed vessel of $4L$ capacity. At the equilibrium point, PCl_5 is 35% dissociated into PCl_3 and Cl_2. Calculate the equilibrium constant.

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7. The equilibrium composition for the reaction is

$$\begin{array}{ccccc} PCl_3 & + & Cl_2 & \Longleftrightarrow & PCl_5 \\ 0.20 & & 0.10 & & 0.40 mol L^{-1} \end{array}$$

What will be the equilibrium concentration of PCl_5 on adding $0.10 mol$ of Cl_2 at the same temperature?

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8. If 1 mole of acetic acid and 1 mole of ethyl alchol are mixed and reaction proceeds to equilibrium , the concentrations of acetic acid and water are found to be $1/3$ and $2/3$ mole respectively . If 1 mole of ethyl acetate and 3 moles of water are mixed , how much ester is present when equilibrium is reached ?

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9. Calculate the degree of dissociation of HI at $450^\circ C$ if the equilibrium constant for the dissociation reaction is 0.263.

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10. One mole of pure ammonia was injected into a one litre flask at a certain temperature. The equilibrium mixture was then analysed and found to contain 0.30 mole of H_2 . Calculate (i) the concentration of of N_2 and (ii) the concentration of NH_3 at equilibrium.

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11. Amount of PCl_5 (in moles) need to be added to one litre vessel at $250^\circ C$ in order to obtain a concentration of 0.1mole of Cl_2 for the given change is:

$PCl_5 \Leftrightarrow PCl_3 + Cl_2$, $K_c = 0.0414 mol litre^{-1}$

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12. In an experiment , 2 moles of HI are taken into an evacuated 10.0 litre container at 720 K. The equilibrium constant equals to 0.0156for the

gaseous reaction, $2HI(g) \Leftrightarrow H_2(g) + I_2(g)$. find equilibrium concentration of $HI(g), H_2(g), I_2(g)$.

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13. When PCl_5 is heated in a closed vessel at 575 K, the total pressure at equilibrium is found to be 1 atm and partial pressure of Cl_2 is found to the 0.324 atm . Calculate the equilibrium constant (K_p) for the decomposition reaction.

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14. In the dissociation of HI, $20\,\%$ of HI is dissociated at equilibrium. Calculate K_p for

$HI(g) \Leftrightarrow 1/2H_2(g) + 1/2I_2(g)$

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15. A reaction mixture containing N_2 at $0 \cdot 50$ atm, at $0 \cdot 05$ atmNH_3 and $3 \cdot 0$ atm of hydrogen is he

In which direction the reaction $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ will go if K_p is$4 \cdot 28 \times 10^{-5}$?

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16. The equilibrium constant for the reaction :

$CH_3COOH + C_2H_5OH \Leftrightarrow CH_3COOC_2H_5 + H_2O$

is 4.0 at $25^\circ C$. Calculate the weight of ethyl acetate that will be obtained when 120 g of acetic acid are reacted with 92 g of ethyl alcohol.

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17. At $448^\circ C$, the equilibrium constant (K_c) for the reaction

$H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$

is 50.5. Presict the direction in which the reaction will proceed to reach

equilibrium at $448^\circ C$, if we start with 2.0×10^{-2} mol of HI, 1.0×10^{-2} mol of H_2 and 3.0×10^{-2} mol of I_2 in a $2.0L$ constainer.

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18. For the reaction , $2NO(g) + Cl_2(g) \Leftrightarrow 2NOCl(g)$ and the following info is given:

p_{NOCl}= $0.32atm$

p_{NO}= $0.22atm$

p_{Cl_2}= $0.11atm$

then find K_p

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19. The K_p values for the reaction, $H_2 + I_2 \Leftrightarrow 2HI$, at $460^\circ C$ is 49. If the initial pressure of H_2 and I_2 is $0.5atm$ respectively, determine the partial pressure of each gas at equilibrium.

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Problem For Practice

1. The reaction

$CH_3COOH(l) + C_2H_5OH(l) \Leftrightarrow CH_3COOC_2H_5(l) + H_2O(l)$

was carried out at $27^\circ C$ by taking one mole of each of the reactants. The reaction reached equilibrium when $2/3$ rd of the reactants were consumed. Calculate the free energy change for the reaction $\left(R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}\right)$.

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Curiosity Questions

1. A magician took yellow colured solution in one test tube and added a colourless solution Into It and announced the fun of getting red colour. Then he added red coloured solution into it and announced the fun of

colour becoming lighter. What chemicals he musthave used and explain how all this might have happened ?

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2. Why tooth decay occurs when we eat too much sweets?

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3. Some reactions yield greater amount of products on heating while some others give lesser amount. Why ?

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4. At $0^{\circ} C$, ice and water are present in equilibrium. What will happen on increasing the pressure ?

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Advanced Problems

1. The degree of dissociation of HI at a particualr temperature is 0.8. Calculate the volume of $2MNa_2S_2O_3$ solution required to neutralise the iodine present in an equilibrium mixture of a reaction when 2 mol each of H_2 and I_2 are heated in a closed vessel of $2L$ capacity and the equilibrium mixture is freezed.

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2. NH_3 is heated at 15 at, from $25^\circ C$ to $347^\circ C$ assuming volume constant. The new pressure becomes 50 atm at equilibrium of the reaction $2NH_3 \Leftrightarrow N_2 + 3H_2$. Calculate $\%$ moles of NH_3 actually decomposed.

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3. An equilibrium mixture at $300K$ contains N_2O_4 and NO_2 at 0.28 and $1.1atm$, respectively. If the volume of container is doubles, calculate the new equilibrium pressure of two gases.

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4. When 0.15 mol of CO taken in a $2.5L$ flask is maintained at $750K$ along with a catalyst, the following reaction takes place

$CO(g) + 2H_2(g) \Leftrightarrow CH_3OH(g)$

Hydrogen is introduced until the total pressure of the system is 8.5 atm at equilibrium and 0.08 mol of methanol is formed.

Calculate

a. K_p and K_c

b. The final pressure, if the same amount of CO and H_2 as before are used, but with no catalyst so that the reaction does not take place.

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5. For the reaction

$Ag(CN)_2^{\ominus} \Leftrightarrow Ag^{\oplus} + 2CN^{\ominus}$, the K_c at $25^{\circ}C$ is 4×10^{-19} Calculate $\left[Ag^{\oplus}\right]$ in solution which was originally $0.1M$ in KCN and $0.03M$ in $AgNO_3$.

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6. A sample of air consisting of N_2 and O_2 was heated to 2500 K until the equilibrium

$N_2(g) + O_2(g) \Leftrightarrow 2NO(g)$

was established the intial composition of air in mole fraction of N_2 and O_2.

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7. At $817^{\circ}C$, K_p for the reaction between $CO_{2(g)}$ and excess hot graphite (s) is $10atm$.

(a) What are the equilibrium concentration of the gases at $817^{\circ}C$ and a

total pressure of $5atm$?

(*b*) At what total pressure, the gas contains $5\ \%\ CO_2$ by volume?

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8. The value of K_p is $1 \times 10^{-3} atm^{-1}$ at $25^\circ C$ for the reaction: $2NO + Cl_2 \Leftrightarrow 2NOCl$. A flask contains NO at $0.02atm$ and at $25^\circ C$. Calculate the mole of Cl_2 that must be added if $1\ \%$ of the NO is to be converted to $NOCl$ at equilibrium. The volume of the flask is such that $0.2mole$ of gas produce $1atm$ pressure at $25^\circ C$. (Ignore probable association of NO to N_2O_2.)

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9. The K_p for the reaction $N_2O_4 \Leftrightarrow 2NO_2$ is $640mm$ at $775K$. Calculate the percentage dissociation of N_2O_4 at equilibrium pressure of $160mm$. At what pressure, the dissociation will be $50\ \%$?

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10. The equilibrium constant of a reaction doubles on increasing the temperature of the reaction from $25^{\circ}C \rightarrow 35^{\circ}C$. Calculate enthalpy change of the reaction, assumpting it to be constant in this temperature range.

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11. A mixture in which the mole ratio of H_2 and O_2 is $2:1$ is used to prepare water by the reaction.

$2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(g)}$

The total pressure in the container is $0.8atm$ at $20^{\circ}C$ before the reaction. Determine the final pressure at $120^{\circ}C$ after reaction assuming $80\,\%$ yield of water.

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12. For a hypothetical reaction`P(g) + Q(g) hArr R(g) + S(g) , " a graph between log K and " T^(-1) " is a straight line as hsown in the fig. in which " theta = tan^(-1) 0*5 and OA = 10. " Assuming "Delta H^(@) " is independent of temperature , calculate the equilibrium constant of the reaction at 298 K and 798 K respectively.

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13. 2 mole of an equimolar mixture of alchols ROH and R'OH are taken in! L flask. One mole of acetic acid is added to it. At equilibrium , 80% of acetic acid is found to be reacted and the ratio of $RCOOCH_3$ and $R'COOCH_3$ formed is 3 : 2 , Calculate the equilibrium constant for the esterification of ROH.

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14. The values of K_p and Kp_2 for the reactions $X \Leftrightarrow Y + Z$, (a) and $A \Leftrightarrow 2B$, (b)

are in the ration of $9:1$. If the degree of dissociation of X and A is equal, then the total pressure at equilibriums (a) and (b) is in the ratio

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15. Formaldehyde polymerizes to form glucose according to the reaction, $6HCHO \rightarrow C_6H_{12}O_6$ The theoretically computed equilibrium constant for this reaction is found to be 6×10^{22} If 1M solution of glucose dissociates according to the above equilibrium, the concentration of formaldehyde in the solution will be :

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Test Your Grip Multiple Choice Questions

1. For reaction,

$PCl_3(g) + Cl_2(g) \Leftrightarrow PCl_5(g)$

the value of K_c at $250^\circ C$ is 26. The value of K_p at this temperature will be .

A. $0 \cdot 61$

B. $0 \cdot 57$

C. $0 \cdot 83$

D. $0 \cdot 46$

Answer: A::B::C::D

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2. K_p / K_c for the reaction

$CO(g) + \frac{1}{2}O_2(g) \Leftrightarrow CO_2(g)$ is

A. 1

B. RT

C. $1 / \sqrt{RT}$

D. $(RT)^{1/2}$

Answer: A::B::C::D

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3. For the reaction $N_{2(g)} + O_{2(g)} \Leftrightarrow 2NO_{(g)}$, the value of K_c at $800^\circ C$ is 0.1. When the equilibrium concentrations of both the reactants is 0.5 mol, what is the value of K_p at the same temperature

A. $0 \cdot 5$

B. $0 \cdot 1$

C. $0 \cdot 01$

D. $0 \cdot 025$

Answer: A::B::C::D

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4. In a reversible chemical reaction having two reactants in equilibrium, if the concentration of the reactants are doubled then the equilibrium constant will :

A. Reduced to half its original value

B. Reduced to one fourth of its original value

C. Doubled

D. Constant

Answer: D

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5. The equilibrium constant for a reacton

$N_2(g) + O_2(g) = 2NO(g)$ is 4×10^{-4} at $2000K$. In the presence of catalyst, the equilibrium constant is attained 10 times faster. The equilibrium constant in the presence of catalyst, at $2000K$ is

A. 40×10^{-4}

B. 4×10^{-4}

C. 4×10^{-3}

D. difficult to compute without more data.

Answer: B

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6. For the hypothetic reaction, the equilibrium constant (K) values are given

$A \Leftrightarrow B, K_1 = 2.0$

$B \Leftrightarrow C, K_2 = 4.0$

$C \Leftrightarrow D, K_3 = 3.0$

The equilibrium constant for the reaction

$A \Leftrightarrow D$ is

A. 48

B. 6

C. 12

D. 24

Answer: A::B::C::D

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7. For the reaction $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ at $400K$, $K_p = 41$

Find the value of K_p for the following reaction :

$\frac{1}{2}N_2(g) + \frac{3}{2}H_2 \Leftrightarrow NH_3(g)$

A. $6 \cdot 4$

B. $0 \cdot 02$

C. 50

D. $4 \cdot 6$

Answer: A::D

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8.

K_p for the following reaction will be equal to $3Fe(s) + 4H_2O(g) \Leftrightarrow Fe_3O$

A. $(p_{H_2})^4(p_{Fe_3O_4})$

B. $\frac{p_{H_2}}{p_{H_2O}}$

C. $\frac{(p_{H_2})^4}{(p_{H_2O})^4}$

D. $\frac{(p_{H_2})(p_{Fe_3O_4})}{p_{F_e}}$

Answer: C

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9. a' moles of PCl_5 are heated in a closed container to equilibrate $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$ at a pressure of p atm . If x moles of PCl_5 dissociate at equilibrium , then

A. $0 \cdot 04$

B. $0 \cdot 025$

C. $0 \cdot 02$

D. $0 \cdot 05$

Answer: A

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10. The what manner will increase of pressure affect the following equation ?

$C(s) + H_2O(g) \Leftrightarrow CO(g) + H_2(g)$

A. Shift in the forward direction

B. Shift in the reverse direction

C. Increase in the yield of hydrogen

D. No effect.

Answer: B

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11. Formation of SO_3 take place according to the reaction $2SO_2 + O_2 \Leftrightarrow 2SO_3, \Delta H = -45.2$ kcal Which of the following factors favours the formation of SO_3 ?

A. Increase in temperature

B. Increase in pressure

C. Removal of oxygen

D. Increase in volume

Answer: B

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12. Le Chatelier's principle is not applicable to

A. $Fe(s) + S(s) \Leftrightarrow F_eS(s)$

B. $H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$

C. $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$

D. $N_2(g) + O_2(g) \Leftrightarrow 2NO(g)$

Answer: A::B::C::D

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13. In which one of the following reactions, the yield of the products decreases by in creasing the pressure ?

A. $2SO_2(g) + O_2 \Leftrightarrow 2SO_3(g)$

B. $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$

C. $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$

D. $N_2(g) + O_2(g) \Leftrightarrow 2NO(g)$

Answer: A::C

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14. What would happen to a reversible dissociation reaction at equilibrium when an inert gas is added while the pressure remains unchanged ?

A. Less of the product will be formed

B. More of the product will be formed

C. More of thereactants will be fromed

D. It remains unaffected.

Answer: B

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15. The supply of oxygen to the tissues by blood (haemoglobin) can be examined by

A. Boyle's law

B. Le chatelier's principle

C. Dalton's law

D. Charles'law

Answer: B

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Test Your Grip Ii Fill In The Blanks

1. A bulb containing N_2O_4 is colourless in ice. Its colour inboiling water is ..... while in water at 298 K, it is .....

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2. Equimolar amounts of H_2 and I_2 were taken in a bulb maintained at $500^\circ C$. Dark violet colour faded to light violet which does not change

further. This shows that the bulb contains ..... amounts of ..... .

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3. According to law of mass action rate of a chemical reaction is proportional to

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4. In terms of rate constants for forward and backward reactions $\left(k_f \text{ and } k_b\right)$, equilibrium constant of a reaction is equal to ..... .

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5. Equilibrium constant of a reaction does not change with ..... but changes with .....

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6. Ratio K_p / K_c of the reaction $2SO_2 + O_2 \Leftrightarrow 2SO_3$ is equal to .....

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7. Equilibrium constant for the reaction , $N_2 + 3H_2 \Leftrightarrow 2NH_3$ is K, then equilibrium constant for the reaction, $NH_3 \Leftrightarrow \frac{1}{2}N_2 + \frac{3}{2}H_2$ will be .....

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8. Adding a catalyst to a reaction at equilibrium

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9. The equilibrium constant of an endothermic reaction ..... with increase of temperature.

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10. Write the expression for equilibrium constant K_p for the reaction, $3Fe(s) + 4H_2O(g) \Leftrightarrow Fe_3O_4(s) + 4H_2(g)$.

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11. If the concentration quotient of a reaction in greater than its equilibrium constant, then the reaction will proceed in the _____ direction.

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12. N_2 gas id added to the reaction equilibrium $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$ at constant temperature . If pressure is kept constant, equilibrium constant will ..... and equilibrium will shift in the ..... direction.

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13. Solution of $FeCl_3$ (yellow) and NH_4SCN (colourless) were mixed in a beaker. Red colour was obtained . On adding $HgCl_2$ to the solution, the intensity of colour will .....

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14. Exothermic reactions are favoured by ___ in temperature

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15. Low pressure is favourable for those reversible reactions in which there is ..... in the number of molecules.

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16. When the pressure is applied over system ice $\Leftrightarrow$ wate what will happen

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Conceptual Questions

1. In a chemical reaction under equilibrium , there is no change in moler conertration of products and reactants. Does the reaction stop?

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2. Reaction between ethyl acetate and water attains a state of equilibrium in an open vessel but not the decomposition of $CaCO_3$. Explain.

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3. If concentration are expressed in moles L^{-1} and pressure in atmospheres, what is the ratio of $K_p \text{to} K_c$ for the reaction, $2SO_2(g) + O_2(g) \leftrightarrow 2SO_3(g)$ at $25^\circ C$?

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4. The value of equlibrium constant depends on what?

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5. The equilibrium constant for the reactions

$N_2 + O_2 \Leftrightarrow 2NO$ and $(ii) 2NO + O_2 \Leftrightarrow 2NO_2 \text{are } K_1 \text{ and } K_2$

respectively, then what will be the equilibrium constant for the reaction

$N_2 + 2O_2 \Leftrightarrow 2NO_2$

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6. For the reactions, $N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$. At $400K$, $K_p = 41atm^{-2}$. Find the value of K_p for each of the following reactions at the same temperature:

$(i)\ 2NH_{3(g)} \Leftrightarrow N_{2(g)} + 3H_{2(g)}$,

$(ii)\ \frac{1}{2}N_{2(g)} + \frac{3}{2}H_{2(g)} \Leftrightarrow NH_{3(g)}$,

$(iii)\ 2N_{2(g)} + 6H_{2(g)} \Leftrightarrow 4NH_{3(g)}$

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7. The equilibrium $H_2O(l) \Leftrightarrow H_2O(v)$ is attained in a closed container at $40^\circ C$. The aqueous tension of water at $40^\circ C$ is 23 mm . What is K_p for the said equilibrium ?

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8. The concentration quotient of a reversible reaction is Q, and the equilibrium constant is K. What do youconclude if (i) $Q = K(ii)Q > K(iii)Q < K$?

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9. What does the equilibrium constant K less than 1 indicate ?

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10. What quantiative information can you obtain from the value of the equilibrium constant?

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11. In which one of the following reactions, the yield of the product will be maximum ?

$2A + B \Leftrightarrow C, K = 10^{-5}, C + 2D \Leftrightarrow E, K = 10^{5}, D + 3B \Leftrightarrow f, K = 10^{3}.$

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12. For the reaction $H_2 + I_2 \Leftrightarrow 2HI,$ if intially 25 mL of H_2 and 20 mL of I_2 are present ia a container in a container and at equilibrium, 30 mL of HI is foprmed , then calculate equilibrium constant.

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13.

$\Delta_r G^\circ = -RT \ln K$. For the same reaction at the same temperature usin are found to be different . Why ?

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14. What happence to the equilibrium $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$, if nitrogen gas is added to it (i)at constant volume(ii) at constant pressure ? Give reasons.

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15. What two changes on the equilibrium, $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g), \Delta H = -92.4 \text{ kJ}.$ can keepitsstate undisturbed ?

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16. The following system is equilibrium : $SO_2Cl_2 + Heat \Leftrightarrow SO_2 + Cl_2$ What will happen to the temperature of the system if some Cl_2 gas is added at equilibrium

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17. Areaction $A(g) + B(g) \leftrightarrow 2C(g)$ is an equlibrium at a certain temperature. Can we increases the amount of products by (i) adding catayst (ii) increasing pressure?

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18. $2N_2O(g) + O_2(g) \Leftrightarrow 4No(g), \Delta H > 0$

What will be the effect on equilibrium when

(i) Volume of the vessel increases ? (ii) Temperature decreases ?

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19. Some process are given below. What happens to the process if it is subjected to a change given in the barckets ?

(ii) Dissolution of $Ice \overset{M.pt}{\Longleftrightarrow} \text{Water (Pressure is increased)}$

(ii) Dissolution of NaOH in water (Temperature is increased)

(iii) $N_2(g) + O_2(g) \Leftrightarrow 2NO(g) - 180 \cdot 7kJ$ (pressure is increased and temperature is decreased).

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20. What is the effect of the reduction of the volume of the system for the equilibrium

$2C(s) + O_2(g) \Leftrightarrow 2CO(g)$?

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21. In the direction , $N_2 + 3H_2 \Leftrightarrow 2NH_3$ at equilibrium , helium gas is injected into the vessel without disturbing the overall pressure of the system. What will be the effect on the equilibrium ?

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Ncert Questions And Exercises With Answers

1. A liquid is in equilibrium with its vapour in a sealed container at a fixed temperature. The volume of the container is suddenly increased.

a. what is the initial effect of the change on vapour pressure?

b. How do rates of evaporation and condensation change initially?

c. What happens when equilibrium is restored finally and what will be the final vapour pressure?

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2. What is K_c for the following equilibrium concentration of each substance is:

$[SO_2] = 0.60M$, $[O_2] = 0.82M$ and $[SO_3] = 1.90M$?

$2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$

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3. At a certain temperature and a total pressure of 10^5 Pa, iodine vaour contain 40% by volume of iodine atmos $[I_2(g) \Leftrightarrow 2I(g)]$. Calculate K_p for the equilibrium.

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4. Write the expression for the equilibrium constant K_c for each of the following reactions:

a. $2NOCl(g) \Leftrightarrow 2NO(g) + Cl_2(g)$

b. $2Cu(NO_3)_2(s) \Leftrightarrow 2CuO(s) + 4NO_2(g) + O_2(g)$

c. $CH_3COOC_2H_5(aq) + H_2O(1) \Leftrightarrow CH_3COOH(aq) + C_2H_5OH(aq)$

d. $Fe^{3+}(aq) + 3OH^{\Theta}(aq) \Leftrightarrow Fe(OH)_3(s)$

e. $I_2(s) + 5F_2 \Leftrightarrow 2IF_5$

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5. Find out the value of K_c for each of the following equilibrium from the value of K_p:

a. $2NOCl(g) \Leftrightarrow 2NO(g) + Cl_2(g), K_p = 1.8 \times 10^{-2}$ at $500K$

b. $CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g), K_p = 167$ at $1073K$

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6. For the following equilibrium, $K_c = 6.3 \times 10^{14} at 1000K$

$NO(g) + O_3(g) \Leftrightarrow NO_2(g) + O_2(g)$

Both the forward and reverse reactions in the equilibrium are elementary bimolecular reactions. What is K_c, for the reverse reaction?

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7. Explain why pure liquids and solids can ignored while writing the equilibrium constant expression?

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8. Reaction between nitrogen and oxygen takes place as following:

$2N_{2(g)} + O_2 \Leftrightarrow 2N_2O_{(g)}$

If a mixture of $0.482 \text{mole} N_2$ and 0.933mole of O_2 is placed in a reaction vessel of volume $10 litre$ and allowed to form N_2O at a temperature for which $K_c = 2.0 \times 10^{-37} litremol^{-1}$. Determine the composition of equilibrium mixture.

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9. Nitric oxide reacts with bromine and gives nitrosyl-bromide as per reaction given below:

$2NO_{(g)} + Br_{2(g)} \Leftrightarrow 2NOBr_{(g)}$.

When 0.087mole of NO and 0.0437mole of Br_2 are mixed in a closed container at constant temperature, 0.0518mole of $NOBr$ is obtained at equilibrium. Calculate equilibrium amount of nitric oxide and bromine.

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10. At $450K$, $K_p = 2.0 \times 10^{10}/$ bar for the given reaction at equilibrium.

$2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$

What is K_c at this temperature?

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11. A sample of $HI(g)$ is placed in flask at a pressure of $0.2atm$. At equilibrium. The partial pressure of $HI(g)$ is $0.04atm$. What is K_p for the given equilibrium?

$2HI(g) \Leftrightarrow H_2(g) + I_2(g)$

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12. A mixture of $1.57mol$ of N_2, $1.92mol$ of H_2 and $8.13mol$ of NH_3 is introduced into a $20L$ reaction vessel at $500K$. At this temperature, the equilibrium constant K_c for the reaction $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ is 1.7×10^2. Is the reaction mixture at equilibrium? If not, what is the direction of the net reaction?

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13. The equilibrium constant expression for a gas reaction is :

$$K_c = \frac{[NH_3]^4[O_2]^5}{[NO]^4[H_2O]^6}$$

Write the balanced chemical equation corresponding to this expression.

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14. One mole of H_2O and one mole of CO are taken in a $10litre$ vessel and heated to $725K$. At equilibrium, $40percent$ of water (by mass) reacts with carbon monoxide according to the equation,

$H_2O_{(g)} + CO_{(g)} \Leftrightarrow H_{2(g)} + CO_{2(g)}$

Calculate the equilibrium constant for the reaction.

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15. At $700K$ equilibrium constant for the reaction,

$H_{2(g)} + I_{2(g)} \Leftrightarrow 2HI_{(g)}$

is 54.8. If $0.5mollitre^{-1}$ of $HI_{(g)}$ is present at equilibrium at $700K$, what are the concentrations of $H_{2(g)}$ and $I_{2(g)}$, assuming that we initially started with $HI_{(g)}$ and allowed it to reach equilibrium at $700K$.

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16. What is the equilibrium concentration of each of the substance in the equilibrium when the initial concentration of ICl was $0.78M$?

$2ICl(g) \Leftrightarrow I_2(g) + Cl_2(g), K_c = 0.14$

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17. $K_p = 0.04atm$ at $899K$ for the equilibrium shown below. What is the equilibrium concentration of C_2H_6 when it is placed in a flask at $4.0atm$ pressure and allowed to come to equilibrium?

$C_2H_6(g) \Leftrightarrow C_2H_4(g) + H_2(g)$

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18. Ethyl accetate is formed by the reaction between ethanol and acetic acid and the equilibrium is represented as :

$CH_3COOH(l) + C_2H_5OH(l) \Leftrightarrow CH_3COOC_2H_5(l) + H_2O(l).$

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19. A sample of pure PCl_5 was introduced into an evacuted vessel at $473K$. After equilibrium was attained,concentration of PCl_5 was found to be $0.5 \times 10^{-1} mollitre^{-1}$. If value of K_c is $8.3 \times 10^{-3} mollitre^{-1}$. What are the concentrations of PCl_3 and Cl_2 at equilibrium ?

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20. One of the reaction that takes plece in producing steel from iron ore is the reduction of iron(II) oxide by carbon monoxide to give iron metal and CO_2.

$FeO(s) + CO(g) \Leftrightarrow Fe(s) + CO_2(g)$, $K_p = 0.265$ atm at $1050K$

What are the equilibrium partial pressure of CO and CO_2 at $1050K$ if the partical pressure are: $p_{CO} = 1.4atm$ and $p_{CO_2} = 0.80atm$?

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21. Equilibrium constant, K_c for the reaction, $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ at $500K$ is $0 \cdot 061$. At a particular time, the analysis shows that composition of the reaction mixture is $3 \cdot 0$ mol $L^{-1}N_2, 2 \cdot 0$ mol $L^{-1}H_2$ and $5 \cdot 0$mol $L^{-1}NH_3$. Is the reaction at equilibrium ? If not , in which direction does the reaction tend to reach equilibrium ?

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22. Bromine monochloride, $(BrCl)$ decomposes into bromine and chlorine and reaches the equilibrium.

$2BrCl_{(g)} \Leftrightarrow Br_{2(g)} + Cl_{2(g)}$

For which $K_c = 32$ at $500K$. If initially pure $BrCl$ is present at a concentration of $3.30 \times 10^{-3} mollitre^{-1}$, what is its molar concentration in the mixture at equilibrium?

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23. At $1127K$ and $1atm$ pressure, a gaseous mixture of CO and CO_2 in equilibrium with solid carbon has $90.55\ \%\ CO$ by mass:

$C_{(s)} + CO_{2(g)} \Leftrightarrow 2CO_{(g)}$

Calculate K_c for the reaction at the above temperature.

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24. Calculate $(a)\Delta G^{\Theta}$ and (b) the equilibrium constant for the formation of NO_2 from NO and O_2 at 298 K

$NO(g) + 1/2O_2(g) \Leftrightarrow NO_2(g)$ where

$\Delta_f G^{\Theta}(NO_2) = 52.0kJ/mol, \Delta_f G^{\Theta}(NO) = 87.0kJ/mol, \Delta_f G^{\Theta}(O_2) =$

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25. Does the number of moles of reaction products increase , decrease or remain same when each of the folllowing equilibria is subjected to a decrease by increasing the volume ?

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26. Which of the following reactions will get affected by increasing the pressure? Also, mention whether change will cause the reaction the reaction to go into forward of backward direction.

a. $COCl_2(g) \Leftrightarrow CO(g) + Cl_2(g)$

b. $CH_4(g) + 2S_2(g) \Leftrightarrow CS_2(g) + 2H_2S(g)$

c. $CO_2(g) + C(s) \Leftrightarrow 2CO(g)$

d. $2H_2(g) + CO(g) \Leftrightarrow CH_3OH(g)$

e. $CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g)$

f. $4NH_3(g) + 5O_2(g) \Leftrightarrow 4NO(g) + 6H_2O(g)$

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27. The equilibrium constant for the following reaction is 1.6×10^5 at $1024K$

$H_2(g) + Br_2(g) \Leftrightarrow 2HBr(g)$

find the equilibrium pressure of all gases if 10.0 bar of HBr is introduced into a sealed container at $1024K$.

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28. Dihydrogen gas is obtained from natural gas by partial oxidation with steam as per following endothermic reaction:

$CH_4(g) + H_2O(g) \Leftrightarrow CO(g) + 3H_2(g)$

a. Write an expression for K_(p) for the above reaction.

b. How will the value of K_(p) and composition of equilibrium mixture be affected by

i. Increasing the pressure

ii. Increasing the temperature

iii. Using a catalyst?

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29. Decribe the effect of:

a. Addition of H_2

b. Addition of CH_3OH

c. Removal of CO

d. Removal of CH_3OH

on the equilibrium of the reaction:

$2H_2(g) + CO(g) \Leftrightarrow CH_3OH(g)$

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30. At $473K$, equilibrium constant K_c for decomposition of phosphorus pentachloride, PCl_5 is 8.3×10^{-3}. If decomposition is depicted as,

$PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g) \Delta_r H^{\Theta} = 124.0 kJ mol^{-1}$

a. Write an expression for K_c for the reaction.

b. What is the value of K_c for the reverse reaction at the same temperature?

c. What would be the effect on K_c if

i. More PCl_5 is added

ii. Pressure is increased

iii. The temperature is increased?

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31. Dihydrogen gas used in Haber's process is produced by reacting methane from natural gas with high temperature steam. The first stage of the two 2 stage reaction involves the formation of CO and H_2. In second stage, CO formed in first stage is reacted with more steam in water gas shift reaction,

$CO(g) + H_2O(g) \Leftrightarrow CO_2(g) + H_2(g)$

If a reaction vessel at $400^\circ C$ is charged with an equimolar mixture of CO and steam such that $p_{CO} = p_{H_2O} = 4.0$ bar, what will be the partial pressure of H_2 at equilibrium? $K_p = 0.1$ at $400^\circ C$.

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32. Predict which of the following reaction will have appreciable concentration of reactants and product :

$(a) Cl_2(g) \Leftrightarrow 2Cl(g), K_c = 5 \times 10^{-39}$

(b) $Cl_2(g) = 2NO(g) \Leftrightarrow 2NOCl(g), K_c = 3 \cdot 7 \times 10^8$

(c) $Cl_2(g) + 2NO_2(g) \Leftrightarrow 2NO_2Cl(g), K_c = 1 \cdot 8$

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33. The value of

K_c for the reaction , $3O_2(g) \Leftrightarrow 2O_3(g)$, is $2 \cdot 0 \times 10^{-50}$ at $25^\circ C$. If t
What is the concentration of O_3 ?

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34. The reaction , $CO(g) + 3H_2(g) \Leftrightarrow CH_4(g) + H_2O(g)$, is at equilibrium at 1300 K in a 1 L flask. It also contains 0*30 mol of CO, 0*10 mol of H_2 and $0 \cdot 02$ mol of H_2O and an unknown amount of CH_4 in the flask. Determine the concentration of CH_4 in the mixture. The equilibrium constant, K_c, for the reaction at the given temperature is $3 \cdot 90$.

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Additional Questions Very Short Answer Questions

1. Which measurable property becomes constant in water $\Leftrightarrow watervapour$ equilibrium at constant temperature.

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2. Give one example of everyday life in which there is gas solution equilibrium .

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3. Give one example of a reversible reaction taking place in aqueous solution.

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4. Write the reversible reaction taking place between ferric ions and thiocyanate ions and write the colour of each reactant and product.

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5. What will be K_p for the reaction $2NOCl(g) \rightarrow 2NO(g) + Cl_2(g)$ at 1000 K? K_c at 1

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6. Under what condition, a reversible process becomes irreverible?

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7. What is the effect on equilibrium and on the value of equilibrium constant on adding catalyst ?

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8. If the equilibrium constant for a reaction is $4 \cdot 0$, what will be the equilibrium constant for the reverse reaction.

A. 1

B. 4

C. 0.25

D. 25

Answer: C

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9. Write the expression for equilibrium constant K_p for the reaction,

$3Fe(s) + 4H_2O(g) \Leftrightarrow Fe_3O_4(s) + 4H_2(g).$

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10. What is van't Hoff reaction isotherm ?

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11. What happens to the disociation of PCl_5 in a closed vassel if helium gas is introduced into it at the same temperature ?

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12. What happens when potassium ferrocyanide solution is added to a ferric salt solution?

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13. $N_2 + 3H_2 \Leftrightarrow 2NH_3$ in this equilibrium system if the pressure is increased at $25^\circ C$ then the value of K will

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14. What are the conditions for getting maximum yield of NH_3 by Haber's process?

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Additional Questions Short Answer Questions

1. What do you understand by term 'Equilibrium' ? Explain physical equilibrium with one suitable example.

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2. Give one example of each of the following equilibria :

(i) Solid - Liquid Equilibria (ii) Liquid - Gas Equilibrium (iii) Solid - Solutions Equilibrium

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3. Define the terms ' Vapour pressure and 'Solubility'.

Watch Video Solution

4. Define Henry Law. Why the gas fizzes out when a soda water bottle is opened ?

Watch Video Solution

5. What do you understand by Reversible and Irreversible reactions? Illustrate your answer with two examples of each. Under what conditions a reversible reaction becomes irreversible ?

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6. What do you understand by chemical equilibrium? Explain with one suitable example.

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7. List any four important characteristics of a chemical equilibrium.

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8. State and explain the Law of Mass Action.

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9. State and explain the 'Law of Chemical Equilibrium.'

Watch Video Solution

10. Derive a general expression for the equilibrium constant.

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11. What do you understand by K_c and K_p ? Derive a relationship between them.

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12. K_p and K_c are related by $K_p = K_c(RT)^{\Delta n}$. Under what practical condition/s, $K_p = K_c$?

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13. Characteristics of Equilibrium constant continued..

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14. Discuss the effect of temperature of the equilibrium constant. How does it change for (a) exothermi reaction (b) endothermic reaction © reaction having zero heat of reaction ?

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15. Define 'Homogeneous Equlibria and Heterogeneous Equilibria'. Give two examples of each of them.

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16. Applying the law of chemical equilibrium, explain why vapour pressure of water is constant at constant temperature.

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17. Why strictly speaking equilibrium constant has no units ?

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18. How does the magnitude of equilibrium constant give an idea of the relative amounts of the reactants and products ?

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19. Write the relationship between standard free energy change and equilibrium constant of a reaction. Express it in the exponential form. Using this relation how does $+$ or $-$ $signof\Delta G$ decided the extent of reaction in the forward direction?

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20. What is the effect of adding a catalyst on a reaction which is (a) in equilibrium (b) not in equilibrium ?

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21. What is the effect of adding 1 mole of He (g) to a flask containing SO_2, O_2 and SO_3 in equilibrium at constant temperature ?

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22. For the reaction at equilibrium ,

$2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g) + Heat,$

indicate the direction in which the equilibrium will shift when the following changes are made :

(i) Temperature of the system is decreased

(ii) Total pressure is decreased

(iii) Volume of the container is increased (iv) A catalyst is added.

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23. Consider the following reaction

$N_2O_4(g) \Leftrightarrow 2NO_2(g)\Delta H = 58.6KJ$

What will be the effect of the following changes on the concentration of N_2O_4 at equilibrium?

(i) Increasing the pressure (ii) Increasing the temperature

(iii) Increasing the volume

(iv) Adding more $NO_2(g)$ to the system without changing temperature and pressure (v) Adding catalyst.

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24. What will be the effect of increased pressure on the following equilibria ?

$(i) H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$

$N_2(g) + 3H_2 \Leftrightarrow 2NH_3(g)$

(iii) $2SO_2(g) + O_2 \Leftrightarrow 2SO_2(g)$,

(iv) $2O_3(g) \Leftrightarrow 3O_2(g)$

(v)$N_2O_4(g) \Leftrightarrow 2NO_2(g)$

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25. Using Le chatelier's principle , predict the effect of

(i) decreasing the temperature and (ii) increasing the pressure on each of the following equilibria :

A. $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g) Heat$ B.

$N_2(g) + O_2 \Leftrightarrow 2NO(g) + Heat$

C. $H_2O(g) + Heat \Leftrightarrow H_2(g) + \frac{1}{2}O_2(g)$ D. $2CO(g) + O_2(g) \Leftrightarrow 2CO_2(g) + Heat$

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26. In the reaction equilibrium , $A + B \Leftrightarrow C + D,$ what will happen to concentration of A, B and D if the concentration of C is increased ?

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27. Mention at least three ways which the concentration of SO_3 can be increased after the equilibrium is establish in the reaction : $2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3 + Heat$

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28. Why does manufacture of ammonia by Haber's process require higher pressure, low temperature , use of catalyst and pure gases ?

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Analytical Questions And Problems With Answer Solutions Questions

1. Why is there a fizz when a soda water bottle is opened?

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2. For an exothermic reaction, what happens to the equilibrium constant if temperature is raised?

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3. The equilibrium constant of a reaction is 2×10^{-3} at $25^{\circ} C$ and 2×10^{-2} at $50^{\circ} C$. Is the reaction exothermic or endothermic ?

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4. Why is equilibrium constant related to standard free energy change and not free energy change ?

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5. The following reaction has attained equilibrium

$CO(g) + 2H_2(g) \Leftrightarrow CH_3OH(g). \Delta H^\circ = -92.0 KJmol^{-1}$

What will happen if

(i) Volume of the reaction vessel is suddenly reduced to half?

(ii) the partial pressure of hydrogen is suddenly doubled?

(iii) an inert gas is added to the system at constant volume.

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6. Why does ice melt showly at higher altitudes?

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7. Show that degree of dissociation (α) for the dissociation of PCl_5 into PCl_3 and Cl_2 at pressure P is given by $\alpha = \left[\frac{kp}{P+kp}\right]^{1/2}$

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8. At temperature T, a compound $AB_2(g)$ dissociation according to the reaction, $2AB_2(g) \Leftrightarrow 2AB(g) + B_2(g)$ with degree of dissociation, α, which is small compared to unity . Deduce the expression for α in terms of the equilibrium constant K_p and the total pressure P.

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9. Prove that the pressure necessary to obtain 50% dissociation of PCl_5 at 500 K is numerically three times the value of K_p.

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Analytical Questions And Problems With Answer Solutions Problems

1. The equilibrium constant of the reaction $A_2(g) + B_2(g) \Leftrightarrow 2AB(g)$ at $100^\circ C$ is 50. If a one litre flask containing one mole of A_2 is connected to a two litre flask containing two moles of B_2, how many moles of AB will be formed at $373K$?

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2. A mixture of SO_3, SO_2 and O_2 gases is maintained in a $10L$ flask at a temperature at which the equilibrium constant for the reaction is 100:

$2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$

a. If the number of moles of SO_2 and SO_3 in the flask are equal. How many moles of O_2 are present?

b. If the number of moles of SO_3 in flask is twice the number of moles of SO_2, how many moles of oxygen are present?

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3. The equilibrium constant K_p of the reaction: $2SO_2 + O_2 \Leftrightarrow 2SO_3$ is $900atm^{-1}$ at $800K$. A mixture constaining SO_3 and O_2 having initial pressure of 1 atm and 2 atm respectively, is heated at constant volume to equilibriate. Calculate the partial pressure of each gas at $800K$ at equilibrium.

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4. When sulphur in the form of S_8 is heated at $900K$, the initial pressure of 1 atm falls by $10\,\%$ at equilibrium. This is because of conversion of some S_8 to S_2. Find the value of equilibrium constant for this reaction.

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5. K_c for $CO(g) + H_2O(g) \Leftrightarrow CO_2(g) + H_2(g)$ at $986^\circ C$ is 0.63. A mixture of 1 mol $H_2O(g)$ and 3 mol $CO_2(g)$ is allowed to react to come to an equilibrium. The equilibrium pressure is 2.0 atm.

a. Hoe many moles of H_2 are present at equilibrium ?

b. Calculate partial pressure of each gas at equilibrium.

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6. Calculate the percent dissociation of $H_2S(g)$ if $0.1mol$ of H_2S is kept in $0.4L$ vessel at $1000K$. For the reaction:

$2H_2S(g) \Leftrightarrow 2H_2(g) + S_2(g)$

The value of K_c is 1.0×10^{-6}

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7. At some temperature and under a pressure of 4 atm, PCl_5 is $10\,\%$ dissociated. Calculated the pressure at which PCl_5 will be $20\,\%$ dissociated temperature remaining same.

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8. An equilibrium mixture $CO(g) + H_2O(g) \Leftrightarrow CO_2(g) + H_2(g)$ present in a vessel of one litre capacity at 1000 K was found to contain$0 \cdot 4$mole of CO, $0 \cdot 3$mole of H_2O, $0 \cdot 2$ mole of CO_2 and $0 \cdot 6$ mole of H_2. If it is desired to increase the concentration of CO to $0 \cdot 6$mole by adding CO_2 into the vessel , how many moles of it must be added into equilibrium mixture at constant temperature in order to get this change ?

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9. At $540K, 0.10mol$ of PCl_5 is heated in a $8L$ flask. The pressure of equilibrium mixture is found to be $1.0atm$. Calculate K_p and K_c for the reaction.

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10. When $3.06g$ of solid NH_4HS is introduced into a two-litre evacuated flask at $27^\circ C$, 30% of the solid decomposes into gaseous ammonia and hydrogen sulphide. (i) Calculate K_c and K_p for the reaction at $27^\circ C$. (ii)

What would happen to the equilibrium when more solid NH_4HS is introduced into the flask?

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11. For the reaction

$CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g), K_p = 1 \cdot 16 \text{ atm}$. If $20 \cdot 0$ g of CaC

would remain unreached at equilibrium ? (Mol. wt. of $CaCO_3 = 100, R$

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12. Solid Ammonium carbamate dissociates as:

$NH_2COONH_4(s) \Leftrightarrow 2NH_3(g) + CO_2(g).$

In a closed vessel, solid ammonium carbonate is in equilibrium with its dissociation products. At equilibrium, ammonia is added such that the partial pressure of NH_3 at new equilibrium now equals the original total pressure. Calculate the ratio of total pressure at new equilibrium to that of original total pressure. Also find the partial pressure of ammonia gas added.

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13. Some solid NH_4HS is placed in flask containing 0.5 atm of NH_3. What would be the pressure of NH_3 and H_2S when equilibrium is reached.

$NH_4HS(g) \Leftrightarrow NH_3(g) + H_2S(g), K_p = 0.11$

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14. The degree of dissociation of N_2O_4 into NO_2 at 1 atm $40^\circ C$ is 0.310. Calculate its K_p at $40^\circ C$. Also report the degree of dissociation at 10 atm pressure at same temperature.

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15. When $\alpha - D$ glucose is dissolved in water, it undergoes a partial converion to $\beta - D$ glucose to exhibit mutarotation. This conversion

stops when $63.6\,\%$ of glucose is in β form. Assuming that equilibrium has been attained, calculate K_c for mutarotation.

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16. At $77^\circ C$ and one atmospheric pressure , N_2O_4 is 70% dissociated into NO_2 What will be the volume occupied by the mixture under these conditions if we start with 10 g of N_2O_4 ?

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17. 0.1 mole of $N_{2O_4(g)}$ was sealed in a tude under one atmospheric conditions at $25^\circ C$ Calculate the number of moles of $NO_2(g)$ preesent , if the equilibrium $N_2O_4(g) \Leftrightarrow 2NO_2(g)(K_P = 0.14)$ is reached after some time :

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18. The degree of dissociation is 0.4 at $400K$ and 1.0 atm for the gaseous reaction

$PCl_5 \Leftrightarrow PCl_3 + Cl_2$

assuming ideal behaviour of all gases, calculate the density of equilibrium mixture at $400K$ and 1.0 atm (relative atomic mass of P is 31.0 and of Cl is 35.5).

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19. One mole of H_2, two moles of I_2 and three moles of HI are injected in a litre flask. What will be the concentration of H_2, I_2 and HI at equilibrium at $490^\circ C$?

The equiibrium constant for the reaction at 490° is 45.9

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20. A mixtue of H_2 and I_2 (vapour) in molecular proportion of 2: 3 was heated at $449^\circ C$ till the reaction $H_2 + I_2 \Leftrightarrow 2HI$ reached equilibrium

state . Calculate the percentage of iodine converted into $HI(K_c \text{at} 440^\circ C \text{ is } 0 \cdot 02)$.

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Competition Focus Jee Main And Advanced Medical Entrance I Multiple Choice Questions With One Correct Answer

1. The vapour pressure of a liquid in a closed container depends upon

A. depandes upon the amount of the liquid taken s

B. Keeps on increasing continously as more and more liquid evaporates

C. has a constant value depending only on the nature of the liquid

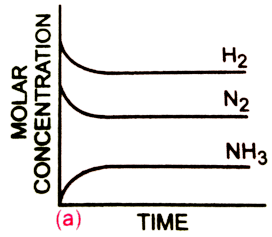
D. had a constant value at constant temperature

Answer: D

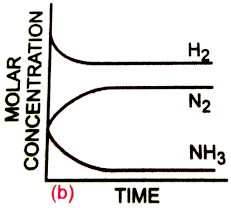
Watch Video Solution

2. For the synthesis of ammonia by the reaction $N_2 + 3H_2 \Leftrightarrow 2NH_3$ in the Haber's process ,the attainment of equilibrium is correctly predicated bt the curve

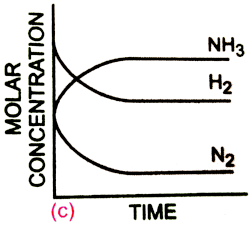
A.



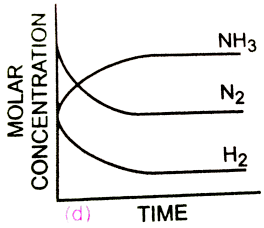
B.



C.



D.



Answer: A

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3. For the reversible reaction

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$

at $500^\circ C$, the value of K_p is 1.44×10^{-5} when the partial pressure is measured in atmosphere. The corresponding value of K_c with concentration in mol L^{-1} is

A. $1 \cdot 44 \times 10^{-5} / (0 \cdot 082 \times 500)^{-2}$

B. $1 \cdot 44 \times 10^{-5} / (8 \cdot 314 \times 773)^{-2}$

C. $1 \cdot 44 \times 10^{-5} / (0 \cdot 082 \times 773)^{2}$

D. $1 \cdot 44 \times 10^{-5} / (0 \cdot 082 \times 7773)^{-2}$

Answer: D

Watch Video Solution

4. The temperature at which K_c and K_p will have the same value for the equilibrium ,

$N_2O_4(g) \Leftrightarrow 2NO_2(g)$ is

A. 0 K

B. 273 K

C. 1 K

D. 12.18 K

Answer: D

Watch Video Solution

5. The pressure at which equilibrium constant in terms of pressures is found to be equal to that in terms of mole fraction for the equilibrium,

$PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$

A. 10 atm

B. 1 atm

C. $0 \cdot 1$atm

D. 2 atm

Answer: B

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6. White solid balls of naphthalene $(C_{10}H_8)$ used as moth balls were kept in a closed container at room temperature $(27^\circ C)$. The vapour pressure above the balls was found to be 0.10 mm Hg. The value of K_c for the sublimation equilibrium ,

$C_{10}H_8(s) \Leftrightarrow C_{10}H_8(v)$ is

A. $1 \cdot 32 \times 10^{-4}$

B. $5 \cdot 36 \times 10^{-6}$

C. $3 \cdot 4 \times 10^{-7}$

D. $0 \cdot 10$

Answer: B

Watch Video Solution

7. For the reaction, $SO_2(g) + \frac{1}{2}O_2(g) \Leftrightarrow SO_3(g)$, If $K_p = K_c(RT)^x$ where the symbols have usual meaning then, the value of x is (assuming ideality).

A. 1

B. -1

C. $-\frac{1}{2}$

D. $\frac{1}{2}$

Answer: C

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8. For the reaction

$CO(g) + CI_2(g) \Leftrightarrow COCI_2(g)$

K_p / K_c is equal to

A. $\sqrt{RT}$

B. RT

C. $\frac{1}{RT}$

D. $1 \cdot 0$

Answer: C

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9. The equilibrium constant K_p for the reaction $H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$ changes if:

A. total pressure

B. temperature

C. catalyst

D. amount of H_2 and I_2 present

Answer: B

Watch Video Solution

10. Given : $2N_2O(g) \Leftrightarrow 2N_2(g) + O_2(g), K = 3 \cdot 5 \times 10^{33}$

$2NO_2(g) \Leftrightarrow N_2(g) + 2O_2(g), K = 6 \cdot 7 \times 10^{16}$

$2NO(g) \Leftrightarrow N_2(g) + O_2(g), K = 2 \cdot 2 \times 10^{30}$

$2N_2O_5(g) \Leftrightarrow 2N_2(g) + 5O_2(g), K + 1 \cdot 2 \times 10^{34}$

Which oxide of nitrogen is most stable ?

A. N_2O

B. NO_2

C. NO

D. N_2O_5

Answer: B

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11. The equilibrium constant for the reaction

$N_2(g) + O_2(g) \Leftrightarrow 2NO(g)$

at temperature T is 4×10^{-4}.

The value of K_c for the reaction

$NO(g) \Leftrightarrow \frac{1}{2}N_2(g) + \frac{1}{2}O_2(g)$

at the same temperature is

A. $50 \cdot 0$

B. $0 \cdot 02$

C. $2 \cdot 5 \times 10^2$

D. 4×10^{-4}

Answer: A

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12. If the equilibrium constant for

$N_2(g) + O_2(g) \Leftrightarrow 2NO(g)$ is K , the equilibrium constant for $\frac{1}{2}N_2(g) + \frac{1}{2}O_2(g) \Leftrightarrow NO(g)$ will be

A. $\frac{1}{2}K$

B. K

C. K^2

D. $K^{1/2}$

Answer: D

Watch Video Solution

13. Consider the following gaseous equilibria with equilibrium constant $K_1 \text{and} K_2$ respectively.

$SO_2(g) + \frac{1}{2}O_2(g) \rightarrow SO_3(g), 2SO_3(g) \rightarrow 2SO_2(g) + O_2(g)$

The equilibrium constant are related as :

A. $K_1^2 = \frac{1}{K_2}$

B. $2k_1 = K_2^2$

C. $K_2 = \frac{2}{K_1^2}$

D. $K_2^2 = \frac{1}{K_1}$

Answer: A

Watch Video Solution

14. The following equilibria are given by :

$N_2 + 3H_2 \Leftrightarrow 2NH_3, K_1$

$N_2 + O_2 \Leftrightarrow 2NO, K_2$

$H_2 + \frac{1}{2}O_2 \Leftrightarrow H_2O, K_3$

The equilibrium constant of the reaction $2NH_3 + \frac{5}{2}O_2 \Leftrightarrow 2NO + 3H_2O$ in terms of K_1, K_2 and K_3 is

A. $K_1K_3^3 / k_2$

B. $K_2K_3^3 / K_1$

C. K_2K_3 / K_1

D. $K_2^3K_3 / K_1$

Answer: B

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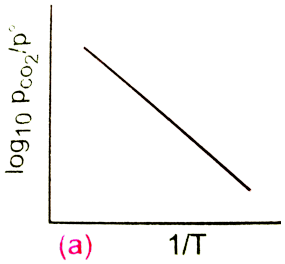
15. For the chemical equilibrium,

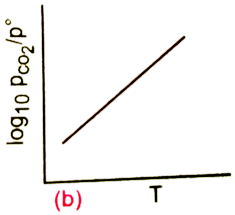
$CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g)$

$\Delta_r H^{\ominus}$ can be determined from which one of the following plots?

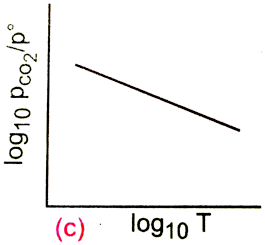
A.



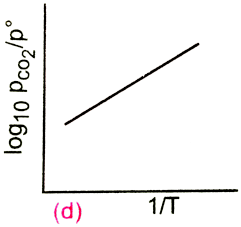
B.



C.



D.



Answer: A

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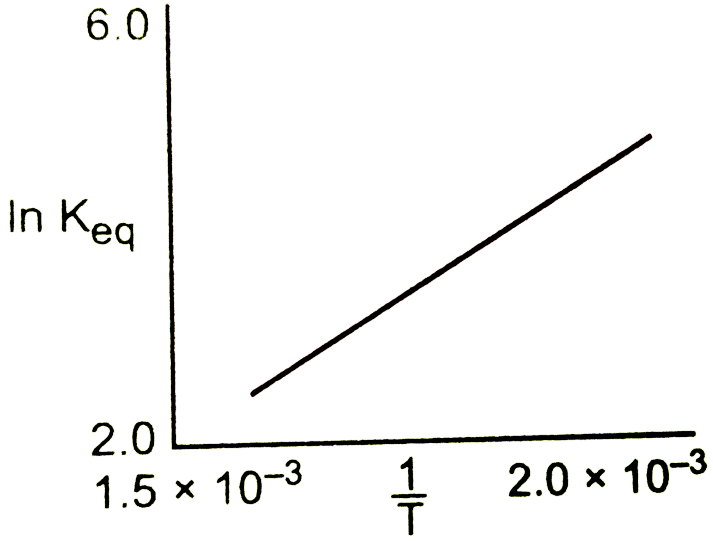
16. A schematic plot of In K_{eq} versus inverse of temperature for a reaction is shown below :



The reaction must be

A. exothermic

B. endothermic

C. one with negliable enthalpy change

D. highly spontaneous at ordianary temperature

Answer: A

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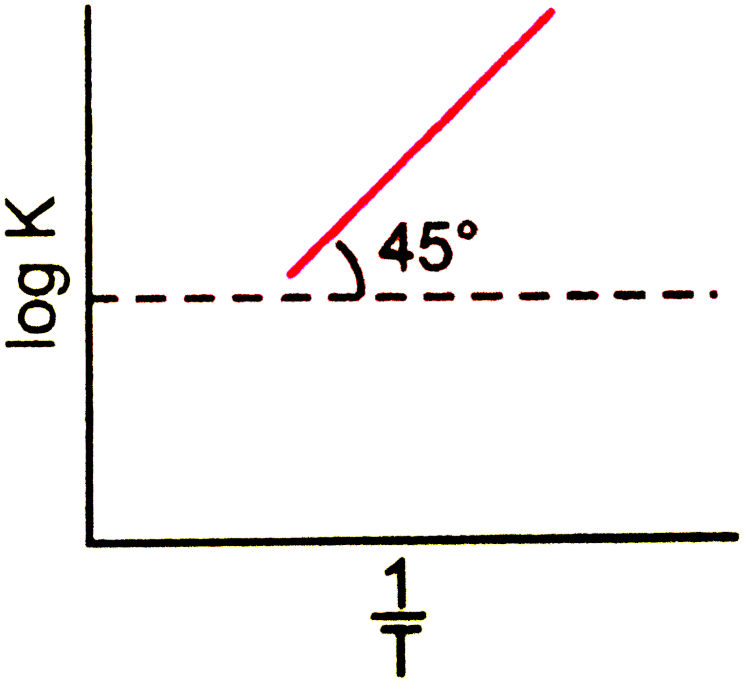
17. The variation of equilibrium constant (K) with temperature (T) was stupied by plotting log K versus 1/T The plot obtained is shown iin the Fig . Hence, enthalpy change (ΔH°) of the reaction is



A. $+2cal$

B. $-2cal$

C. $+4.606cal$

D. $-4.606cal$

Answer: D

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18. In the preparation of CaO from $CaCO_3$ using the equilibrium,

$CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g)$

K_p is expressed as

$\log K_p = 7.282 - \frac{8500}{T}$

For complete decomposition of $CaCO_3$, the temperature in celsius to be used is:

A. 1167

B. 894

C. 8500

D. 850

Answer: B

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19. For a given exothermic reaction , K_p and k'_p are the equilibrium constants at temperatures T_1 and T_2 respectively. Assuming that heat of reaction is constant in temperature range between T_1 and T_2 , it is readily observed that

A. $K_p > K_p{}'$

B. $K_p < K'_p$

C. $K_p = K'_p$

D. $K_p = \frac{1}{K'_p}$

Answer: A

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20. If the value of equilibrium constant for a particular reaction is 1.6×10^{12} , then art equilibrium the system will contain

A. mostly products

B. similar amounts of reactants and products

C. all reactants

D. mostly reactants

Answer: A

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21. An aqueous solution contains 0.10 M H_2S and 0.20 M HCl. If the equilibrium constants for the formation of HS from HS is 1.0×10^{-7} and that of S^{2-} ? from HS^- ions is 1.2×10^{-7} then the concentration of S^{2-} ions in aqueous solution is

A. 5×10^{-8}

B. 3×10^{-20}

C. 6×10^{-21}

D. 5×10^{-19}

Answer: B

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22. The following equilibrium constants are given :

$N_2 + 3H_3 \Leftrightarrow 2NH_3, K_1$

$N_2 + O_2 \Leftrightarrow 2NO, K_2$

$H_2 + \frac{1}{2}O_2 \Leftrightarrow H_2O, K_3$

The equilibrium constant for the oxidation of NH_3 by oxygen to give NO is :

A. K_1K_2 / K_3

B. $K_2K_3^3 / K_1$

C. $K_2K_3^2 / K_1$

D. $K_2^2K_3 / K_1$

Answer: B

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23. The dissociation constants for acetic acid and HCN at $25^{\circ}C$ are 1.5×10^{-5} and 4.5×10^{-10} , respectively. The equilibrium constant for the equilibirum $CN^{-} + CH_3COOH \Leftrightarrow HCN + CH_3COO^{-}$ would be

A. 3.0×10^{-5}

B. 3.0×10^{-4}

C. 3.0×10^{4}

D. 3.0×10^{5}

Answer: C

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24. Consider the following reactions in which all the reactants and the products are in gasous state

$2PQ \Leftrightarrow P_2 + Q_2, K_1 = 2.5 \times 10^{5}$

$PQ + \frac{1}{2}R_2 \Leftrightarrow PQR, K_2 = 5 \times 10^{-3}$

The value of K_3 for the equilibrium

$1/2P_2 + 1/2Q_2 + 1/2R_2 \Leftrightarrow PQR,$ is

A. 2.5×10^{-3}

B. 2.5×10^{3}

C. 1.0×10^{-5}

D. 5×10^{3}

Answer: C

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25. Partial pressure of O_2 in the reaction

$1/2P_2 + 1/2Q_2 + 1/2R_2 \Leftrightarrow PQR,$

A. K_p

B. $\sqrt{K_p}$

C. $\sqrt[3]{K_p}$

D. $2K_p$

Answer: A

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26. Mercurous chloride , Hg_2Cl_2, in a saturated solution has the equilibrium called solubility equilibrium . The equilibrium constant for this solubility equilibrium will be

A. $\left[Hg^+\right]\left[Cl^-\right]$

B. $\left[Hg^+\right]^2\left[Cl^-\right]^2$

C. $\left[Hg_2^{2.+}\right]\left[Cl^-\right]^2$

D. $2\left[Hg^+\right] \times 2\left[Cl^-\right]$

Answer: C

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27. In a reaction $A + 2B \Leftrightarrow 2C$, 2.0 moles of $'A'$ 3 moles of 'B' and 2.0 moles of 'C' are placed in a 2.0 L flask and the equilibrium concentration of 'C' is 0.5 mol $/$ L . The equilibrium constant (K) for the reaction is

A. 0.073

B. 0.147

C. 0.05

D. 0.026

Answer: C

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28. 500 ml vessel contains 1.5 M each of A, B, C and D at equlibrium. If 0.5 M each of C and D are taken out, the value of K_c for $A + B \Leftrightarrow C + D$ will be

A. 1.0

B. $1/9$

C. $4/9$

D. $8/9$

Answer: A

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29. When two reactants, A and B are mixed to give products C and D, the reaction quotient Q, at the initial stages of the reaction.

A. is zero

B. decreases with time

C. is independent of time

D. increases with time.

Answer: D

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30. 9.2 grams of $N_2O_{4(g)}$ is taken in a closed one litre vessel and heated till the following equilibrium is reached $N_2O_{4(g)} \Leftrightarrow 2NO_{2(g)}$. At equilibrium, $50\,\%\, N_2O_{4(g)}$ is dissociated. What is the equilibrium constant (in mol $litre^{-1}$) (Molecular weight of $N_2O_4 = 92$) ?

A. 0.1

B. 0.2

C. 0.4

D. 2

Answer: B

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31. Calculate the partial pressure of carbon monoxide from the following data :

$CaCO_3 \overset{\Delta}{\Longleftrightarrow} CaO(s) + CO_2 \uparrow, K(p) = 8 \times 10^{-2}$

$CO_2(g) + C(s) \Leftrightarrow 2CO(g), K_p = 2$

A. $0 \cdot 2$

B. $0 \cdot 4$

C. $1 \cdot 6$

D. 4

Answer: B

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32. The equilibrium:

$P_4(g) + 6Cl_2(g) \Leftrightarrow 4PCl_3(g)$

is attained by mixing equal moles of P_4 and Cl_2 in an evacuated vessel. Then at equilibrium:

A. $[Cl_2] > [PCl_3]$

B. $[Cl_2] > [P_4]$

C. $[P_4] > [Cl_2]$

D. $[PCl_3] < [P_4]$

Answer: C

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33. An amount of solid NH_4HS is placed in a flask already containing ammonia gas at a certain temperature and 0.50 atm pressure.Ammonium hydrogen sulphide decomposes to yield NH_3 and H_2S gases in the flask.When the decomposition reaction reaches equilibrium, the total pressure in the flask rises to 0.84 atm ? The equilibrium constant for NH_4HS decomposition at this temperature is :

A. 0.30

B. $0 \cdot 18$

C. $0 \cdot 17$

D. $0 \cdot 11$

Answer: D

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34. $A + B \Leftrightarrow C + D$. If finally the concentrations of A an d B are both equal but at equilibrium concentration of D will be twice of that of A then what will be the equilibrium constant of reaction.

A. $4/9$

B. $0 \cdot 18$

C. $0 \cdot 17$

D. $0 \cdot 11$

Answer: D

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35. The equilibrium constant at $298K$ for a reaction, $A + B \Leftrightarrow C + D$ is 100. If the initial concentrations of all the four species were 1M each, then equilibirum concentration of D (in molL^{-1}) will be

A. $0 \cdot 182$

B. $0 \cdot 818$

C. $1 \cdot 818$

D. $1 \cdot 182$

Answer: C

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36. $NH_4COONH_2(s) \Leftrightarrow 2NH_3(g) + CO_2(g)$ If equilibrium pressure is 3 atm for the above reaction, then K_p for the reaction is

A. 4

B. 27

C. $4/27$

D. $1/27$

Answer: A

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37. The equilibrium pressure for the reaction $MSO_4.2H_2O(s) \Leftrightarrow MSO_4(s) + 2H_2O(g)$ is $\pi/4\text{atm}$ at $400\,\text{K}$. The K_p is

A. $\pi^2/4$

B. $\pi/6$

C. $\pi^2/16$

D. $\frac{\pi}{16}$

Answer: C

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38. For the reaction

$H_2(g) + CO(g) \Leftrightarrow CO(g) + H_2O(g)$, if the initial concentration of $[H_2] = [CO_2]$and x moles /litres of hydrogen is consummed at equilibrium , the correct expression of K_p is :

A. $\frac{x^2}{(1-x)^2}$

B. $\frac{(1+x)^2}{(1-x)^2}$

C. $\frac{x^2}{(2+x)^2}$

D. $\frac{x^2}{(1-x)^2}$

Answer: A

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39. A mixture of nitrogen and hydrogen in the ratio of $1:3$ reach equilibrium with ammonia, when $50\,\%$ of the mixture has reacted. If the total pressure is P, the partial pressure of ammonia in the equilibrium mixture was :

A. $P/2$

B. $P/3$

C. $P/4$

D. $P/6$

Answer: B

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40. For the reaction, $H_2 + I_2 \Leftrightarrow 2HI, K = 47.6$. If the initial number of moles of each reactant and product is 1 mole then at equilibrium

A. $[I_2] = [H_2], [I_2] > [HI]$

B. $[I_2] < [H_2], [I_2] = [HI]$

C. $[I_2] = [H_2], [I_2] < [HI]$

D. $[I_2] > [H_2], [I_2] = [HI]$

Answer: C

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41. The equilibrium constant (K_p) for the decomposition of gaseous H_2O

$H_2O(g) \Leftrightarrow H_2(g) + \frac{1}{2}O_2(g)$

is related to the degree of dissociation α at a total pressure P by

A. $K_p = \frac{\alpha^3 p^{1/2}}{(1+\alpha)(2+\alpha)^{1/2}}$

B. $K_p = \frac{\alpha^3 p^{3/2}}{(1-\alpha)(2+\alpha)}$

C. $K_p = \frac{\alpha^{3/2} p^2}{(1-\alpha)(2+\alpha)^{1/2}}$

D. $K_p = \frac{\alpha^{3/2} p^{1/2}}{(1-\alpha)(2+\alpha)^{1/2}}$

Answer: D

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42. a' moles of PCl_5 are heated in a closed container to equilibrate $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$ at a pressure of p atm . If x moles of PCl_5 dissociate at equilibrium , then

A. $\frac{x}{a} = \left(\frac{K_p}{p}\right)^{1/2}$

B. $\frac{x}{a} = \frac{K_p}{K_p + p}$

C. $\frac{x}{a} = \left(\frac{K_p}{K_p + p}\right)^{1/2}$

D. $\frac{x}{a} = \left(\frac{K_p + p}{K_p}\right)^{1/2}$

Answer: C

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43. If the concentration of OH^- ions in the reaction

$Fe(OH)_3(s) \Leftrightarrow Fe^{3+}(aq.) + 3OH^-(aq.)$

is decreased by $1/4$ times, then the equilibrium concentration of Fe^{3+} will increase by

A. 8 times

B. 16 times

C. 64 times

D. 4 times

Answer: C

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44. The dissociation equilibrium of a gas AB_2 can be represented as, $2AB_2(g) \Leftrightarrow 2AB(g) + B_2(g)$. The degree of disssociation is 'x' and is small compared to 1. The expression relating the degree of dissociation (x) with equilibrium constant k_p and total pressure P is

A. $(2K_p / P)$

B. $(2K_p / P)^{1/3}$

C. $(2K_p / P)^{1/2}$

D. (K_p / P)

Answer: B

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45. Equimolar concentrations of H_2 and I_2 are heated to equilibrium in a 2 L flask. At equilibrium, the forward and backward rate constants are

found to be equal. What percentage of initial concentration of H_2 has reached at equilibrium ?

A. $33\ \%$

B. $66\ \%$

C. $50\ \%$

D. $40\ \%$

Answer: C

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46. 5 moles of $SO_2$and 5 moles of O_2 are allowed to react .At equilibrium , it was foumnd that $60\ \%$ of SO_2 is used up .If the pressure of the equilibrium mixture is one aatmosphere, the parital pressure of O_2 is :

A. $0\cdot 52$ atm

B. $0\cdot 21$ atm

C. $0\cdot 41$atm

D. $0 \cdot 82$ atm

Answer: C

Watch Video Solution

47. Consider thr reaction where $K_p = 0.497$at 500K

$PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$

If the htree gasses are mixed in a right container so that the partial pressure of each gas in initially 1 atm ,then which is correct observation ?

A. More PCl_5 will be produced

B. More PCl_3 will be produced

C. Equilibrium will be established when 50% of the reaction is complete

D. None of the above

Answer: A

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48. The reaction,

$2A(g) + B(g) \Leftrightarrow 3C(g) + D(g)$

is begun with the concentration of A and B both at an intial value of 1.00 M. When equilibrium is reached, the concentration of D is measured and found to be 0.25 M. The value for the equilibrium constant for this reaction is given by the expression:

A. $\left[(0 \cdot 75)^3(0 \cdot 25)\right] \div \left[(1.00)^2(1.00)\right]$

B. $\left[(0 \cdot 75)^3(0 \cdot 25)\right] \div \left[(0 \cdot 50)^2(0 \cdot 75)\right]$

C. $\left[(0 \cdot 75)^3(0 \cdot 25)\right] \div \left[(0 \cdot 50)^2(0 \cdot 75)\right]$

D. $\left[(0 \cdot 75)^3(0 \cdot 25)\right] \div \left[(0 \cdot 75)^2(0 \cdot 25)\right]$

Answer: B

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49. For the reaction, $AB(g) \Leftrightarrow A(g) + B(g)$, AB is $33\,\%$ dissociated at a total pressure of 'p' Therefore, 'p' is related to K_p by one of the following options

A. $P = K_p$

B. $P = 3K_p$

C. $P = 4K_p$

D. $P = 8K_p$

Answer: D

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50. A vessel at 1000 K contains CO_2 with a pressure of 0.5 atm. Some of the CO_2 is converted to CO on addition of graphite. Calculate the value of K, if the total pressure at equilibrium is 0.8 atm.

A. 3 atm

B. $0 \cdot 3$atm

C. $0 \cdot 18atm$

D. $1 \cdot 8$ atm

Answer: D

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51. For the reaction $C(s) + CO_2(g) \rightarrow 2CO(g)$, $k_p = 63$ atm at 100 K. If at equilibrium $p_{CO} = 10p_{CO_2}$ then the total pressure of the gases at equilibrium is

A. $6 \cdot 3$ atm

B. $6 \cdot 93$ atm

C. $0 \cdot 63$atm

D. $0 \cdot 693$ atm

Answer: B

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52. In the reaction $AB(g) \Leftrightarrow A(g) + B(g)$ at $30^{\circ}C, k_p$ for the dissociation equilibrium is $2.56 \times 10^{-2} atm.$ If the total pressure at equilibrium is 1 atm, then the percentage dissociation of AB is

A. 0.87

B. 0.13

C. $43 \cdot 5\,\%$

D. 0.06

Answer:

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53. A 20 litre container at 400 K contains $CO_2(g)$ at pressure $0.4 atm$ and an excess of SrO (neglect the volume of slid SrO). The volume of the container is now decreased by moving the movable piston fitted in the

container . The maximum volume of the container, when pressure of CO_2 attains its maximum value, will be

[Given that : $SrCO_3(s) \Leftrightarrow SrO(s) + CO_2(g), Kp = 1.6atm$]

A. 5 litre

B. 10 litre

C. 4 litre

D. 2 litre

Answer: A

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54. Which of the following statement is correct for a reversible process in a state of equilibrium ?

A. $\Delta G^\circ = -2 \cdot 30RT \log K$

B. $\Delta G^\circ = 2 \cdot 30RT \log K$

C. $\Delta G = -2 \cdot 30R \log K$

D. $\Delta G = 230RT \log K$

Answer: A

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55. The standard Gibbs energy change at $300K$ for the reaction $2A \Leftrightarrow B + C$ is 2494. $2J$. At a given time, the composition of the reaction mixture is $[A] = \frac{1}{2}, [B] = 2$ and $[C] = \frac{1}{2}$. The reaction proceeds in the

$(R = 8.314JK/\text{mole} = 2.718)$

A. Forward direction because $Q > K_c$

B. Reverse direction because $Q > K_c$

C. Forward direction because $Q < K_c$

D. Reverse direction because $Q < K_c$

Answer: B

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56. Choose the equilibrium that is not influenced by pressure

A. $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$

B. $CO_2(g) + 3H_2(g) \Leftrightarrow CH_4(g) + H_2O(g)$

C. $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$

D. $2HI(g) \Leftrightarrow H_2(g) + I_2(g)$

Answer: D

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57. The reaction , $SO_2 + Cl_2 \Leftrightarrow SO_2Cl_2$ is exothermic and reversible . A mixture of $SO_2(g), Cl_2 \Leftrightarrow SO_2Cl_2(g)$ is at equilibrium in a closed container . Now a certain quantity of extra SO_2 is introduced into the container , the volume remaining the same. Which of the following is / are/ true ?

A. The pressure inside the container will not change

B. The temperature will not change

C. The temperature will increases

D. The temperature will decrease.

Answer: C

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58. Consider the following equilibrium in a closed container

$N_2O_4(g) \Leftrightarrow 2NO_2(g)$

At a fixed temperature, the volume of the reaction container is halved. For this change, which of the following statements hold true regarding the equilibrium constant (K_p) and degree of dissociation (α)?

A. neither $K_p \text{nor} \alpha$ changes

B. both K_p and α change

C. K_p changes but α does not change

D. K_p does not change but α changes

Answer: D

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59. Given reaction is $2X_{(gas)} + Y_{(gas)} \Leftrightarrow 2Z_{(gas)} + 80$ Kcal

Which combination of pressure and temperature gives the highest yield of Z at equilibrium ?

A. 1000 atm and $200^\circ C$

B. 500 atm and $500^\circ C$

C. 500 atm and $200^\circ C$

D. 500 atm and 100°

Answer: A

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60. The following two reactions:

i. $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$

(ii) $COCl_2(g) \Leftrightarrow CO(g) + Cl_2(g)$

are simultaneously in equilibrium in a container at constant volume. A few moles of $CO(g)$ are later introduced into the vessel. After some time, the new equilibrium concentration of

A. PCl_5 will increases

B. PCl_5 will remain unaffected

C. Cl_2 will increases

D. PCl_5 will decreases

Answer: B

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61. At equilibrium of the reaction

$2X(g) + Y(g) \Leftrightarrow X_2Y(g)$

the number of moles of X_2Y at equilibrium is affected by the

A. temperature and pressure

B. temperature only

C. pressure only

D. temperature , pressure and catalyst used

Answer: A

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62. To an equilibrium mixture of

$2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$

some helium , an inert gas, is added at constant volume. The addition of helium causes the total pressure to double . Which of the following is true ?

A. The concentration of the three gases is unchanged

B. The concentration of sulphur trioxide increases

C. The number of moles of sulphur trioxide increases

D. The concentration of sulphur dioxide increases

Answer: A

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63. The equilibrium of the reaction $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ will be shifted to the right when:

A. by increasing the concentration of NH_3

B. by decreasing the pressure

C. by decreasing the pressure

D. by decreasing the concentration of $N_2(g)$ and H_2 (g)

Answer: D

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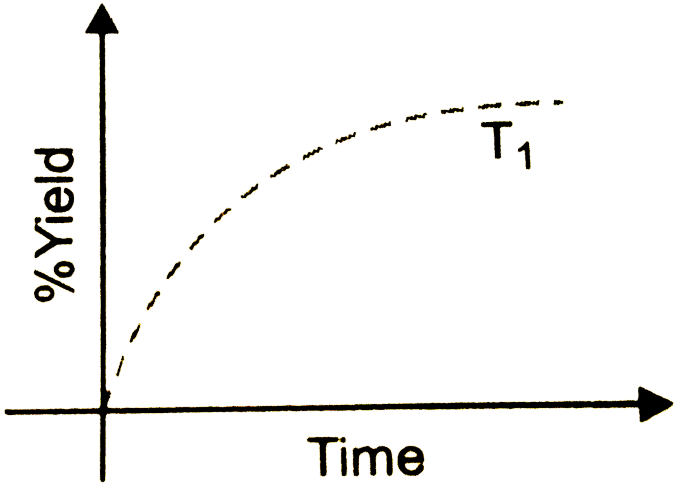
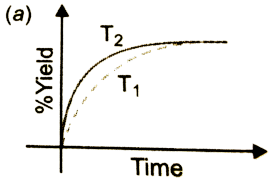
64. The % yield of ammonia as a function as a function of time in the reaction

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g), \Delta H < 0$ at(P, T_1) is given below

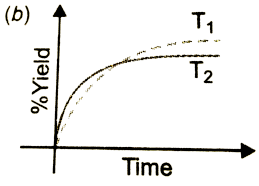


If this reaction is cnducted at (P, T_2) with $T_2 > T_1)$ the % yield of ammonia as a function of time is

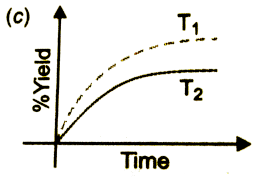
A.



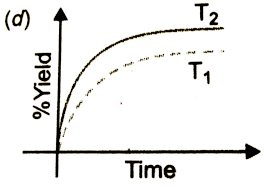
B.



C.



D.



Answer: B

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65. In which one of the following the increase of presure favours the backward reaction?

A. Formation of equilibrium ammonia from $N_2(g)$ and $H_2(g)$

B. Decomposition equilibrium of HI (g) to $H_2(g)$ and $I_2(g)$

C. Synthesis of SO_3 (g) by contact process

D. Production of 'syngas' by coal gasification

Answer: D

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66. Consider the reaction equilibrium

$$\underset{(\text{Greater volume})}{\text{Ice}} \Leftrightarrow \underset{(\text{Lesser volume})}{\text{Water}} - 2\text{kcal}$$

The favourable conditions for forward reaction are

A. low temperature , high pressure and excess of ice

B. low temperature ,low pressure and excess of ice

C. high temperature , low pressure and excess

D. high temperature , high pressure and excess of ice

Answer: D

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67. Which one of the following condition will favour maximum formation of the product in the reaction. $A_2(g) + B_2(g) \Leftrightarrow X_2(g) \Delta_r H = -X$ kJ ?

A. Low temperature and high pressure

B. Low temperature and low pressure

C. High temperature and high pressure

D. High temperature and low pressure

Answer: A

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68. A mixture of NO_2 and N_2O_4 has a vapor density of 38.3 at 300 K. What is the number of moles of NO_2 in 100 g of themixture ?

A. $0 \cdot 043$

B. $4 \cdot 4$

C. $3 \cdot 4$

D. $0 \cdot 437$

Answer: D

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69. Ammonium carbamate when heated to $200^{\circ}C$ gives a mixture of NH_3 and CO_2 vapours with a density of $16 \cdot 0$. What is the degree of disociation of ammonium carbamate ?

A. $3/2$

B. $1/2$

C. 2

D. 1

Answer: D

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70. The vapour density of fully dissociated NH_4Cl would be

A. double than that of NH_4Cl

B. half than that of NH_4Cl

C. same as that of NH_4Cl

D. determined by the amount of solid NH_4Cl taken

Answer: B

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71. N_2O_4 is 10% dissociated at a total pressure P_1 and 20% dissociated at a total pressure P_2. $Thenratio' \frac{P_1}{P_2}$ is

A. $\frac{1}{2}$

B. $\frac{2}{1}$

C. $\frac{1}{4}$

D. $\frac{4}{1}$

Answer: D

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72. At equilibrium of the reaction ,

$N_2O_4(g) \Leftrightarrow 2NO_2(g)$

the observed molecular weight of $N_{92})O_4$ is 80g mol^{-1} at 350K. The percentage dissociation of $N_2O_4(g)$ at 350K is

A. 0.1

B. 0.15

C. 0.2

D. 0.18

Answer: B

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73. The values of K_{p_1} and K_{p_2} for the reactions

$X \Leftrightarrow Y + Z$ ....(i)

and $A \Leftrightarrow 2B$ ...(ii)

are in ratio of 9 : 1. If degree of dissociation of X and A be equal, then total presure at equilibrium (i) and (ii) are in the ratio.

A. $3:1$

B. $1:9$

C. $36:1$

D. $1:1$

Answer: C

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74. 3 moles of A and 4 moles of B are mixed together and allowed to come into equilibrium according to the following reaction

$A(g) + 4B(g) \Leftrightarrow 2C(g) + 3D(g)$

When equilirium is reached , there is 1 mole of C. The equilibrium extent of the reaction is

A. $1/4$

B. $1/3$

C. $1/2$

D. 1

Answer: C

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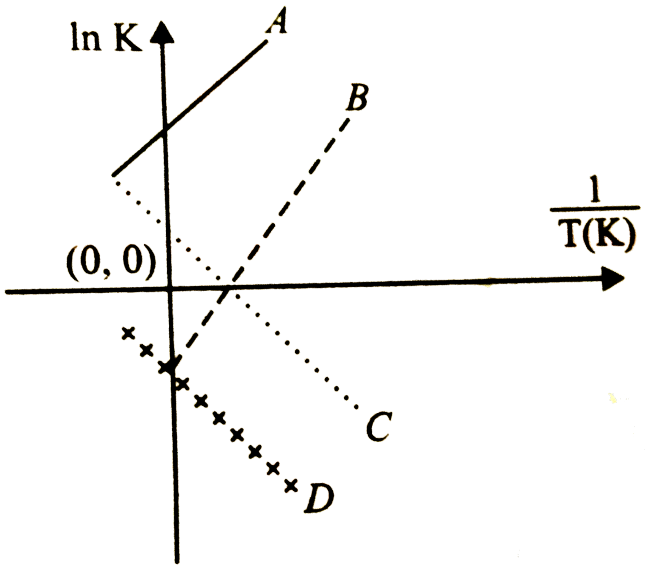
75. Which of the following lines correctly show the temperature dependence of equilibrium constant K, for an exothermic reaction ?



A. A and B

B. B and C

C. C and D

D. A and D

Answer: A

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Competition Focus Jee Main And Advanced Medical Entrance Ii Multiple Choice Questions With One Or More One Correct Answer

1. Which of the following are reversible reactions ?

A. $AgNO_3(aq) + NaCl(aq) \rightarrow$

$AgCl(s) + NaNO_3(aq)$

B. $KNO_3(aq) + NaCl(aq) \rightarrow$

$KCl(aq) + NaNO_3$

C. $BaCl_2(aq) + Na_2SO_4 \rightarrow$

$BaSO_4(s) + 2NaCl(aq)$

D. $AgCl(s) + Water \rightarrow Ag^+(aq) + Cl^-(aq)$

Answer: B::D

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2. Which of the following statement are wrong ?

A. Equilibrium constant of a reaction is doubled if the equilibrium concentration of the products become double

B. If a reaction mixture is compressed to half the volume, equilibrium constant is halved

C. Equilibrium , constant increases of tempertature

D. Equilibrium concentrations increase in the presence of a catalyst .

Answer: A::B::C::D

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3. The equilibrium

$SO_2CI_2(g) \Leftrightarrow SO_2(g) + CI_2(g)$

is attained at $25^\circ C$ in a closed container and inert gas helium is introduced. Which of the following statement (s) is / are correct ?

(1).concentrations of SO_2, CI_2 and SO_2CI_2 change

(2). More chlorine is formed

(3).Concentration of SO_2 is reduced

(4).More SO_2CI_2 is formed

A. Concentration of SO_2, Cl_2 and SO_2Cl_2 change

B. More chlorine is formed

C. Concentration of SO_2 is reduced

D. More SO_2Cl_2 is formed

Answer:

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4. For the reaction,

$PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}$, the forward reaction at constant temperature is favoured by:

A. introducing an inert gas at constant volume

B. introducing PCl_5 at constant volume.

C. introducing an inert gas at constant pressure

D. increasing the volume of the container

Answer: B::C::D

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5. The equilibrium: $2Cu^1 \Leftrightarrow Cu^0 + Cu^u$ in aqueous medium at $25^\circ C$ shifts towards the left in the presence of

A. NO^-

B. Cl^-

C. SCN^-

D. CN^-

Answer: B::C::D

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6. The thermal dissociation of equilibrium of $CaCo_3(s)$ is studied under different conditions

$CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g)$

For this equilibrium, the correct statement (s) is/are

A. ΔH is dependent on T

B. K is independent of the itial amount of $CaCO_3$

C. K is indepdent of the pressure of CO_2 at a given T

D. ΔH is independent of the catalyst , ifany

Answer: A::B::D

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Competition Focus Jee Main And Advanced Medical Entrance Iii Multiple Choice Questions Based On The Given Passage Comprehension

1. The expression for the reaction quotient , Q, is similar to that for equilibrim constant , Q, is similar to that for equilibrium constant K. The value of Q for the given composition of a reaction mixture helps us to know whether the reaction will move forward or backward or remain in equilibrium . It also helps to predict the effect of pressure on the direction of the gaseous reaction .In certain reactions, addition of inert gas also favours either the formation of reactants or products . The value of equilibrium constant of a reaction changes with change of temperature and the change is given by van't Hoff equation , d In $K_p/dT = \Delta H^\circ/RT^2$ where enthaply change, ΔH° , is taken as constant in the small temperature range.

The equilibrium constant for the reaction between $CH_4(g)$ and $H_2S(g)$ to form $CS_2(g)$ and $H_2(g)$, at 1173 K is $3 \cdot 6$. For the following composition of the reaction mixture , decide which of the following option is correct ?

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2. The expression for the reaction quotient , Q, is similar to that for equilibrim constant , Q, is similar to that for equilibrium constant K. The value of Q for the given composition of a reaction mixture helps us to know whether the reaction will move forward or backward or remain in equilibrium . It also helps to predict the effect of pressure on the direction of the gaseous reaction .In certain reactions, addition of inert gas also favours either the formation of reactants or products . The value of equilibrium constant of a reaction changes with change of temperature and the change is given by van't Hoff equation , d In $K_p/dT = \Delta H^\circ/RT^2$ where enthaply change, ΔH° , is taken as constant in the small temperature range.

The reaction $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3$ is in equilibrium . Now the reaction mixture is compressed to half the volume

A. More of ammonia will be formed

B. Ammonia will dissociate back into N_2 and H_2

C. There will be no effect on equilibrium

D. Equilibrium constant of the reaction will change

Answer: A

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3. The expression for the reaction quotient , Q, is similar to that for equilibrim constant , Q, is similar to that for equilibrium constant K. The value of Q for the given composition of a reaction mixture helps us to know whether the reaction will move forward or backward or remain in equilibrium . It also helps to predict the effect of pressure on the direction of the gaseous reaction .In certain reactions, addition of inert gas also favours either the formation of reactants or products . The value of equilibrium constant of a reaction changes with change of temperature and the change is given by van't Hoff equation , d In $K_p/dT = \Delta H^\circ/RT^2$ where enthaply change, ΔH° , is taken as constant in the small temperature range.

For the above reaction in equilibrium , helium gas was added but the mixture was allowed to expand to keep the pressure constant . Then

A. More of ammonia will be formed

B. Ammonia will dissociate back into N_2 and H_2

C. There will be no effect on equilibrium

D. Equilibrium constant of the reaction will change

Answer: B

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4. The expression for the reaction quotient , Q, is similar to that for equilibrim constant , Q, is similar to that for equilibrium constant K. The value of Q for the given composition of a reaction mixture helps us to know whether the reaction will move forward or backward or remain in equilibrium . It also helps to predict the effect of pressure on the direction of the gaseous reaction .In certain reactions, addition of inert gas also favours either the formation of reactants or products . The value of equilibrium constant of a reaction changes with change of temperature and the change is given by van't Hoff equation , d In $K_p/dT = \Delta H^\circ/RT^2$ where enthaply change, ΔH° , is taken as

constant in the small temperature range.

Which of the following will be correct ?

A. Plot of In k_p versus $1/T^2$ will be linear with + ve slope

B. Plot of In $K_p$verus$1/T$ will be linear with + vve slope

C. Plot of In K_p versus$1/T^2$ will be linear with -ve slope

D. Plot of In K_p versus $1/T$ will be linear with -ve slope

Answer: D

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5. The expression for the reaction quotient , Q, is similar to that for equilibrim constant , Q, is similar to that for equilibrium constant K. The value of Q for the given composition of a reaction mixture helps us to know whether the reaction will move forward or backward or remain in equilibrium . It also helps to predict the effect of pressure on the direction of the gaseous reaction .In certain reactions, addition of inert gas also favours either the formation of reactants or products . The value

of equilibrium constant of a reaction changes with change of temperature and the change is given by van't Hoff equation , d In $K_p/dT = \Delta H^\circ/RT^2$ where enthaply change, ΔH° , is taken as constant in the small temperature range.

In which of the following case , equilibrium constant decreases with increase of temperature ?

A. When the reaction is exothermic

B. When the reaction is endothermic

C. When the reaction is in the gaseous phase

D. When the reaction takes place in the solution.

Answer: A

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

$X_2(g) \Leftrightarrow 2X(g)$ The standard reaction Gibbs energy , $\Delta_r G^\circ$ of this

reaction is positive . At the start of the reaction, there is positive . At the start of the reaction , there is one mole of X_2 and no. As the reaction proceeds , the number of moles of X formed is given by β. Thus $\beta_{equilbrium}$ 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 = $0 \cdot 0833$ $\mathrm{L\ bar}$ $K^{-1}mol^{-1}$).

The equilibrium constant K_p for this reaction at 298 K, in terms of $\beta_{equilibrium}$, is

A. $\frac{8\beta^2_{\text{equilibrium}}}{2-\beta_{\text{equilibrium}}}$

B. $\frac{8\beta^2_{\text{equilibrium}}}{4-\beta^2_{\text{equilibrium}}}$

C. $\frac{4\beta^2_{\text{equilibrium}}}{2-\beta_{\text{equilibrium}}}$

D. $\frac{4\beta^2_{\text{equilibrium}}}{4-\beta^2_{\text{equilibrium}}}$

Answer: B

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

$X(g) \Leftrightarrow 2X(g)$

The standard reaction Gibbs energy $\Delta_r G^\circ$, 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, $R = 0.083L$ bar $K^{-1}mol^{-1}$)

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. $\beta._{\text{equilibrium}} = 0 \cdot 7$

D. $K_c < 1$

Answer: C

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Competition Focus Jee Main And Advanced Medical Entrance Vi Integer Type Questions

1. The answer to each of the folowing questions is a single digit integar, ranging from 0 to 9. If the correct answers to the question numbers A, B, C and D (say) are 4,0,9 and 2 respectively , then the correct darkening of bubbles should be as shown on the side :

If concentrations of SO_2 and O_2 in the equilibrium reaction , $2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$ are quadrupled , the concentration of SO_3 now will be times ..... times.

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2. The answer to each of the folowing questions is a single digit integar, ranging from 0 to 9. If the correct answers to the question numbers A, B, C and D (say) are 4,0,9 and 2 respectively , then the correct darkening of bubbles should be as shown on the side :

Equilibrium constant for the reaction $A_3(g) + 3B_2(g) \Leftrightarrow 3AB_2(g)$ is $64 \cdot 0$Then the equilibrium constant for t will be

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3. The answer to each of the folowing questions is a single digit integar, ranging from 0 to 9. If the correct answers to the question numbers A, B, C and D (say) are 4,0,9 and 2 respectively , then the correct darkening of bubbles should be as shown on the side :

For the reaction involving oxidation of ammonia by oxygen to form nitric oxide and water vapour , the equilibrium constant has the units $(\text{bar})^n$. Then n is

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Competition Focus Jee Main And Advanced Medical Entrance Vii Numerical Value Type Questions

1. The approach to the following equilibrium was observed kinetically from both directions :

$PtCl_4^{2-} + H_2O ? \left[Pt(H_2O)Cl_3^-\right] + Cl^-$ at $25^\circ C$, it was found that

$-\frac{\Delta}{\Delta t}\left[PtCl_4^{2-}\right] = \left[3.9 \times 10^{-5} \text{ sec}^{-1}\right]\left[PtCl_4^{2-}\right] - \left[2.1 \times 10^{-3} \text{ L. mol}^{-1}\right.$

What is the value of equilibrium constant for the complexation of the fourth Cl^- by Pt(II) ?

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Competition Focus Jee Main And Advanced Medical Entrance Viii Assertion Reason Type Questions Type I

1. Each question given below contains STATEMENT -1 (Assertion) and STATEMENT -2 (Reason). It has four choice (a), (b), (c) and (d) out of which

ONLY ONE is correct . Choose the correct option as under :

Statement -1 Adding inert gas to dissociation equilibrium of N_2O_4 at constant pressure and temperature increases the dissociation .

Statement -2. Molar concentrations of the reactants and products decrease .

A. (a) Statement -1 is True , Statement -2 is true , Statement -2 is the correct explanation of Statement -1

B. (b) Statement -1 is True , Statement -2 is not a correct expanation of Statement -1 .

C. (c) Statement -1 is True, Statement -2 is False .

D. (d) Statement -1 is False , Statement -2 is True .

Answer: A

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2. Each question given below contains STATEMENT -1 (Assertion) and STATEMENT -2 (Reason). It has four choice (a), (b), (c) and (d) out of which ONLY ONE is correct . Choose the correct option as under :

Statement -1 K_p is always greater than K_c

Statement -2 . The reactions in the gaseous phase are usually faster than the reactions in the liquid phase.

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3. Each question given below contains STATEMENT -1 (Assertion) and STATEMENT -2 (Reason). It has four choice (a), (b), (c) and (d) out of which ONLY ONE is correct . Choose the correct option as under :

Statement -1. Reaction quotiet of a reaction at any time decides the direction in which the reaction will proceed.

Statement -2. The value of reaction quotient cannot be greater than the equilibrium constant .

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4. Each question given below contains STATEMENT -1 (Assertion) and STATEMENT -2 (Reason). It has four choice (a), (b), (c) and (d) out of which ONLY ONE is correct . Choose the correct option as under :

Statement -1. Equilibrium constant of an endothermic reaction increases with increase of temperature .

Statement -2. With increase in temperature , an endothermic reaction is favoured more in the forward direction.

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Competition Focus Jee Main And Advanced Medical Entrance Viii Assertion Reason Type Questions Type Ii

1. In each of the following questions, a statement of Assertion is given followed by a corresponding statement of Reason just below it. Of the statements, mark the correct answer as

Assertion . The vapour pressure of a pure liquid has a fixed value at a

particular temperature .

Reason . When equilibrium is reached , no more vapour are formed .

A. If both assertion and reason are true, and reason is the true explanation of the assertion .

B. If both assertion and reason are true but reason is the true explanation of the assertion .

C. If assertion is true, but reason is false.

D. If both assertion and reason are false .

Answer: C

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2. In each of the following questions, a statement of Assertion is given followed by a corresponding statement of Reason just below it. Of the statements, mark the correct answer as

Assertion . A reversible reaction cannot be carried out in an open vessel.

Reason. When equilibrium is reached , no more vapour are formed .

A. If both assertion and reason are true, and reason is the true explanation of the assertion .

B. If both assertion and reason are true but reason is the true explanation of the assertion .

C. If assertion is true, but reason is false.

D. If both assertion and reason are false .

Answer: D

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3. Assertion (A) : For the reaction

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$

unit of $K_c = L^2 mol^{-2}$

Reason (R) : For the reaction

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$

equilibrium constant $K_c = \frac{[NH_3]^2}{[N_2] \times [H_2]^3}$

A. If both assertion and reason are true, and reason is the true explanation of the assertion .

B. If both assertion and reason are true but reason is the true explanation of the assertion .

C. If assertion is true, but reason is false.

D. If both assertion and reason are false .

Answer: A

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4. Assertion (A) : The equilibrium constant is fixed and characteristic for any given chemical reaction at a specified temperature.

Reason (R) : The composition of the final equilibrium mixture at a particular temperature depends upon the starting amount of reactants.

A. If both assertion and reason are true, and reason is the true explanation of the assertion .

B. If both assertion and reason are true but reason is the true explanation of the assertion .

C. If assertion is true, but reason is false.

D. If both assertion and reason are false .

Answer: A

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5. In each of the following questions, a statement of Assertion is given followed by a corresponding statement of Reason just below it. Of the statements, mark the correct answer as

Assertion . The equilibrium constant of a reaction increases if temperature is increased .

Reason . The forward reaction becomes faster with increase of temperature .

A. If both assertion and reason are true, and reason is the true explanation of the assertion .

B. If both assertion and reason are true but reason is the true explanation of the assertion .

C. If assertion is true, but reason is false.

D. If both assertion and reason are false .

Answer: D

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6. Assertion (A) : The active mass of pure solid and pure liquid is taken unity.

Reason (R) : The active mass of pure solids and liquids depends on the density and molecular mass. The density and molecular of a mass of pure liquids and solids are constant.

A. If both assertion and reason are true, and reason is the true explanation of the assertion .

B. If both assertion and reason are true but reason is the true explanation of the assertion .

C. If assertion is true, but reason is false.

D. If both assertion and reason are false .

Answer: A

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7. In each of the following questions, a statement of Assertion is given followed by a corresponding statement of Reason just below it. Of the statements, mark the correct answer as

Assertion . If standard free energy change of a reaction is zero , this implies that equilibrium constant of the reaction is unity .

Reason . For a reaction in equilibrium , equilibrium constant is always unity .

A. If both assertion and reason are true, and reason is the true explanation of the assertion .

B. If both assertion and reason are true but reason is the true explanation of the assertion .

C. If assertion is true, but reason is false.

D. If both assertion and reason are false .

Answer: C

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8. Assertion (A) : When a catalyst is added to a reaction mixture in equilibrium the amount of the products increases.

Reason (R) : The forward reaction becomes faster on adding the catalyst.

A. If both assertion and reason are true, and reason is the true explanation of the assertion .

B. If both assertion and reason are true but reason is the true explanation of the assertion .

C. If assertion is true, but reason is false.

D. If both assertion and reason are false .

Answer: D

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9. Statement: The reaction: $2NO_{(g)} + O_{2(g)} \Leftrightarrow 2NO_2$ is favoured in the forward direction with increase of pressure.

Explanation: The reaction is exothermic.

A. If both assertion and reason are true, and reason is the true explanation of the assertion .

B. If both assertion and reason are true but reason is the true explanation of the assertion .

C. If assertion is true, but reason is false.

D. If both assertion and reason are false .

Answer: B

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10. Assertion (A) : A catalyst does not influences the values of equilibrium constant

Reason (R) : Catalyst influences the rate of both forward and backward reactions equally.

A. If both assertion and reason are true, and reason is the true explanation of the assertion .

B. If both assertion and reason are true but reason is the true explanation of the assertion .

C. If assertion is true, but reason is false.

D. If both assertion and reason are false .

Answer: A

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