CHEMISTRY

JEE (MAIN AND ADVANCED) CHEMISTRY

CHEMICAL EQUILIBRIUM

Lecture Sheet Exercise I Straight Objective Type Questions

1. Pure ammonia is placed in a vessel at a temperature where its degree of dissociation (α) is appreciable. At equilibrium $2NH_3 = N_2 + 3H_2$.

A. K_p does not change with pressure

B. α changes with pressure

C. concentration of NH_3 does not change with pressure

D. concentration of H_2 is more than that of N_2

Answer: A::B::D

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2. For the gas-phase reaction, $2NO \Leftrightarrow N_2 + O_2 : \Delta H = -43.5$ keal. Which one of the following is false for the reaction $N_2(g) + O_2(g) \Leftrightarrow 2NO(g)$

A. K_c is independent of temperature

B. K_c increases as T decreases

C. K_c is decreases as T decreases

D. K_c varies with addition of NO

Answer: A::B::D

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Lecture Sheet Exercise I Linked Comprehension Type Questions

1. In a 7.0 Levacuated chamber, 0.50 mol H_2 and 0.50 mol I_2 react at 427° C.

$H_2(g) + I_2(g) \Leftrightarrow HI(g)$ + Heat , At the given temperature, K_c = 49 for the reaction.

The K_c for above reaction at 500° C is

A. less than 49

B. more than 49

C. equal to 49

D. None of the above

Answer: A

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2. In a 7.0 Levacuated chamber, 0.50 mol H_2 and 0.50 mol I_2 react at 427° C.

$H_2(g) + I_2(g) \Leftrightarrow HI(g)$ + Heat , At the given temperature, K_c = 49 for

the reaction.

what is the value of K_p ?

A. 7

B. 49

C. 24.5

D. None of the these

Answer: B

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3. In a 7.0 Levacuated chamber, 0.50 mol H_2 and 0.50 mol I_2 react at 427° C.

$H_2(g) + I_2(g) \Leftrightarrow HI(g)$ + Heat , At the given temperature, K_c = 49 for the reaction.

What is the total pressure (atm) in the chamber ?

A. 83.14

B. 831.4

C. 8.21

D. None of these

Answer: C

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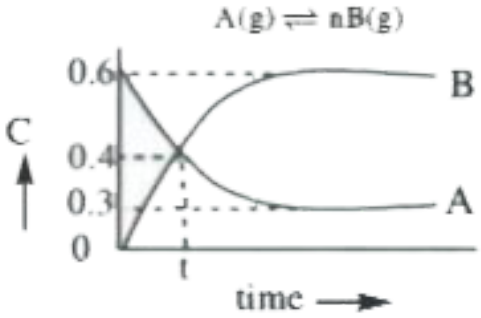
4. The progress of the reaction A nB with time t is shown in Fig.



From this information answer the following questions

The value of n. is

A. 1

B. 2

C. 3

D. 4

Answer: B

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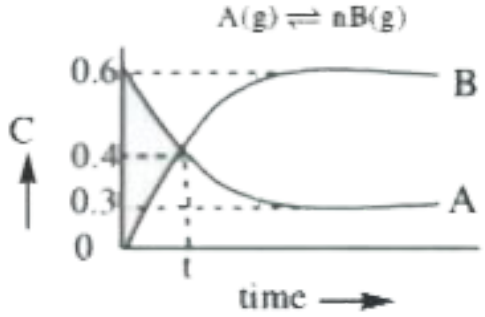
5. The progress of the reaction A nB with time t is shown in Fig.

From this information answer the following questions



The equilibrium constant K_C is

A. 1.2

B. 1.4

C. 1.6

D. 1.8

Answer: A

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Lecture Sheet Exercise I Matrix Matching Type Questions

1.

$List - I$	$List - II$
$(A) N_2 + O_2 \Leftrightarrow 2NO$	$(p)(atm)^{-2}$
$(B) 2SO_2(g) + O_2 \Leftrightarrow 2SO_3(g)$	(Q)NO unit
$(C) H_2 + I_2 \Leftrightarrow 2HI$	(R)No cffect of pressure
$(D) N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$	(S)High pressure favours forward react

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2.

$List - I$	$List - II$
$(A) CaCO_3 \Leftrightarrow CaO + CO_3$	$(P) K_p = K_c$
$(B) NH_4HS \Leftrightarrow NH_3 + H_2S$	(Q) High pressure favours
$(C) PCI_5 \Leftrightarrow PCI_3 + CI_2$	$(R) K_p = K_c(RT)$
$(D) 3Fe(s) + 4H_2O(g) \Leftrightarrow Fe_3O_4(s) + 4H_2(g)$	(S) Heterogeneous equili

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Lecture Sheet Exercise I Integer Type Questions

1. 4.5 moles, each of hydrogen and iodine was heated in a sealed 10 L vessel. At equilibrium, 3 moles of HI were found. The equilibrium constant for $H_2(g) + I_2(g) \rightarrow 2HI(g)$, is

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2. SO_2CI_2 and CI_2 are introduced into a 3L vessel. Partial pressure of SO_2CI_2 and CI_2 at equilibrium are I atm and 2 atm respectively. The

value of K_p is 10 for the reaction $SO_2Cl_2(g) \Leftrightarrow SO_2(g) + Cl_2(g)$. The total pressure in atm at equilibrium would be ____

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3. For the equilibrium of the reaction $NH_4Cl(s) \Leftrightarrow NH_3$ (g) + HCl (g) Kp = $81atm^2$. Total pressure at equilibrium will be x times the pressure of NH_3. The value of x will be .....

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Lecture Sheet Exercise Ii Straight Objective Type Questions

1. Consider the reaction cquilibrium, $2SO_{2(g)} + O_{2(g)} \Leftrightarrow 2SO_{3(g)}, \Delta H^\circ = -$ 198KJ . On the basis of Le Chatelier's principle, the condition favourable for the forward reaction is

A. Lowering of temperature as well as pressure

B. Increase of temperature as well as pressure

C. Lowering of temperature and increase of pressure

D. Any value of temperature and pressure

Answer: C

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2. The gascous reaction $A_{(g)} + B_{(g)} \Leftrightarrow 2C_{(g)} + D_{(g)} + q$ kJ is most favoured at :

A. High temperature and low pressure

B. Low temperature and low pressure

C. Low temperature and high pressure

D. High temperature and high pressure

Answer: B

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3. Exothermic formation represented by equation $Cl_{2(g)} + 3F_{2(g)} \Leftrightarrow 2ClF_3(g)$. Δ H = - 339 KJ . Which of the following will increase the quantity of CIF_3 in equilibrium mixture ?

A. Increase in temperature

B. Removing Cl_2

C. Increasing volume of vessel

D. Adding F_2

Answer: D

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4. Under what conditions of tenperature and pressure the formation of atomic hydrogen from molecular hydrogen will be favoured.

A. High temperature and high pressure

B. Low temperature and low pressure

C. High temperature and low pressure

D. Low temperature and high pressure

Answer: C

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5. Of the following, which change will shift the reaction towards the product $I_2(g) \Leftrightarrow 2I(g) \Delta H^\circ{}_f(298K)$ = + 150 kJ

A. Increase in concentration of I

B. Decrease in concentration of I_2

C. Increase in temperature

D. Increase in total pressure

Answer: C

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6. At constant temperature, the equilibrium constant (K_p) for the decomposition reaction $N_2O_4 \Leftrightarrow 2NO_2$ is expressed by $K_p = 4x^2P/\left(1-x^2\right)$ where Pis pressure, x is extent of decomposition. Which of the following statement is true ?

A. K_p increases with increase of P

B. K_p increases with increase of x

C. K_p increases with decrease of x

D. K_p remains constant with change in P or x

Answer: D

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7. (A) : For $N_2 + 3H_2 \Leftrightarrow 2NH_3$. Δ H =-Q KJ, high pressure yicldS more Ammonia

(R) According to Lechatlier's principle, increase of pressure shifts equilibrium in a direction that proceeds in decrease in number of moles.

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8. (A): The degree of decomposition of $PC1_5$ is more at low pressures.

(R) : In a reversible reaction, on increasing the pressure the equilibrium shifts in the direction in which decrease in volume takes place.

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9. $CaCO_3 \Leftrightarrow CaO + CO_2$ reaction in a lime kiln goes to completion because

A. It is a heterogeneous reaction

B. Backward reaction is very slow

C. CO_2 formed escapes out

D. K_C (or) K_p has no unit

Answer: C

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10. When the rate of formation of reactants is equal to the rate of formation of products, this is known as,

A. Chemical reaction

B. Chemical equilibrium

C. Chemical kinetics

D. Chemical energetics

Answer: B

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11. Change in volume of the system does not alter the number of moles in which of the following equilibrium?

A. $N_{2(g)} + O_{2(g)} \Leftrightarrow 2NO_{(g)}$

B. $PCI_{5(g)} \Leftrightarrow PCI_{3(g)} + Cl_{2(g)}$

C. $N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$

D. $SO_2Cl_{2(g)} \Leftrightarrow SO_{2(g)} + Cl_{2(g)}$

Answer: A

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12. For $2SO_2 + O_2 \Leftrightarrow 2SO_3$. Δ H = - Q KJ. as per Lechatelier's principle which of the following changes favours forward reaction, yielding more SO_3

(A) Adding more O_2 (B) Removing SO_3 (C) Applying high P

(D) Change of catalyst

A. A, B, C & D

B. A, B & D

C. A & D

D. A, B & C

Answer: D

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13. $H_2O(I) \Leftrightarrow H_2O(g)$ $II) I_2(s) \Leftrightarrow I_2$ (vap) III) $H_2O(l) \Leftrightarrow H_2O$ (s) $\mathrm{IV}) CO_2(g) \Leftrightarrow CO_2$ (aq) Rise of T shifts equilibrium towards right in the case of

A. I & IV

B. II, III & IV

C. I & II

D. I, II & III

Answer: C

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14. $K_C$for $H_2 + 1/2O_2 \Rightarrow H_2O$ at 500 K is 2.4×10^{47} . Now backward reaction is fovoured by

A. High P

B. High T

C. Presence of Pt

D. Addition of He (g)

Answer: B

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15. In the equilibrium $NH_4HS_s \Leftrightarrow NH_{3(g)} + H_2S_{(g)}$. the forward reaction can be favoured by

A. Adding some more NH_4HS

B. Adding some more NH_3

C. Removing some NH_3 from the reaction mixture

D. Adding some more H_2 S

Answer: C

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16. The following are some state ments regarding dissociation of lime stone according to the equation $CaCO_{3(s)} \Leftrightarrow CaO_{(s)} + CO_{2(g)}$: ΔH = 110 kJ. The reaction is carried in a closed vessel.

A) The pressure of CO_2 increases when temperature is inereased.

B) The pressure of CO_2 inereases when temperature is deereased

C) The pressure of CO_2 increases when amount of $CaCO_3$ is decreased.

The incorrect statements are .

A. A and B

B. B and C

C. A and C

D. All A, B, C

Answer: B

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17. Acetic acid dissociates as

$CH_3COOH \Leftrightarrow CH_3COO^- + H^+$. If a little amount of sodium acetate is added to its aqueous solution

A. The acid dissociates further

B. The H^+ ion concentration increases

C. The acid dissocitation is suppressed

D. The equilibrium is unaffected

Answer: C

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18. $N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$. If some HCl gas is passed into the reaction mixture at the equilibrium of this R reaction,

A. Equilibrium shifts towards left

B. Equilibriums shifts towards right

C. Concentration of H_2 increases

D. The equilibrium is not affected

Answer: B

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19. A gaseous phase reaction taking place in 1 lit at 400K is given N_2 (g) + $3H_2(g) \Leftrightarrow 2NH_3$ (g) starting with 1 mole N_2 and 3 moles H_2 equilibrium mixture required 250 ml of 1 M H_2SO_4 . Thus , Ke is

A. 0.006

B. 0.08

C. 0.029

D. 2.05

Answer: C

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20. In a reversible reaction $K_c > K_p$ and Δ H = + 40 K. Cal. The product will be obtained in less amount on

A. Increasing both pressure & temperature

B. Decreasing both pressure & temperature

C. Decreasing pressure & increasing temperature

D. Increasing pressure & decreasing temperature

Answer: B

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21. For the physical equilibrium ice $\Leftrightarrow$ water, the forward reaction is not favoured by

A. Increasing pressure

B. Increasing temperature

C. Keeping in contact with hot water

D. Taking more ice

Answer: D

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22. A reaction $N_2 + 3H_2 \Leftrightarrow 2NH_3 + 92\text{k.j}$ is at equilibrium. If the concentration of N_2 is increased the temperature of the system

A. decreases

B. increases

C. remains constant

D. becomes half

Answer: B

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23. In reversible reaction $CaF_{2(g)} \Leftrightarrow Ca^{+2}{}_{aq} + 2F^{-}_{(aq)^{+}}$, the concentration of fluoride ions was made halved, then equilibrium concentration of Ca^{+2}

A. increases by 2 times

B. decreases by 2 times

C. increases by 4 times

D. decreases by 4 times

Answer: C

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24. K_c Value of a gaseous reaction is Smole/lit. If pressure is increased.

A. Forward reaction is favoured

B. Backward reaction is favoured

C. Reaction is uneffected

D. K_c value increases

Answer: B

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25. Increase of pressure favours the forward reaction in the following equilibrium

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

B. $2NO_{2(g)} \Leftrightarrow N_2O_{4(g)}$

C. $PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}$

D. $N(2(g)) + O_{2(g)} \Leftrightarrow 2NO(g)$

Answer: B

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Lecture Sheet Exercise Ii More Than One Correct Answer Type Questions

1. Which of the following factors will not distrub the equilibrium state of the reaction $N_2(g) + O_2 \Leftrightarrow 2NO(g)$?

A. Change in pressure

B. Change in temperature

C. Addition of catalyst

D. Addtion of N_2

Answer: A::C

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2. For a physical equilibrium, H_2 O (Ice) $\Leftrightarrow$ H_2 O (Water) which of the following is the true statement:

A. The pressure change do not affect the equilibrium

B. More of ice melts, if pressure on the system is increased

C. More of liquid freezes, if pressure on the system is increased

D. More of ice melts, if temperature of the system is increased

Answer: B::D

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3. Consider the following 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 Cl_2 gas at constnat volume

C. introducing an inert gas at constant pressure

D. increasing the volume of the container

Answer: C::D

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4. For the given reaction $2A(g)+B(g) \Leftrightarrow C(g)$, $\Delta H = x$ kJ which of the following favour the reactants ?

A. Low pressure

B. High pressure

C. Low temperature

D. Catalyst

Answer: A::C

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5. For the following equilibrium, $H_2O(l) \Leftrightarrow H_2O(g)$ the increase in the pressure causes

A. formation of more H_2O(l)

B. formation of more H_2 O(g)

C. increase in the boiling point of H_2O(l)

D. decrease in boiling point of H_2O(l)

Answer: A::C

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6. When a sample of NO_2 is placed in a container, the equilibrium is rapidly established. If the equilibrium mixture is of a darker colour at high temperalures and at low pressures, which of the following statements about the reaction is true ? $2NO_2(g) - Q \Leftrightarrow N_2O_4$ (g)

A. Formation of N_2O_4 from NO_2 is exothermic and N_2O_4 is darker in colour than NO_2

B. Formation of N_2O_4 from NO_2 is exothermic and N_2O_4 is darker in colour than NO_2O_4

C. Rate of transformation of NO_2 to N_2O_4 is equal to the rate of transformation of N_2O_4 to NO_2 at equilibrium

D. There is no change in the concentrations, colour, vapour density of reaction mixture, at equilibrium

Answer: B::C::D

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7. In which of the following systems, doubling the volunme of the container causes a shift of reaction to left ?

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

B. 2CO(g) + $O_2(g) \Leftrightarrow 2CO_2$ (g)

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

D. $PCI_5(g) \Leftrightarrow PCI_3(g) + Cl_2(g)$

Answer: B::C

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8. The pressure of an equilibrium mixture of the three gases NO, Cl_2 and NOCl2$NO(g) + Cl_2(g) \Leftrightarrow$ 2NOCl(g) is suddely decreased by doubling by doubling the volume of the container at constant temperature. When the system returns to equilibrium

A. the concentration of NOCI will be increased

B. the value of the equilibrium constant K_c will be increased

C. the number of moles of Cl_2 will be increased

D. the number of moles of NOCI will be decreased

Answer: C::D

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9. When $NaNO_3$ is heated in a closed vessel, O_2 is liberated and $NaNO_2$ is left behind. At equilibrium: $NaNO_{3(g)} \Leftrightarrow NaNO_{2(g)} + \frac{1}{2}O_{2(g)}$

A. addition of $NaNO_2$ favours reverse reaction

B. addition of $NaNO_3$ favours forward reaction

C. increasing temperature favours forward reaction

D. increasing pressure reduces the rate of forward reaction

Answer: C::D

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10. Which of the following factors will favour the backward reaction?

$Cl_2(g) + 3F_{2(g)} \Leftrightarrow 2ClF_{3(g)}$, ΔH= - ve

A. Addition of inert gas at constant pressure

B. Addition of Cl_2 gas

C. Increase in the temperature of reaction

D. Increasing the volume of the container

Answer: A::C::D

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Lecture Sheet Exercise Ii Linked Comprehension Type Questions

1. AT673 K. in the formation of NH_3 From N_2 and H_2 , the partial pressures of N_2, H_2 and and NH_3 at equilibrium are 0.5 , 1 and 9×10^{-3} atm respectively. $(N_2 + 3H_2 \Leftrightarrow + Q)$

Calculate K_c for the reaction.

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2. AT673 K. in the formation of NH_3 From N_2 and H_2 , the partial pressures of N_2, H_2 and and NH_3 at equilibrium are 0.5 , 1 and 9×10^{-3} atm respectively. $(N_2 + 3H_2 \Leftrightarrow + Q)$

Report ΔG° using K_p value

A. 22.66 kea

B. 11.33 keal

C. 61.33 keal

D. 30.2 keal

Answer: B

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3. AT673 K. in the formation of NH_3 From N_2 and H_2 , the partial pressures of N_2, H_2 and and NH_3 at equilibrium are 0.5 , 1 and 9×10^{-3} atm respectively. $(N_2 + 3H_2 \Leftrightarrow + Q)$

Report ΔK_C Value

A. 9.3 kCal

B. 430 kCal

C. 220 kCal

D. 0.293 kCal

Answer: D

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4. Equilibrium constants are given (in atm) for the following reactions at 0° C.

$SrCl_2.6H_2O(s) \Leftrightarrow SrCl_2.2H_2O(s) + 4H_2O(g), K_p = 5 \times 10^{-12}$

$Na_2HPO_4.12H_2O(s) \Leftrightarrow Na_2HPO_4.7H_2O(s) + 5H_2O(g), K_p = 2.43 \times 1$

$Na_2SO_4.10H_2O(s) \Leftrightarrow Na_2SO_4(s) + 10H_2O(g), K_p = 1.024 \times 10^{-27}$

The vapour pressure of water at 0° is 4.56 torr.

At what relative humidity will $Na_2SO_4.10H_2O$ be eflorescent when exposed to air at 0^C ?

A. above 33.33 %

B. below 33.33%

C. above 66.66%

D. below 66.66%

Answer: B

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5. Equilibrium constants are given (in atm) for the following reactions at 0° C.

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$Na_2SO_4.10H_2O(s) \Leftrightarrow Na_2SO_4(s) + 10H_2O(g), K_p = 1.024 \times 10^{-27}$

The vapour pressure of water at 0° is 4.56 torr.

At what relative humidity will Na_2SO_4 be deliquescent (ie., absorb moisture when exposed to the air) at 0° C ?

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Lecture Sheet Exercise Ii Matrix Matching Type Questions

1.

$Lis-I$	$List-II$
$(A) H_2(g)+I_2(g) \Leftrightarrow 2HI(g)$	(P) Unaffected by inert gas addition
$(B) CaCO_3(s) \Leftrightarrow CaO(s)+CO_2(g)$	(Q) Forward shift by rise in pressu
$(C) N_2(g)+3H_2+(g) \Leftrightarrow 2NH_3(g)$	(R) Unaffected by increase in pres
$(D) PCl_3(g) \Leftrightarrow PCl_3(g)+Cl_2(g)$	(S) ackward shift by rise in pressure

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2.

$Lis-I$	$List-II$
$(A) N_{2(g)}+3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$ (Exothermic)	(P) Forward shift by rise in pressu
$(B) 2SO_{2(g)}+O_{2(g)} \Leftrightarrow 2SO_{3(g)}$ (Exothermic)	(Q) affcted by change in pressure
$(C) N_{2(g)}+O_{2(g)} \Leftrightarrow 2NO(g)$ (Endothermic)	(R) Forward shift by rise in tempe
$(D)\ PCI_{5(g)} \Leftrightarrow PCi_{3(g)}+Cl_{2(g)}$ (Endothermic)	(S) Forward shift by lowering the

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Lecture Sheet Exercise Ii Integer Type Questions

1. For the reaction in equilibrium: $2NOBr_{(g)} \Leftrightarrow 2NO_{(g)} + Br_{2(g)}$ If P_{Br_2} is $\frac{P}{9}$ t equilibrium and P is total pressure, If $\frac{P}{Kp} = x^2$ then what is x value.

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2. $N_2O_4 \Leftrightarrow 2NO_2$. At 300K N_2O_4 at 6 atmosphere is heated to 600K where equilibrium is established with a total pressure of 16 atmospheres. What is K_p at 600K ?

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3. One mole of N_2 and 3 mole of PCI_5 are placed in a 100 litre vessel heated to 227°c. The equilibrium pressure is 2.05 atm. Assuming ideal behaviour, If K_p of the reaction $PCl_5 \Leftrightarrow PCl_3 + Cl_2$ is $y \times 10^{-1}$ then what is 'y'?

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Practice Sheet Exercise I Level I Straight Objective Type Qestions

1. If $N_2 + 3H_2 \Leftrightarrow 2NH_3 \ldots (1) \& N_2 + 3H_2 \overset{Fe}{\Longleftrightarrow} 2NH_3 \ldots .$ (II) are in equilibrium at same temperature. Then

A. K_C of I $= K_c$ of II

B. K_c of I $= K_p of II$

C. K_C of I $< K_C$ of II

D. K_p of II $> K_p$ of I

Answer: A

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2. A vessel (A) contains I mole each of $N_2 \& O_2$ and another vesser (B) contains 2 mole each of $N_2 \& O_2$. 3oth vessels are heated to same

temperature till equilibrium is established in-both cases. Then, correct statement is

A. $K_C$for $N_2 + O_2 \Leftrightarrow$ 2NO in A & B are in the ratio 1:2

B. $K_P$for $N_2 + O_2 \Leftrightarrow$ 2NO in A & B are in the ratio 1:3

C. $K_C$for$N_2 + O_2 \Leftrightarrow$ 2NO in A & B are equal

D. $K_p$for $N_2 + O_2 \Leftrightarrow$ 2NO in A &B are in the ratio 2:1

Answer: C

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3. For the equilibrium reaction, $3Fe_{(s)} + 4H_2O_{(g)} \Leftrightarrow Fe_3O_{4(s)} + 4H_{2(g)}$ the relation between K_p and K_c is

A. $K_p > K_C$

B. $K_P < K_C$

C. $K_p = K_C x (RT)^{-2}$

D. $K_p = K_C$

Answer: D

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4. The following are some statements about equilibrium constant

(A) The value of K is affected by temperature

(B) The cquilibrium constant gives idea about the extent of completion of reaction

(C) The cquilibrium constant is affected by volume and pressure

the correct combination is

A. A and B

B. B and C

C. C and A

D. All

Answer: A

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5. For the reaction $CO_{(g)} + Cl_{2(g)} \Leftrightarrow COCl_{2(g)}$. $The K_p / K_c$ is equal to

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

B. 1

C. $\sqrt{RT}$

D. RT

Answer: A

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6. What is the equilibrium expression for the reaction, $P_{4(s)} + 5O_{2(g)} \Leftrightarrow P_4O_{10(s)}$? .

A. $K_c = \frac{[P_4O_{10}]}{[P_4][O_2]^5}$

B. $K_c = \frac{1}{[O_2]^5}$

C. $K_c = [O_2]^5$

D. $K_c = \frac{[P_4O_{10}]}{5[P_4][O_2]}$

Answer: B

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7. Which of the following is an irreversible reaction

A. $PCI_5 \rightarrow PCI_3 + Cl_2$

B. $2SO_2 + O_2 \rightarrow 2SO_3$

C. $N_2 + 3H_2 \rightarrow 2NH_3$

D. $2\mathrm{KClO}_3 \rightarrow 2\mathrm{KCi} + 3O_2$

Answer: D

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8. At a given temperature, Ke is 4 for the reaction $H_{2(g)} + CO_{2(g)} \Leftrightarrow H_2O_{(g)} + CO_{(g)}$. Initially 0.6 moles each of H_2 and CO_2 are taken in 1lit flask. The equilibrium concentration of $H_2O_{(g)}$ is

A. 0.4 M

B. 0.46 M

C. 0.2 M

D. 0.8 M

Answer: A

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9. One mole of $A_{(g)}$ is heated to 300° C in a closed one litre vessel till the following equilibrium is reached. $A_{(g)} \Leftrightarrow B_{(g)}$. The equilibrium constant of the reaction at 300° C is 4. What is the conc. of B $\left(\text{in. mole. lit}^{-1}\right)$ at equilibrium ?

A. 0.2

B. 0.6

C. 0.8

D. 0.1

Answer: C

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10. A(g) + 3(g) $\Leftrightarrow$ 4C(g) Initial concentration of A is equal to that of B. The equilibrium concentration of A and C are equal. K_c is equal to .

A. 0.08

B. 8

C. $1/8$

D. 80

Answer: B

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11. A vessel at 1000 K contains CO_2 with a pressure of 0.5 atm. Some of CO_2 is converted into CO on addtion of graphite. The value of K' at equilibrium when total pressure is 0.8 atm will be

A. 0.18 atm

B. 1.8 atm

C. 2 atm

D. 1 atm

Answer: B

Watch Video Solution

12. 1.2 moles of SO_3 are allowed to dissociate in a 2 litre vessel the reaction is $2SO_{3(g)} \Leftrightarrow 2SO_{2(g)} + O_{2(g)}$ and the concent ration of

oxygen at equilibrium is 0.1 mole per litre. The total number of moles at equilibrium will be

A. 2

B. 1.4

C. 0.8

D. 1.6

Answer: B

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13. Kp value for $2SO_{2(g)}O_{2(g)} \Leftrightarrow 2SO_{3(g)}$ is 5.0 atm^{-1}. What is the cquilibrium partial pressure of O_2 if the equilibrium pressures of SO_2 and SO_3 are equal ?

A. 0.2

B. 0.3

C. 0.4

D. 0.1 atm

Answer: A

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14. 20 gm of $CaCO_3$ is allowed to dissociate in a 5.6 litres container at 819° C. If 50% of $CaCO_3$ is dissocitated at equilibrium the $'K_p'$ value is

A. 5 atm

B. 1.6 atm

C. 4.8 atm

D. 10 atm

Answer: B

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15. Ata certain temperature, the degree of dissociationof PCI_3 was found to be 0.25 under a total pressure of 15 atm. The value of K_p for the dissociation of PCl_5 is

A. 1

B. 0.25

C. 0.5

D. 0.75

Answer: A

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16. HI was heated in a sealed tube at 440°C till the equilibrium was reached. HI was found to be 22% decomposed. The equilibrium constant for the dissociation of HI is $[2HI \Leftrightarrow H_2 + I_2]$

A. 0.282

B. 0.0796

C. 0.0199

D. 1.99

Answer: C

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17. Active mass of 0.64g SO_2 in 10 lit vessel is

A. 10^{-2} M

B. 10^{-3}M

C. 10^{-1} M

D. 0.64g

Answer: B

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18. An equilibrium mixture for the reaction, $2H_2S(g) \Leftrightarrow 2H_2(g) + S_2(g)$ has 1 mole of H_2S, 0.2 mole of H_2 and 0.8 mole of S_2 in 2 L flask . The value of K_C in mol L^{-1} is

A. 0.004

B. 0.08

C. 0.0016

D. 0.16

Answer: C

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19. When the molar concentrations of SO_2, O_2 and SO_3 at equilbrium at certain temperature are $0.5, 0.25$ & 0.25 M respectively, k_c for $2SO_3 \Leftrightarrow 2SO_2 + O_2$ is

A. 0.5 lit-mol^{-1}

B. $1\ \text{lit}^2 - mol^{-2}$

C. $1\ \text{mol-lit}^{-1}$

D. $0.25\ mol^2 - lit^{-2}$

Answer: C

Watch Video Solution

20. For the reaction $CO_{(g)} + \frac{1}{2}O_{2(g)}$, K_1 / K_c is

A. RT

B. $(RT)^{-1}$

C. $(RT)^{-1/2}$

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

Answer: C

Watch Video Solution

Practice Sheet Exercise I Level Ii Straight Objective Type Qestions

1. As per law of mass action, for $NH_4HS(s) \Leftrightarrow NH_3(g) + H_2S(g)$ ratio of rate constants of forward (K_f) & backword (K_b) reactions at equilibrium equals ot

A. $[NH_4HS]$

B. $P_{NH_3} + P_{H_2S}$

C. $[H_2S] + [NH_3]$

D. $[NH_3][H_2S]$

Answer: D

Watch Video Solution

2. Law of mass action can not be applied to

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

B. $PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}$

C. $S_{\text{Rhombic}} \Leftrightarrow S_{\text{Monoclinic}}$

D. $CaCO_{3(s)} \Leftrightarrow CaO_{(s)} + CO_{2(g)}$

Answer: C

Watch Video Solution

3. At a given temperature, for a reversible reaction, if the concentration of reactants is doubled then the equilibrium constant will

A. be doubled

B. be halved

C. change to 1/3

D. remain same

Answer: D

Watch Video Solution

4. The units of cquilibrium constant Kc for the following system $H_{2(g)} + l_{2(g)} \Leftrightarrow 2HI_{(g)}$ is

A. mole^{-1} lit

B. mot^{-2} litre

C. mole lit^{-1}

D. no units

Answer: D

Watch Video Solution

5. Consider the following equilibrium

$PCl(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$ in a closed container. At a fixed temperature, the volume of the reaction container is halved. For this change, which of the following statements holds true regarding the equilibrium constant (K_p) and degree of dissocitation (α) ?

A. Neither K_p nor α chnages

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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6. At equilibrium state

A. ΔG^0 = 0

B. Δ G = negative

C. Δ G = zero

D. ΔG = positive

Answer: C

Watch Video Solution

7. For which of the following reactions, the degree of dissociation (α) and equilibrium constant (K_p) are related as $K_p = \frac{4\alpha^2 p}{(1-\alpha^2)}$

A. $N_2O_{4(g)} \Leftrightarrow 2NO_{2(g)}$

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

C. $N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$

D. $PCI_{3(g)} + Cl_{(g)} \Leftrightarrow PCl_{5(g)}$

Answer: A

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8. When a system is in equilibrium state

A. The concentration of products is equal to the concentration of the reactants

B. The ratio of the product of active masses of products to reactants is constant

C. Number of moles of reactants and products is the same

D. The ratio of rate constants of the forward and backward reaction is always unity

Answer: B

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9. Attainment of equilibrium can be noticed with the help of constancy of which of the following physical properties ?

A. Intensity of colour

B. Density

C. Pressure

D. All the above

Answer: D

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10. A catalyst

A. Alters the equilibrium constant

B. Increases the equilibrium concentration of products

C. helps establishing the equilibrium quickly

D. Supplies energy to the reactants

Answer: C

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11. The following are some statements about chemical equilibrium.

(A) The rate of forward reaction is equal to the rate of backward reation.

(B) The chemical equilibrium can be established from reactant side only.

(C) The concentration of the reactants and products remain same with time. The correct statements are

A. A and B

B. A and C

C. B and C

D. All A , B , C

Answer: B

Watch Video Solution

12. A mixture of 2 moles of N_2 and 8 moles of H_2 are heated in a 2 lit vessel, till equilibrium is established. At equilibrium, 04 moles of N_2 was present. The equilibrium concentration of H_2 will be

A. 2 mole/lit

B. 4 mole/lit

C. 1.6 mole /lit

D. 1 mole /lit

Answer: C

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13. For the reaction $C(s) + CO_2(g) \Leftrightarrow$ 2CO(g). the partial pressures of CO_2 and CO are 2.0 and 4.0 atm respectively at equilibrium. What is the value of K_p for this reaction?

A. 0.5

B. 4

C. 8

D. 32

Answer: C

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14. The equilibrium conatant for the reaction $H_{2(g)} + I_{2(g)} \Leftrightarrow 2HI_{(g)}$ is 2 at a certain temperature. The equilibrium concentrations of H_2 and HI are 2 mole $.lit^{-1}$. What is the equilibrium concentration (in mole lit^{-1}) of I_2 ?

A. 16

B. 4

C. 8

D. 1

Answer: D

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15. Initially 0.8 mole of PCl_5 and 0.2 mole of PCl_3 are mixed in one litre vessel . At equilibrium 0.4 mole of PCl_3 is present . The value of K_C for the reaction $PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}$ is

A. 0.13 $molL^{-1}$

B. $0.05 mol L^{-1}$

C. 0.065 $mol L^{-1}$

D. $0.1 mol L^{-1}$

Answer: A

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16. $4 g H_2$ &$127 g I_2$ are mixed & heated in 10 lit closed vessel until equilibrium is reached. If the equilibrium concentration of HI is 0.05 M, total number of moles present at cquilibrium is

A. 3.25

B. 1.75

C. 2.25

D. 2.5

Answer: D

Watch Video Solution

17. A vessel at 1000 K contains CO_2 with a pressure of 0.5 atm. Some of CO_2 is converted into CO on addtion of graphite. The value of 'K at equilibrium when total pressure is 0.8 atm will be

A. 0.18 atm

B. 1.8 atm

C. 2 atm

D. 1 atm

Answer: B

Watch Video Solution

18. $3C_2H_2 \Leftrightarrow C_6H_6$ the above reaction is performed in a I lit vessel. Equilibrium is established when 0.5 mole of benzene is present at certain

tempe-rature. If equilibrium constant is 4 $lit^2 \text{mole}^{-2}$ The total number ot moles of the substances present at cquilibrium,

A. 0.5

B. 1

C. 1.5

D. 2

Answer: B

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19. 1.0 mole of ethyl alcohol and 1.0 mole of acctic acid are mixed. At equilibrium, 0.666 mole of ester is formed. The value of equilibrium constant is

A. $1/4$

B. $1/2$

C. 4

D. 3

Answer: C

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20. A mixture of Nitrogen and Hydrogen (1:3 mole ratio) is at an initial pressure of 200atm. If 20% of the mixture reacts by the time equilibrium is reached, the equilibrium pressure of the mixture is

A. Data insufficient

B. 180 atm

C. 170 atm

D. 160 atm

Answer: B

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Practice Sheet Exercise I Level Ii More Than One Correct Answer Type Qestions

1. In the preparation of MgO, the reaction is $MgCO_3(s) \Leftrightarrow$ =MgO(s) + $CO_2(g)$ Experiments carried out between $50^\circ C$ and 950° C led to a set of K_p values fitting an empirical equation log $K_p = 7.310 - \frac{8500}{T}$. If the reaction is carried out in quiet air, then

A. the complete decomposition temperature of the $MgCO_3 = 890^\circ$ C

B. K_p = 1 atm

C. P_{CO_2} = 1 atm

D. $K_p = 10$ atm

Answer: A::B::C

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2. The equilibrium constant of a chemical reaction

A. is constant at a given temperature

B. has only numerical value and carries no units

C. its value always depends upon the units in which the concentrations of species involved in chemical reaction are measured

D. changes if the sioichiometric coofficients of all the species involved in the chemical equation are changed

Answer: A::C

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3. In which of the following equilibrium, the value of K_p is less than K_c?

A. $N_2O_{4(g)} \Leftrightarrow 2NO_{2(g)}$

B. $N_2 + O_2 \Leftrightarrow$ 2NO

C. $N_2 + 3H_2 \rightarrow 2NH_3$

D. $2SO_2 + O_2 \Leftrightarrow b2SO_3$

Answer: C::D

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4. Which are correct for a reversible reaction

A. The reaction is never completed

B. These always attain equlibrium

C. At equilibrium only products are present

D. When the gaseous phase reaction is carried out in closed space, it attains equilibrium state after suitable time.

Answer: A::B::C

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5. Which of the following statements are correct about equilibrium constant for a gaseous phuse reaction.

A. Equilibrium constant cxpressed in terms of partial pressures has the unit of $(\text{concentration})^{\Delta n}$

B. Equilibrium constant expressed in terms of concentrations has the unit of $(\text{concentration})^{\Delta n}$

C. quilibrium constant expressed in terms of relative activity (i.e. the activity of substance relative to its activity in standard state has no unit.

D. Equilibrium constant is written simply ask° in terms of relative activity = $k_p \times p^{\circ}$ where p° = 100 k pa in standard state for gases

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

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6. Steam is passed over hot carbon to attain the equilibrium at 400k. $C_s + H_2O_{(g)} \Leftrightarrow CO_{(g)} + H(2(g))$. The equilibrium constant k = 1.34 (dimensionless) and the total pressure of the equilibrium mixture is 200 k.pa.

Which one is correct when equilibrium is attained

A. Mole fraction of CO = molefraction of $H_2 = 0.388$

B. Mole fraction of CO = molefraction of H_2 = 0.0.75

C. Mole fraction of H_2O = 0.224

D. Mole fraction of H_2O = 0.85

Answer: A::C

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7. Which of the following are correct about the reaction $A + 2B \Leftrightarrow C + D$

A. $K_p = \frac{n_C \times n_D}{n_A \times (n_B)^2} \times \left(\frac{p}{RT}\right)^{-1}$

B. $K_p = \frac{n_C \times n_p}{n_A \times (n_n)^2} \times \left(\frac{p}{\sum n}\right)^{-1}$

C. $K_p = \frac{n_C \times n_p}{n_A \times (n_B)^2} \times \left(\frac{V}{RT}\right)$

D. $K_c = \frac{(C](D)}{(A](B)^2}$

Answer: B::C::D

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8. Select the correct statements.

A. The value of Q_C for a given reaction is constant

B. A change in the physical state of gaseous product shows a change in the value of equilibrium constant of that reaction

C. The value of ratio of $\frac{Q_c}{K_c}$ can be used to predict the direction in which a system will proceed spontaneously towards equilibrium

D. The rate constans for forward and backward reaction for a reversible reaction always increases with temperature but their ratio $\left(i.\ e.\ \frac{k_f}{k_b}\right)$ may increase or decrease with temperature.

Answer: B::C::D

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9. For the reaction $AB_{2(g)} \Leftrightarrow AB_{(g)} + B_{(g)}$ if α is negligiable w.rt 1 then degree of dissociation (α) of AB_2 is proportional to

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

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

C. $\frac{1}{\sqrt{p}}$

D. $\sqrt{v}$

Answer: C::D

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10. Which of the following is correct about the chemical equilibrium ?

A. $(\Delta G)_{T.P} = 0$

B. Equlibrium constant is independent of intial concentration of reactants

C. Catalyst has no effect on equilibrium state

D. Reaction stops at equilibrium

Answer: A::B::C

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11. For the following type of revrsible reaction $N_2O_{4(g)} \Leftrightarrow 2NO_{2(g)}$

A. Equilibrium is possible only in a closed system at a given temperature

B. Both the opposing processes occur at the same rate and there is dynamic but stable condition

C. It can be represented as

D. (X) represents point of dynamic equilibrium

Answer: A::B::C

View Text Solution

12. For the reaction $N_2O_{4(g)} \Leftrightarrow 2NO_{2(g)}$. which of the following factors will have no cffect on the value of equilibrium constant ?

A. Temperature

B. Intial concentration of N_2O_4

C. resence of catalyst

D. pressure

Answer: B::C::D

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13. A reaction $S_{(g)} \Leftrightarrow 4S_{2(g)}$ is s carried out by taking 2 moles of $S_{8(g)}$ and 0.2 mole of $S_{2(g)}$ in a reaction vessel of l lit. Which one is not correct. If $K_c = 6.3 \times 10^{-6}$.

A. Reaction quotient is 8×10^{-4}

B. Reaction proceed in backward direction

C. Reaction proceed in forward direction

D. $K_p = 2.25 atm^3$

Answer: A::B::D

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14. For the equilibrium at 298 k, $N_2O_{4(g)} \Leftrightarrow 2NO_{2t(g)}$. $G^\circ N_2O_4 = 100$ kj mole^{-1} and $G^\circ NO_2 = 50$ kj mole^{-1} If 5 mole of N_3O_4 and 2 moles of NO_2 are laken intially in one litre container then which statement (S) are correct.

A. K_c = 1

B. $\Delta G = -0.55$kJ, ΔG° = 0

C. Reaction proceed in forward direction

D. At equilibrium $[N_2O_4]$ = 4.8 M and $[NO_2]$ = 2.212 m

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

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15. When two reactans A and B are mixed to give produets C and D, the reaction quotient Qat the initial Stage of the reaction

A. ls zero

B. Decrease with time

C. Is independent of time

D. Increase with time

Answer: A

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16. Which of the following dissociations can be encouraged by increasing the volume of the container at constant temperature ?

A. $2NO_{(g)} \Leftrightarrow N_{2(g)} + O_{2(g)}$

B. $N_2 + O_{5(s)} \Leftrightarrow 2NO_{2(g)} + \frac{1}{2}O_{2(g)}$

C. $H_2O_{(l)} \Leftrightarrow H_2O_{(g)}$

D. $CH_3COOH_{(aq)} \Leftrightarrow CH_3COO^- + H^+_{(aq)}$

Answer: B::C

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17. In which reaction the equilibrium constant value increases with increase in temperature ?

A. $H_2O_{(l)} \Leftrightarrow H_2O_{(g)}$

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

C. $H_2O_{(aq)} \Leftrightarrow H^+_{(aq)} + OH^-(aq)$

D. $N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$

Answer: A::B::C

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18. $SO_2Cl_2 \Leftrightarrow SO_2 + Cl_2(\text{gaseous }), PCl_5 \Leftrightarrow PCl_x + Cl_2$ (gaseous) of some SO_2 is removed from the ahove set of equillibria ocuring in same closed container ___

A. Degree of dissociation ofSO_2C1_2 decreases

B. Degree of dissociation of PCl_5 decreases

C. Degree of dissociation ofSO_2Cl_2 increases

D. Concentration of PCl_3 decreases

Answer: B::C::D

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19. Inereuse in volume of container does not effect the equilibria

A. $N_2 + O_2 \Leftrightarrow$ 2NO (gaseous)

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

C. $C_2H_5OH(l) + CH_3\text{COOH}(l) \Leftrightarrow CH_3\text{COOC}_2H_5(l) + H_2$O(l)

D. $PCl_5 \Leftrightarrow PCl_3 + Cl_2$ (gaseous)

Answer: A::C

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20. Which statements are 'incorrect about a chemical equilibrium A (gas) $\Leftrightarrow$ 2B (gas) ?

A. $'K_f'$ must be equal to $'K'_b$

B. At equilibrium $'K'_f$ and $'K'_b$ are equal

C. At any time [A] $<$ [B]

D. At any time $[A]^2$ [B] is equal to K_b / K_f

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

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Practice Sheet Exercise I Level Ii Linked Comprehension Type Questions

1. As per lechatelier's principle any equilibrium state nullifies the effect of a change imposed on it to establish new equilibrium state.

$N_2O_4(g) \Leftrightarrow 2NO_2(g)$, Δ H = +ve

Decomposition of N_2O_4 can be encouraged by.____

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2. As per lechatelier's principle any equilibrium state nullifies the effect of a change imposed on it to establish new equilibrium state.

$CuSO_4.5H_2O(s) \Leftrightarrow CuSO_4.3H_2O(s) + 2H_2O(g), K_p = 10^{-2} atm^2$

$H_2O(l) \Leftrightarrow H_2O(g), K_p = 100$ mm Hg

The given salt can act as efflourescent if it is kept in ____

A. air with 76% humidity

B. air with 66% humidity

C. air with 86% humidity

D. at any condition

Answer: B

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3. As per lechatelier's principle any equilibrium state nullifies the effect of a change imposed on it to establish new equilibrium state.

H_2O (Ice) $\Leftrightarrow$ H_2O (water) Delta H $<$ 0. Melting of ice is favoured by __

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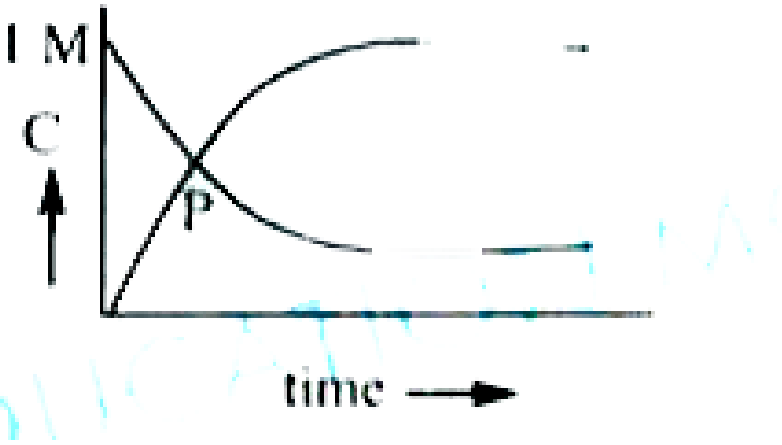
4.



At point P" of the reaction ___

A. [A] $>$ [B]

B. $K_c = Q_c$

C. r_f must be greater than r_b

D. $[A] = Q_c$

Answer: D

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Practice Sheet Exercise I Level Ii Matrix Matching Type Questions

	$Lis - I$(Reaction)	$List - II\left(\frac{K_p}{K_c}\right)$
	$(A)A_2(g) + 3B_2(g) \Leftrightarrow 2AB_3(g)$	$(P)(RT)^2$
1.	$(B)A_2(g) + B_2(g) \Leftrightarrow 2AB(g)$	$(Q)(RT)^\circ$
	$(C)A(s) + \frac{3}{2}B_2(g) \Leftrightarrow AB_3(g)$	$(R)(RT)^{1/2}$
	$(D)AB_2(g) \Leftrightarrow AB(g) + \frac{1}{2}B_2(g)$	$(S)(RT)^{-1/2}$

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	Column-I (F.R.Favourable)	COlumn-II
	$(A)H_{2(g)} + I_{2(g)} \Leftrightarrow 2HI_{(g)} + Q$	(P)High temperature
2.	$(B)2SO_{2(g)} + O_{2(g)} \Leftrightarrow 2SO_{3(g)} + Q$	(Q)Low temperature
	$(C)2NH_{3(g)} \Leftrightarrow N_{2(g)} + 3H_{2(g)} - Q$	(R)High pressure
	$(D)PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)} - Q$	(S)Low pressure

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3. For 2A + 2B $\Leftrightarrow 2C + 2D K_c = \frac{1}{16}$ then K_c for C + D $\Leftrightarrow$ A + B is _____

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4. In the reaction $C_{(s)} + CO_{2(g)} \Leftrightarrow CO_{2(g)}$, the equilibrium pressure is 6.75 atm. If 50% of CO_2 reacts then the find value of K_p.

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5. In a reaction at equilibrium, `x' mole of the reactant 'A' decompose to give I mole of C and D. It has been found that the fraction of A decomposed at equilibrium is independent of intial concentration of A. Find the value of x.

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Practice Sheet Exercise Ii Level I Straight Objective Type Questions

1. $A_{(s)} + B_{(g)} + \text{heat} \Leftrightarrow 2C_{(s)} + 2D_{(g)}$. At equilibrium the pressure of 'B is doubled. By what factor the concentration of 'D' should change, to reattain the equilibrium

A. $\sqrt{2}$

B. 2

C. 3

D. $\sqrt{3}$

Answer: A

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

A. Introduction of an inert gas at constant volume

B. Introduction of $PCl_{3(g)}$ at constant volume

C. Introduction of $PCl_{5(g)}$ at constant volume

D. Introduction of $Cl_{2(g)}$ at constant volume

Answer: C

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3. In the reaction $N_{2(g)} + O_{2(g)} \Leftrightarrow 2NO_{(g)}, \Delta H$ = + 180 kJ On increasing the temperature the production of NO

A. Increases

B. Decreases

C. Remains constant

D. Cannot be predicted

Answer: A

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4. For the Chemical reaction $A_{2(g)} + B_{2(g)} \Leftrightarrow$ 2 AB(g) the amount of AB at equilibrium is affected by

A. Temperature and pressure

B. Temperature only

C. Pressure only

D. Temperature, pressure and catalyst

Answer: B

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5. High temperature and high pressure (as per Lechatclier principle) favour

A. $N_2 + 3H_2 \Leftrightarrow 2NH_3. \Delta H = -Q_1$

B. $CaCO_3(s) \Leftrightarrow CaO(s) + CO_2, \Delta H = +Q_2$

C. $3Q_2 \Leftrightarrow 2O_3, \Delta H = +Q_3$

D. $N_2 + O_2 \Leftrightarrow 2NO, \Delta = +Q_4$

Answer: C

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6. For $CaCO_3(S) \Leftrightarrow CaO(s) + CO_2(g)$, ΔH = + Q at equilibrium. to shift equilibrium towards right,

A. $[CO_2]$ should be increased

B. $[CO_2]$ should be decreased

C. Pressure should be increased

D. Temperature should be decreased

Answer: B

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7. Yield of Ammonia will be more in Haber's process under _____ conditions (L = Low, H = high T = Temp, p = Pressure)

A. LT , LP

B. LT , HP

C. HT, HP

D. HT, LP

Answer: B

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8. $K_C$for $H_2 + 1/2O_2 \Rightarrow H_2O$ at 500 K is 2.4×10^{47} . Now backward reaction is fovoured by

A. High P

B. High T

C. Presence of Pt

D. Addition of He (g)

Answer: B

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9. With increase in temperature generally the value of the equilibrium constant of endothermic reversible reaction

A. Increases

B. decreases

C. Change can not be predicated

D. Does not change

Answer: A

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10. Le chatelier's principle is applicable to

A. Chemical equilibria only

B. Physical equilibria only

C. Both physical and chemical equilibria

D. Gaseous systems only

Answer: C

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11. In the dissociation of $CaCO_3$ in a closed vessel, the forward reaction is favoured by

A. adding some more$CaCO_3$

B. removing some CaO

C. increasing the pressure

D. removing CO_2

Answer: D

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12. K_C value of a gaseous reaction is 5mole/lit. If pressure is increased

A. Forward reaction is favoured

B. Backward reaction is favoured

C. Reaction is uneffected

D. K_C value increases

Answer: B

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13. K_p = 1, For the equilibrium $CaCO_{3(s)} \Leftrightarrow CaO_{(s)} + CO_{2(g)}$. The temperature of the reaction can be given as :

A. $T = \frac{\Delta S^\circ}{\Delta H^\circ}$

B. $T = \frac{\Delta H^\circ}{\Delta S^\circ}$

C. $T = \frac{\Delta G^\circ}{R}$

D. $T = \frac{\Delta G^\circ}{\Delta H^\circ}$

Answer: B

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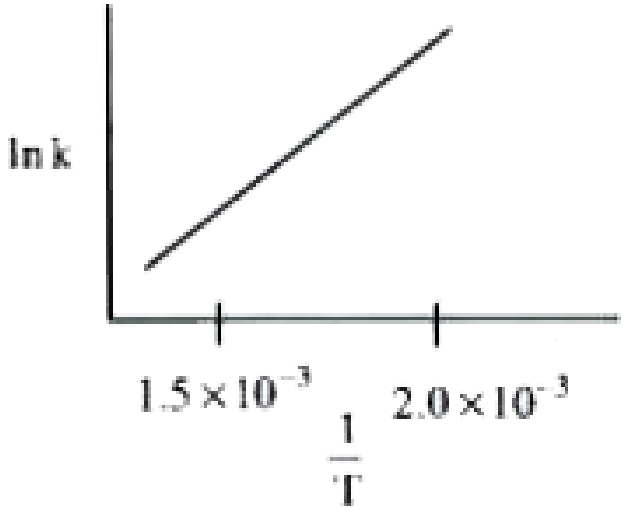
14. The graph relates in K_{eq}. Vs $\frac{l}{T}$ for a reaction. The reaction must be :



A. exothermic

B. endothermic

C. Δ is negligible

D. spontaneous

Answer: A

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15. Choose the incorrect statement .

A. $K_c = \frac{-\Delta G^\circ}{e^{RT}}$

B. More negative is ΔG° , larger is equilibrium constant

C. In complex formation equilibrium constant refers for formation constant of complex

D. Any equilibrium is influenced by increase in pressure

Answer: D

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16. For the equilibrium, $N_2O_4 \Leftrightarrow 2NO_2$, $(G^\circ N_2O_4)_{298}$ = 100 kJ/mole and $(G^\circ NO_2)_{298}$ = 50 kj/mole . When 5 mole / lit of each is taken, the value of Δ G for the reaction.

A. 3.99 kJ mole^{-1}

B. 39.9 kJ mole^{-1}

C. 3.99 j mole^{-1}

D. 39.9 J mole^{-1}

Answer: A

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17. At 627° C and one atmosphere SO_3 is is partially dissociated into SO_2 and O_2 by $SO_{3(g)} \Leftrightarrow SO_{2(g)} + \frac{1}{2}O_{2(g)}$. The density of the equilibrium mixture is 0.925 g/litre. What is the degree of dissociation ?

A. 0.74

B. 0.34

C. 0.68

D. 0.74

Answer: B

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Practice Sheet Exercise Ii Level Ii Straight Objective Type Questions

1. Which equilibrium in gaseous phase would be unaffected by an inerease in pressure ?

A. $N_2O_{4(g)} \Leftrightarrow 2NO_{2(g)}$

B. $N_{2(g)} + O_{2(g)} \Leftrightarrow 2NO_{(g)}$

C. $N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$

D. $CO_{(g)} + \frac{1}{2}O_{2(g)} \Leftrightarrow CO_{2(g)}$

Answer: B

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2. For the chemical reaction, $3X_{(g)} + Y_{(g)} \Leftrightarrow X_3Y_{(g)}$, the amount of X_3 Y at cquilibrium is affected by :

A. Temperature and pressure

B. Temperature only

C. Pressure only

D. Temperature, pressure and catalyst

Answer: A

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3. If pressure is applied to the equilibrium ofsolid $\Leftrightarrow$ liquid. The melting point of the solid

A. will not change

B. may increase or decrease depending upon the nature of solid

C. will always increase

D. will always decrease

Answer: B

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4. Vapour density of N_2O_4 of x 60° C is found to be 30.6 The degree of dissociation of N_2O_4 is :

A. 0.1

B. 0.2

C. 0.4

D. 0.5

Answer: D

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5. The intercepts and slope of graph of log K_p° Vs $\frac{1}{T}$ are :

A. $\Delta G^0, \Delta H^\circ$

B. $\frac{\Delta G^\circ}{2.303R}, \frac{\Delta H^\circ}{2.303R}$

C. $\frac{\Delta S^\circ}{2.303R}, \frac{-\Delta H^\circ}{2.303R}$

D. $\frac{\Delta H^\circ}{2.3003R}, \Delta S^\circ$

Answer: C

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6. Acertain rection has equilibrium constant 10 and 100 at 300K and 400K respectively. The ratio of ΔG° at 300K and 400K respectively

A. $\frac{1}{10}$

B. $\frac{3}{8}$

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

D. $\frac{3}{4}$

Answer: B

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7. Addition of I mole of N_2 is made to an equilibrium mixture of PCl_5 in a piston fittcd cylinder. Which of the following is correct.

A. No effect on equilibrium constant K_c or K_p

B. The degree of dissociation of PCl_5 decreases

C. The volume of container does not change

D. No effect on equilibrium concentration

Answer: A

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8. The value of $\log_{10}^{k}$ for the reaction : A $\rightarrow$ B , If ΔH° = - 55.07 kj mole^{-1} at 298K. $\Delta S^{\circ} = 10 jK^{-1}\text{mole}^{-1}$ at 298 K , R = 8.314 $jK^{-1}\text{mole}^{-1}$ and 2.303 $\times$ 8.314 $\times$ 298 = 5705 is

A. 5

B. 10

C. 95

D. 100

Answer: B

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9. One mole of $N_2O_{4(g)}$ at 300 K is kept in a closed container under latm. It is heated to 600K when 20% by mass of $N_2O_{4(g)}$ decomposes to $NO_{2(g)}$. The resultant pressure is :

A. 1.2 atm

B. 2.4 atm

C. 2.0 atm

D. 1.0 atm

Answer: B

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10. Select the incorrect statement :

A. Solubility of hydrated salts usually increases with temperature

B. White p $\rightarrow$ red p , Δ H = + ve

C. Dissolution of water soluble gas is always exothermic

D. Le-chatelier principle is not valid for solid-solid systems

Answer: B

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11. The standard internal energy change during the course of reaction at equilibrium at 300K : $2A_{(g)} + B_{(g)} \Leftrightarrow A_2B_{(g)}$ is : (Given , $K_p = 10^{-10} atm^{-2}$ and $\Delta S^{\circ} = 5jK^{-1}$)

A. -63.93 KJ

B. $+$ 63.93 KJ

C. $+58.94$ KJ

D. -58.94 KJ

Answer: B

Watch Video Solution

12. Densities of diamond and graphic are 3.5 and 2.5 gm/ml. $C_{\text{daimond}} \Leftrightarrow C_{\text{graphite}}, \Delta_t$ H = -1.9 KJ/ mole favourable conditions for formation of diamond are

A. high pressure and low temperature

B. low pressure and high temperature

C. high pressure and high temperature

D. low pressure and low temperature

Answer: C

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13. The yield of product in the reaction $2A_{(g)} + B_{(g)} \Leftrightarrow 2C_{(g)} + Q$ K J would be lower at :

A. low temperature and low pressure

B. high temperature and high pressure

C. low temperature and too high pressure

D. high temperature and low pressure

Answer: D

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14. The equilibrium constant K (in atm) for the reactio is 9 at 7 atm and 300 K, $A_{2(g)} \Leftrightarrow B_{2(g)} + C_{2(g)}$. calcuate the average molar mass (in gnm/mol) of an equilibrium mixture.

Given: Molar mass of A_2B_2 and C_2 are 70, 49 and 21 gm/mol fespectively.

A. 50

B. 45

C. 40

D. 37.5

Answer: C

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15. in manufacture of NO, the reaction $N_{2(g)} + O_{2(g)} \Leftrightarrow 2NO_{(g)}$. ΔH + ve is favourable if :

A. pressure is increased

B. pressure is decreased

C. Temperature is increased

D. Temperature is decreased

Answer: C

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16. For the following gases equilibrium $N_2O_{4(g)} \Leftrightarrow 2NO_{2(g)}$, K_p is found to be equal to K_c This is attained when temperature is

A. 0° c

B. 273 K

C. 1 K

D. 12.19 K

Answer: D

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17. log $\frac{K_p}{K_c}$ + log RT = 0 is true relationship for the following reaction

A. $PCI_5 \Leftrightarrow PCI_3 + Cl_2$

B. $2SO_2 + O_2 \Leftrightarrow 2SO_3$

C. $N_2 + 3H_2 \Leftrightarrow 2NH_3$

D. both b & c

Answer: B

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18. For the reaction $2NH_3 \Leftrightarrow N_2 + 3H_2$ equilibrium constant at 25°C and 400°C and 3.5 and 35 respcctively. This means that the forward reaction is:

A. Exothermic

B. endothermic

C. Exorgic

D. Onpredic table

Answer: B

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19. For a reversible system at equilibrium, which of the following is correct

A. $K = e^{\frac{-\Delta G^{\circ}}{RT}}$

B. $K = e^{\frac{-\Delta G}{RT}}$

C. $K = 10^{\frac{-\Delta G}{RT}}$

D. $10^{\frac{-\Delta G}{RT}}$

Answer: A

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20. What is the percentage dissociaiton of a substance if its vapour densities before and after dissociation are 30 and 15 respectively and I mole of its dissociation to 3 moles of products ?

A. 0.25

B. 0.5

C. 0.65

D. 0.75

Answer: B

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Practice Sheet Exercise Ii Level Ii More Than One Correct Answer Type Questions

1. Following two eqilibrium is simultaneously establised in a container $PCl_{s(g)} \Leftrightarrow PCl_{(3)(g)} + Cl_{(2)(g)}, CO_{(g)} + Cl_{2(g)} \Leftrightarrow COCl_{(2)(g)}.$

If some $Ni_{(g)}$ is introduced in the container forming $Ni(CO)_4$ then at new equilibrium

A. PCl_3 concentration will increase

B. PCl_3 concentration will decrease

C. Cl_2 concentration will remain same

D. CO concentration will remain same

Answer: B

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2. For the gas phase reaction $C_2H_4 + H_2 \Leftrightarrow C_2H_6(\Delta H = -32.7K.cal)$ carried out in a closed vessel, the equilibrium moles of C_2H_4 can be increased by

A. increasing the temperature

B. decreasing the pressure

C. removing some H_2

D. Adding some C_2H_6

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

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3. Decreasing in the pressure for the following equilibria: $H_2H_{(s)} \Leftrightarrow H_2O_{(l)}$ result in the :

A. Formation of more $H_2O_{(s)}$

B. Formation more $H_2O_{(l)}$

C. ncrease in melting point of $H_2O_{(s)}$

D. Decrease in melting point of $H_2O_{(s)}$

Answer: A::C

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4. Which are true for the reaction: $A_2 \Leftrightarrow 2C+ D$

A. If $\Delta H = 0 : K_p$ and dissociation of A_2 are independent of temperature

B. If $\Delta H = +ve : K_p$ increases with temperature and dissociation of A_2 increases

C. If $\Delta H = +ve : K_p$ increases with temperature and dissociation of $A(2)$ increases

D. $K_p = 4\alpha^3 \left[\frac{p}{1+2\alpha}\right]^2$

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

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5. For given two equilibrium attained in a container which are correct if degree of dissociation of A and A' are α and α^3

$A_{(s)} \Leftrightarrow 2B_{(g)} + C_{(g)}, Kp_1 = 8 \times 10^{-2}, A'_{(s)} \Leftrightarrow 2B_{(g)} + C_{(g)}, K_{p_2} =$

A. $\frac{K_{p_1}}{K_{p_2}} = \left[\frac{(3\alpha^1 + 2\alpha)}{(3\alpha + 2\alpha^1)}\right]^3 \times \frac{\alpha}{\alpha^1}$

B. $\frac{P^1C}{P^1D} = 4$

C. $P^1B = 2P^1C + 2P^1D$

D. $\alpha > \alpha^1$

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

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6. Van't Hoff equation is

A. $\left(\frac{d}{dT}\right)\text{in k} = \frac{-\Delta H}{RT^2}$

B. $\left(\frac{d}{dT}\right)\text{in k} = +\frac{-\Delta H}{RT^2}$

C. $\left(\frac{d}{dT}\right)\text{in k} = \frac{-\Delta H}{RT}$

D. K = A. $e^{-\frac{\Delta H}{RT}}$

Answer: B::D

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7. Which is / are correct ?

A. 2.303 log K = $\frac{-\Delta H^{\circ}}{RT} + \frac{\Delta S^{\circ}}{R}$

B. $\Delta G^{\circ} = -2.303$ RT log K

C. $-2.303 \log \mathrm{K} = \frac{-\Delta H^{\circ}}{RT^{2}} + \frac{\Delta S^{\circ}}{R}$

D. 2.303 log K = $\frac{1}{RT}(\Delta H^{\circ} + \Delta S^{\circ})$

Answer: B::D

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8. Which of the following will not affect the value of equilibrium constant of a reaction?

A. change in the concentration of reactants

B. change in temperature

C. change in pressure

D. addition of catalyst

Answer: A::C::D

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9. Heating a II group metal cabonate leads to decomposition on $\mathrm{BaCO}_{3(s)} \Leftrightarrow BaO_{(s)} + CO_{2(g)}$, equilibrium will shift left

A. By addition of $BaO_{(s)}$

B. By addition of $CO_{2(s)}$

C. By decreasing the temperature

D. By decreasing the volume of the vessel

Answer: B::C::D

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10. $AgCl_{(s)}$ is sparingly soluble salt, $AgCl_{(s)} \Leftrightarrow Ag^{+}_{(aq)} + Cl^{-}_{(g)}$ there is

A. Increase in solubility if $NH_{3(aq)}$ is added

B. Increase in solubilitu it NaCl or $AgNO_3$ is added

C. Decrease in solubility if KC! is added

D. Decrease in solubility if H_2O is added

Answer: A::C

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Practice Sheet Exercise Ii Level Ii Linked Comprehension Type Questions

1. As per Lechatlier's Principle any stress applied on the equilibrium state is minimised by shifting of equilibrium.

$PCl_5 \Leftrightarrow PCl_3 + Cl_2 \quad , \quad SO_2Cl_2 \Leftrightarrow SO_2 + Cl_2$

Both equilibria exist together in a flask. If some SO_2 is introduced into the flask _____

A. SO_2Cl_2 concentration decreases

B. degree of dissociation of PCI_5 decreases

C. degree of dissociation of PCI_5 increases

D. PCl_3 concentration decreases

Answer: C

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2. As per Lechatlier's Principle any stress applied on the equilibrium state is minimised by shifting of equilibrium.

In which cases introduction of inert gas shifts the equilibrium in forward direction at constant pressure ?

A. $\underset{(g)}{N_2} + \underset{(g)}{O_2} \Leftrightarrow \underset{(g)}{2NO}$

B. $N_2 + 3H_2 \Leftrightarrow 2NH_3$

C. $N_2O_4 \Leftrightarrow 2NO_2$

D. $S_8(R) \Leftrightarrow S_8$(M)

Answer: C

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3. As per Lechatlier's Principle any stress applied on the equilibrium state is minimised by shifting of equilibrium.

Increase in volume of container shifts the equilibrium in forward direction in the case of ____

A. $N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$

B. $CaCO_{3(s)} \Leftrightarrow CaO_{(s)} + CO_{2(g)}$

C. $N_{2(g)} + O_{2(g)} \Leftrightarrow 2NO_{(g)}$

D. $C_2H_5OH_{(l)} + CH_3COOH_{(l)} \Leftrightarrow CH_3COOC_2H_{5(l)} + H_2O_{(l)}$

Answer: B

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Practice Sheet Exercise Ii Level Ii Integer Type Questions

1. For the reaction at 298K: $A_{(g)} + B_{(g)} \Leftrightarrow C_{(g)} + D_{(g)} \Delta H^{\circ} +$ 29.8kcal and $\Delta S^{\circ} = 100 cal K^{-1}$. Find the value of equilibrium constant.

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2. At equilibrium, Kp = 1 then the value of AG° will be equal to.....

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Additional Practice Exercise Level I Straight Objective Type Questions

1. For the reaction in equilibrium $A \leftrightarrow B$

$\frac{[B]}{[A]} = 4.0 \times 10^{8}$ $\frac{-d[A]}{dt} = 2.3 \times 10^{6} S^{-1}[A]$ $\frac{-d}{dt}[B] = K$

Thus, K is

A. $1.1 \times 10^{-15} S^{-1}$

B. $5.8 \times 10^{-3} S^{-1}$

C. $1.7 \times 10^{2} S^{-1}$

D. $9.2 \times 10^{14} S^{-1}$

Answer: B

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2. $N_{2(g)} + 3H_{2(g)} \leftrightarrow 2NH_{3(g)}$ is a gaseous phase equilibrium reaction taking place at 400K in a 5 L flask. For this

A. $K_c = K_x$

B. $K_c = 25K_x$

C. $K_x = 25K_c$

D. $K_c = 25K_x$

Answer: B

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3. For the reaction. $SO_{2(g)} + \frac{1}{2}O_{2(g)} \Leftrightarrow SO_{s(g)}$. $IfK_p = K_c(RT)^8$. when the symbols have usual meaning. the value of x is (assuming ideality)

A. -1

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

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

D. $+1$

Answer: B

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4. For the following gaseous phase eqilibrium $PCl_{5(s)} \Leftrightarrow PCg_{3(g)} + Cl_{2(g)}$ Kp is found to be equal to K_x K_x is

equilibrium constant when concentratiion are taken in interms of mole fraction). This attained when

A. 1 atm

B. 0.5 atm

C. 2 atm

D. 4 atm

Answer: A

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5. A1 273 K and I atm, I Lof $N_2O_{4(g)}$ decomposes to $NO_{2(g)}$ as given, $N_2O_{4(g)}\,2NO_{2(g)}$, At equilibrium . original volume is 25% lessthan the exisiting volume percentage decomposition of $N_2O_{4(g)}$ is thus,

A. 0.25

B. 0.5

C. 0.666

D. 0.3333

Answer: D

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6. A sample of $N_2O_{4(g)}$ with a pressure of I atm is placed in a flask. When equilibrium is reached, 20% $N_2O_{4(g)}$ has been converted to $NO_{2(g)}$. $N_2O_{4(g)} \Leftrightarrow 2NO_{2(g)}$, If the orginal pressure is made 10% of the earlier, then percent dissociation will be

A. 0.2

B. 0.42

C. 0.54

D. 0.62

Answer: C

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7. $H_2S_{(g)}$ intially at a pressure of 10 atm anda temperature of 800K, dissociates as $2H_2S_{(g)} \Leftrightarrow 2H_2 + S_{2(g)}$ At equilibrium, the partial pressure of S, vapour is 0.02 atm. Thus, K_p is

A. 3.23×10^{-7}

B. 6.45×10^{-7}

C. 1.55×10^{6}

D. 6.2×10^{-7}

Answer: A

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8. On taking 60 g CH_3COOH and 46g CH_3CH_2OH in a 5 lit. lask in tle presence of H_3O^+ (catalyst), at 298K 44 g of $CH_3COOC_2H_5$ is formed at equilibrium. If amount of CH_3COOH is doubled without affecting amount of CH_3CH_2OH then, $CH_3COOC_2H_5$ formed is

A. 20.33 g

B. 22g

C. 44 g

D. 58.66 g

Answer: D

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9. The rate constant for a forward reaction in a reversible reaction $\left(K_{eq} = 10^6\right)$ is 10^2 . Calculate rate constant for its backward reaction

A. 10^4

B. 10^{-4}

C. 10^{-6}

D. 10^6

Answer: B

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10. K_p for the reaction $N_2 + 3H_2 \Leftrightarrow 2NH_3$, is $1.6 \times 10^{-4} atm^{-2}$ at 400° C. What will be K_p at 500° C ? Heat of reaction in this temperature range is-25.14 Kcal.

A. $1.43 \times 10^{-5} atm^{-2}$

B. $1.43 \times 10^{5} atm^{-2}$

C. $1.43 \times 10^{-5} atm^{2}$

D. $1.43 \times 10^{5} atm^{2}$

Answer: A

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11. For the reaction $A_{(g)} + 3B_{(g)} \Leftrightarrow 2C_{(g)}$ at $27^\circ C$.2 mole of A, 4 moles of B and 6 moles of C are present in 2 lit vessel. If K_c for the reaction is 1.2, the reaction will proceed in

A. Forward direction

B. backward direction

C. neither direction

D. none of these

Answer: A

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12. The equilibrium constant K_c for the reaction $P_{4(g)} \Leftrightarrow 2P_{2(g)}$ is 1.4 at 400° C. Suppose that 3 moles of $P_{4(g)}$ and 2 moles of $P_{2(g)}$ are mixed in 2 litre container at 400° C. What is the value of reaction quotient (Q_c) ?

A. $\frac{3}{2}$

B. $\frac{2}{3}$

C. 1

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

Answer: B

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13. The equilibrium constant for the reaction $N_{2(g)} + O_{2(g)} \Leftrightarrow 2NO_{(g)}$ is 4×10^{-4} at 200K. In presence of a catalyste, equilibrium is attaincd ten times faster. Therefore, the equilibrium constant in the presence of the catalyst at 200K is

A. 40×10^{-4}

B. 4×10^{-4}

C. 4×10^{-3}

D. difficult to compute with out more data

Answer: B

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14. In the reaction $X_{(g)} + Y_{(g)} \Leftrightarrow 2Z_{(g)}$, 2 moles of X, I mole of Y and I mole of Z are placed in a 10 lit vessel and allowed to reach equilibrium. If final concentration of Z is 0.2 M, then K_c. for the given reaction is

A. 1.6

B. $\frac{80}{3}$

C. $\frac{16}{3}$

D. $\frac{3}{16}$

Answer: C

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15.

$CuSO_4.5H_2O_{(g)} \Leftrightarrow CuSO_4, 3H_2O_{(s)} + 2H_2O_{(g)}, K_p = 4 \times 10^{-4} atm^2$. If the vapour pressure of wateris 38 torr then percentage of relative humidity is: (Assume all data at constant temperature)

A. 4

B. 10

C. 40

D. 1

Answer: C

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Additional Practice Exercise Level Ii Lecture Sheet Advanced Straight Objective Type Questions

1. for the reaction $2A_{(g)} \Leftrightarrow B_{(g)} + 3C_{(g)}$, at a given temperature, K_c = 16. What must be the volume of the falsk, If a mixture of 2 mole cach A, B and C exist in equilibrium ?

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

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

C. 1

D. 2

Answer: B

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2. $N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$ for the reaction initially the mole ratio was 1: 3 of $N_2.H_2$. At equilibrium 50% of each has reacted. If the equilibrium pressure is p, the partial pressure of NH_3 at equilibrium is

A. $\frac{p}{3}$

B. $\frac{P}{4}$

C. $\frac{P}{6}$

D. $\frac{P}{8}$

Answer: A

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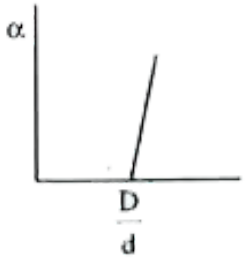
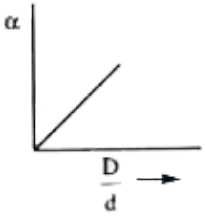
3. For the dissociation of PCI_5 into PCI_3 and Cl_2 in gaseous phase reaction, If "d' is the observed vapour density and 'D' theoretical vapour density with $'\alpha'$ as degree of dissociation. Variation of $\frac{D}{d}$ with $'\alpha'$ is given by which graph?

A.



B.



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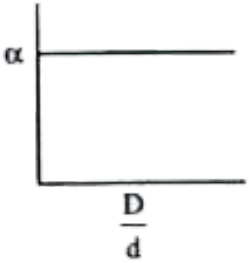

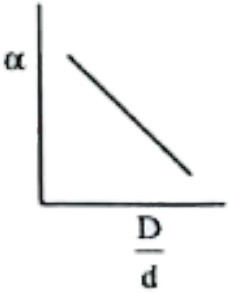

D.

Answer: A

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4. For the reaction $SnO_{2(s)} + 2H_{2(g)} \Leftrightarrow 2H_2O_{(g)} + Sn_{(d)}$. Calculate K_p at 900K, where the equilibrium steam hydrogen mixture was 45% H_2 by volume.

A. 1.49

B. 1.22

C. 0.67

D. 6.7

Answer: A

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5. At $200^\circ C PCl_5$ dissociates as follow , $PCl_{s(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}$. It was found that the equilibrium vapour. are 62 times as heavy as hydrogen. The degree of dissociation of PCl_5 at 200° C is nearly.

A. 0.1

B. 0.42

C. 0.5

D. 0.68

Answer: D

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6. The volume of the reaction vessel containing an equilibrium mixture is increased in the following reaction $SO_2Cl_{2(g)} \Leftrightarrow SO_{2(g)} + Cl_{2(g)}$ when equilbrium is re-establised.

A. The amount of $Cl_{2(g)}$ remains unchanged

B. The amount of $Cl_{2(g)}$ increases

C. The amount of $SO_2Cl_{2(g)}$ increases

D. The amount of $SO_{2(g)}$ decreases

Answer: B

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7. Some inert gas is added at constant volume to the following reaction at equilibrium. $NH_4H_{5(s)} \Leftrightarrow NH_{3(g)} + H_2S_{(g)}$ predict the effect of adding the inert gas.

A. The equilibrium shifts in the forward direction

B. The equilibrium shifts in the backward direction

C. The equilibrium remains unaffected

D. The value of K_p is increased

Answer: C

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8. For which of the following reactions is product formation favoured by low pressure and high temperature

A. $H_{2(g)} + I_{2(g)} \Leftrightarrow 2HI_{(g)}, \Delta H^\circ = -9.4$ KJ

B. $CO_{2(g)} + C_{(s)} \Leftrightarrow 2CO_{(g)}, \Delta H^\circ = 172.5$ KJ

C. $CO_{(g)} + 2H_{2(g)} \Leftrightarrow CH_3OH, \Delta H^\circ = -21.7$KJ

D. $3O_{2(g)} \Leftrightarrow 2O_{3(g)}, \Delta H^\circ = 285$ KJ

Answer: B

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9. For the reaction at 300 K $A_{(g)} \leftrightarrow V_{(g)} + S_{(g)}$. $\Delta_t H^\circ = -30\text{KJ/mol}\, \Delta_t S^\circ = -0.1K.J.K^{-1}.\text{mole}^{-1}$ What Is the value of equilibrium constant ?

A. 0

B. 1

C. 10

D. 0.1

Answer: B

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10. For a reaction, the value of K_p increases with increase in temperature . The Delta H for the reaction would be

A. positive

B. negative

C. zero

D. canot be predicted

Answer: A

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11. Kp for Lane's process is :

A. $\frac{P^4H_2}{P^4H_2O}$

B. $\frac{[Fe_3O_4]}{[Fe]}$

C. $\frac{P^4H_2O}{P^4H_2}$

D. $\frac{P^4H_2}{P^4H_2O} \times \frac{[Fe_3O_4]}{[Fe]}$

Answer: A

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12. Phosgene gas $(COCl_2)$ dissociates to carbon monoxide gas and chlorine gas with a change of pressure from 450 mm Hg to 600 mm Hg. If volume and temperature remain constant through out the experiment the value of K_p is:

A. 400

B. 200

C. 115

D. 75

Answer: D

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13. 1.1 mole of A and 2.2 moles of B reach an cquilibrium in I lit container according to the reaction. $A + 2B \Leftrightarrow$ 2C + D. If at equilibrium 0.1 mole of D is present, the equilibrium constant is:

A. 0.001

B. 0.002

C. 0.003

D. 0.004

Answer: A

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14. 10 moles of each N_2 and H_2 are made to react in a closed chamber. At equilibrium 40% of H_2 was left. The total moles in the chamber are :

A. 4.12

B. 41.2

C. 412

D. 0.412

Answer: A

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15. For the change $N_2O_4 \Leftrightarrow 2NO_2$ what are the slope and intercept constants respectively of plot of degrece D of dissociation a (Y - axis) and $\frac{D}{d}$ (density before dissociation : density after dissociation)

A. 1, - 1

B. $-1, 1$

C. 1,1

D. $-1, \ -1$

Answer: A

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16. In the system $A_{(s)} \Leftrightarrow 2B_{(g)} + 3C_{(g)}$. If the concentration of C at equilibrium is increased by a factor of 2. It will casuse the equilibrium concentration of B to change to:

A. Two times the original value

B. one half of its original value

C. $2\sqrt{2}$ times its original value

D. $\frac{1}{2\sqrt{2}}$ times its original value

Answer: D

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17. The reaction Quotient (Q) predicts:

A. The direction of equilibrium to be attained

B. The ratio of activities at equilibrium ie., K_c

C. he ratio of activities at equilibrium i.e., K_c

D. All of these

Answer: D

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18. For the reaction equilibrium $2NOBr_{(g)} \Leftrightarrow 2NO2_{(g)} + Bz_{2(g)}$. If $PBr_2 = \frac{p}{9}$ at equilibrium and P is total pressure, the ratio $\frac{K_p}{p}$ is equal to

A. $\frac{1}{9}$

B. $\frac{1}{81}$

C. $\frac{1}{27}$

D. $\frac{1}{3}$

Answer: B

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19. N_2O_4 is dissociated to 33% and 50% at total pressure P_1 and P_2 atm respectively. The ratio of $\frac{P_1}{P_2}$ is :

A. $\frac{7}{4}$

B. $\frac{7}{3}$

C. $\frac{8}{3}$

D. $\frac{8}{5}$

Answer: C

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20. For a system in equilibrium Δ G= 0 under conditions of constant:

A. Temperatue and pressure

B. Temperature and volume

C. Energy and volume

D. Pressure and volume

Answer: A

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Additional Practice Exercise Level Ii Lecture Sheet Advanced Matrix Matching Type Questions

1. When two reactants A and B are mixed to give products C and D, the reaction quotient (Q) at the intiai stages of the reaction:

A. zero

B. Decrease with time

C. Is independent of time

D. Increase with time

Answer: A::D

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2. Plots of log K Vs $\frac{1}{T}$ plots shows an intercept of 2 on y-axis with a slope of 45° for the studied reactions. Assuming that ΔH° and ΔS° as temperature independent, select the correct statement

A. $\Delta G^{\circ} = -2.75$ K. cal

B. ΔS° = 4.606 cal

C. ΔH° = - 4.606 cal

D. k = 100.8

Answer: A::C::D

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3. Lechatelier's principle is

A. If a system in equilibrium is subjected to a change of concentration, pressure or temperature, the equilibrium shifts in the direction that tends to a null the effect of change.

B. Applicable to all types of dynamic equilibrium

C. Given to study the effect of state variables

D. None of the above

Answer: A::B::C

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4.

$N_2O_2 \Leftrightarrow 2NO, K_1, \frac{1}{2}N_2 + \frac{1}{2}O_2 \Leftrightarrow NO. K_2, 2NO \Leftrightarrow N_2 + O_2. K_3, NO \Leftarrow$

A. $K_1 \times K_3 = 1$

B. $\sqrt{K_1} \times K_4 = 1$

C. $\sqrt{K_3} \times K_1 = 1$

D. $K_3 \times \sqrt{K_1} = 1$

Answer: A::B::C

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5. In 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 reaction

C. Increase in the yields of H_2

D. No effect

Answer: B

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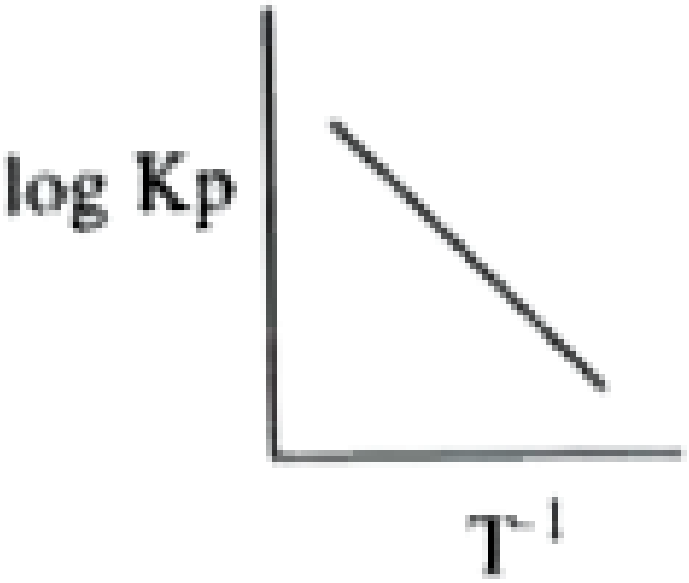
6. Variation of K_p with temperature T is given by for the following cqulibrium $2NH_{3(g)} \Leftrightarrow N_{2(g)} + 3H_{2(g)}$ Thus, decomposition of

$NH_{3(g)}$ can be prevented by



A. lowering the temperature

B. Increasing pressure

C. Isolation of $N_{2(g)}$ and $H_{2(g)}$

D. Adding $H_{2(g)}$

Answer: A::B::D

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7. Select the correct relationship for the given eqilibrium

A.

$N_{2(g)} + O_{2(g)} \Leftrightarrow 2NO_{(g)}, K_{eq} = K_1, NO_{(g)} \Leftrightarrow \frac{1}{2}N_{2(g)} + \frac{1}{2}O_{2(g}$

thus , $K_1K_2^2$ = 1

B. Free energy change is ΔG_1° for

$2NO_{2(g)} \Leftrightarrow N_2O_{4(g)}$ and ΔG_2° for $\frac{1}{2}N_2O_{4(g)} \Leftrightarrow NO_{2(g)}$ then

$2\Delta G_2^\circ + \Delta G_1^\circ$ = 0

C. Vont't Hoff equation is $\Delta_r H^\circ \left[\frac{1}{T_2} - \frac{1}{T_1}\right] - \frac{\Delta G^\circ}{T_2} - \frac{\Delta_r . \Delta G^\circ}{T_1}$

D. Fo the equilibrium $A_{(g)} \Leftrightarrow 2B_{(g)}, x = \sqrt{\frac{K_p}{K_p + 4p}}$ (x = degree of

dissociation)

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

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8. For the reaction, $N_2 + 3H_2 \Leftrightarrow 2NH_3$ in a vessel, equal moles of N_2 and H_2 are mixed to attain equilibrium.

A. $[N_2] = [H_2]$

B. $[N_2] > [H_2]$

C. $[N_2] < [H_2]$

D. $[H_2] > [NH_3]$

Answer: B

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9. In the dissociation of $2Hl \Leftrightarrow H_2 + l_2$, the degree of dissociaiton will be affected by the:

A. Addition of inert gas

B. Addition of H_2 of I_2

C. Increase of temperature

D. Increase of pressuree

Answer: C

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10. For the cqiuilibrium LiCI $3NH_{3(s)}$ LiCI $NH_{3(s)} + 2NH_{3(g)}$, Kp = 9 $atm^2 \text{at} 37^\circ$ C. A 5 lires vesel contains 0. 1 mole of LiCI NH_3. How many moles of NH_3 should be added to the llask at this temperature to derive the backward reaction for completion ?

A. 0.2

B. 0.59

C. 0.69

D. 0.79

Answer: D

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Additional Practice Exercise Level Ii Lecture Sheet Advanced Integer Type Questions

1. At elevated temperature , PCl_5 dissociates as $PCI_{5(a)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}$. At $300^\circ C, mK_p = 11.8$ and $[PCl_3] =$ | at equilibrium $[PCl_5] = x \times 10^{-4} \text{mol} L^{-1}$. What is the value of x ?

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2. What is K_p for the equation $2Cl_{(g)} \Leftrightarrow Cl_{(g)}$? When the system contains equal numberof $Cl_{(g)}$ atom and $Cl_{2(g)}$ molecules at 1 bar and 300 k

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3. For the equilibrium in gaseous phase in 2 lit flask we start with 2 moles of SO_2 and 1 mole of O_2 at 3 atm, $2SO_{2(g)} + O_{2(g)} \Leftrightarrow 2SO_{3(g)}$. When

equilibrium is attained, pressure changes to 2.5 atm. Hence, equilibrium constant K_c is :

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4. Hot copper turnnings can be used as "oxygen getter" for inert gas supplies by slowly passing the gas over the copper tumning at 650 K.

$$2Cu_{(s)} + \frac{1}{2}O_{2(g)} \Leftrightarrow Cu_2O_{(s)} : K_p = 7.5 \times 10^{10}$$

How many molecules of O_2 are left in 1 Lof a gas supply after equilibrium has been reached ?

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5. For a reversible reaction $A \underset{K_2}{\overset{K_1}{\rightleftharpoons}}$ B rate constant K_1 (forward) = $10^{15}e^{-\frac{200}{T}}$ and K_2 (backward) = $10^{12}e^{-\frac{200}{T}}$. What is the value of $\frac{-\Delta G^\circ}{2.303RT}$?

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Practice Sheet Advanced Straight Objective Type Questions

1. For the equilibrium $SO_2Cl_{2(g)} \Leftrightarrow SO_{2(g)} + Cl_{2(g)}$. What is the temperature at which $\frac{K_p(atm)}{K_c(M)} = 3$?

A. 0.027 k

B. 0.36 k

C. 36.54 k

D. 272 k

Answer: C

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2. $I_{2(aq)} + I^-_{(aq)} \Leftrightarrow I^-_{3(aq)}$. We started with I mole of I_2 and 0.5 mole of l^- in one litre flask. After equilibrium is reached, excess of $AgNO_2$ gave 0.25 mole of yellow precipitate. Equilibrium constant is

A. 1.33

B. 2.66

C. 2

D. 3

Answer: a

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3. The equilibrium constant K_c for the $SO_{2(g)} + NO_{2(g)} \Leftrightarrow SO_{3(g)} + NO_{(g)}$ reaction is 16. if 1 mole of each of all the four gases is taken in ldm^3 vessel, the equilibrium concentration of NO would be

A. 0.4 M

B. 0.6 M

C. 1 M

D. 1.6 M

Answer: D

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4. The equilibrium constant for the reaction $CO_{(g)} + H_2O_{(g)} \Leftrightarrow CO_{2(g)} + H_{2(g)}$ is 5. How many moles of CO_2 must be added to I lit container already containing 3 moles of each of CO and H_2O to make 2M equilibrium concentration of CO ?

A. 15

B. 19

C. 5

D. 20

Answer: b

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5. Ammonia under a pressure of 1.5 atm at 27° C is heated to 374° C in a closed vessel in the presence of a catalyst. Under the conditions, NH_3 is partially decomposed according to the equation. $2NH_3 \Leftrightarrow N_2 + 3H_2$ the vessel is such that the volume remains etfectively constant where as pressure increases to 50 atm. Calculate the percentage of NH_3 actually decomposed

A. 0.065

B. 0.613

C. 0.625

D. 0.64

Answer: B

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6. The following equilibrium constants were determined at 1120k :

$2CO_{(g)} \Leftrightarrow C_{(s)} + CO_{2(g)}, Kp_I = 10^{-14} atm^{-1}, CO_{(g)} 0 + Cl_{2(g)} \Leftrightarrow COCl_{2(g)},$

What is the equilibrium constant Kc for the following reaction at 1120K:

$$C_{(s)} + CO_{2(g)} + 2Cl_{2(g)} \Leftrightarrow 2CO_2Cl_{(g)}$$

A. $3.31 \times 10^{11} M^{-1}$

B. $5.5 \times 10^{10} m^{-1}$

C. $5.51 \times 10^{6} M^{-1}$

D. 3.31×10^{11} M

Answer: a

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7. Assume that the decomposition of HNO_3 can be represented by the following equation

$4HNO_{3(g)} \Leftrightarrow 4NO_{2(g)} + 2H_2O_{(g)} + O_{2(g)}$ and the reaction approaches equilibrium at 400K temperature and the copper turnning 0 atm pressure. At cquilibrium partial pressure of HNO_3 is 2 atm. Calculate Kc in $(\text{mole}/L)^3$ at 400 K.

A. 4

B. 8

C. 16

D. 32

Answer: D

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8. Consider the partial decomposition of A as $2A_{(g)} \Leftrightarrow 2B_{(g)} + C_{(g)}$ At equilibrium 700 m/ gaseous mixture contains 100 ml of gas C at 10 atm and 300K. What is the value of Kp for the reaction ?

A. $\frac{40}{7}$

B. $\frac{1}{28}$

C. $\frac{10}{28}$

D. $\frac{28}{10}$

Answer: c

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9. Determine the degree of association (polymerisation) for the reaction in aqueous solution . 6 HCHO $\Leftrightarrow C_6H_{12}O_6$. If observed molar mass of HCHO and $C_6H_{12}O_6$ is 150 :

A. 0.5

B. 0.833

C. 0.9

D. 0.96

Answer: D

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10. The equilibrium constant Kp for the reaction $N_2O_{4(g)} \Leftrightarrow 2NO_{2(g)}$ is 4.5. What would be the average molar naSs (in g/mol) of an eyuilibriunm mixture of N_2O_4 and NO_2 formed by the dissociation of pure V_2O_4 at a total pressure of 2 atm ?

A. 69

B. 57.5

C. 80.5

D. 85.5

Answer: b

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11. Rate of diffusion of ozonised oxygen is $0.4\sqrt{5}$ times that of pure oxygen. What is the percent degree of association of oxygen assuming pure O_2 in the sample initially ?

A. 20

B. 40

C. 60

D. 30

Answer: B

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12. The equilibrium constant for the ionisation of $RNH_{2(g)}$ in water as $RNH_{2(g)} + H_2O_{(l)} \Leftrightarrow \mathrm{RNH}_{3(aq)}^{+} + OH_{(aq)}^{-}$ is 8×10^{-6} at 25° C. Find the pH of a solution at equilibrium when pressure of $RNH_{2(g)}$ is 0.5 bar.

A. ≈ 12.3

B. ≈ 11.3

C. ≈ 11.45

D. ≈ 10.3

Answer: b

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13. The degree of dissociation is 0.4 at 400 K and a I atm for the gaseous reaction: $PCI_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}$: assuming ideal behaviour of gases, calculate the density of cquilibrium mixture at 400K and latm

A. 4.54 g/lit

B. 4.54 g/lit

C. 4.54 g/lit

D. None of these

Answer: A

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14. At some temperature and under a pressure of 4 atm, PCI_5 is 10% dissociated. Calculate the pressure at which PCI_5 will be 20% dissociated, temperature remaining same

A. 9.7 atm

B. 0.97 atm

C. 97 atm

D. 7.9 atm

Answer: b

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15. Equal moles of $F_{2(g)}$ and $Cl_{2(g)}$ are introduced into a sealed container and heated to temperature T to attain the following equilibria. $Cl_{2(g)} + F_{2(g)} \Leftrightarrow 2C/F_{(g)}, Kp_I = 3.2, Cl_{2(g)} + 3F_{2(g)} \Leftrightarrow 2CIF_{2(g)}, K$. If partial pressures of CIF and CIF_3 at equilibria are 0.2 and 0.04 atm respectively. What is the value of Kp_2 ?

A. $14.66 atm^{-2}$

B. 1.466 atm^{-2}

C. 14.66 atm^{-2}

D. 0.1466 atm^{-2}

Answer: A

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16. For , A + B $\Leftrightarrow$ C. the equilibrium concentration of A and B at a temperäture are 15 mol lit^{-1} When volume is doubled the reaction has equilibrium concentration of A as 10 mol lit^{-1} then

A. Kc 0.2 mole lit^{-1}

B. concentration of C in original equilibrium is 45M

C. Kc 0.2 mol^{-l} litre

D. as increasing volume the reaction proceeds in the backwarddirection

Answer: cd

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17. The degree of dissociation of N_2O_2 into NO_2 at one atmosphere and 40° C is 0.310. For this :

A. Kp 0.42 atm

B. Kc =0.003 mole lit^{-1}

C. Degree of dissociation at 10 atm pressure at same temperature α = 0.1025

D. Degree of dissociation α decreases with increase pressure a given temperature

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

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18. The heat of reaction for an endothermic reaction at constant volume in equilibrium is 1200 cal more than al constant pressure at 300K, then

A. $\Delta_{(g)} = -2$

B. $\frac{Kp}{Kc} = 1.648 \times 10^{-3}$

C. $\Delta n_{(g)} = +2$

D. $\frac{Kc}{Kp} = 1.648 \times 10^{-3}$

Answer: ab

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19. $H_2O(l) \Leftrightarrow H_2O_{(s)}, \Delta H = -q$ application of pressure on this equilibrium

A. causes formation of more ice

B. causes fusion of ice

C. has no effect

D. lower the melting point

Answer: B::D

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20. Which of the follow ing on the addition will cause deep red colour to disappeared ?

$$\underset{\text{pale yellow}}{Fe_{aq}^{3+}} + \underset{\text{colourless}}{SCN_{aq}^{-}} \Leftrightarrow \underset{\text{deep red}}{[Fe(SCN)]_{aq}^{2+}}$$

A. $AgNO_3$

B. $HgCl_2$

C. $H_2C_2O_4$

D. H_2O

Answer: A::B::C

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Practice Sheet Advanced Integer Type Questions

1. The values of Kp_1 and Kp_2 for the reaction given below are in the ratio 2: 1. If degree of dissociation of X and A are equal, then total pressure of equilibrium (1) and cquilibrium (2) are in the ratio

$X \Leftrightarrow Y + Z, Kp_1 : A \Leftrightarrow 2B : Kp_2$

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2. The variation of lnKc vs. $\frac{l}{T}$ gives straight line having an angle of 45° . The value of heat of reaction in Cal is ____

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3. For the equilibrium at 2.0 bar

$N_{2(g)} + 3H_{2(g)} \leftrightarrow 2NH_{3(g)} \left[\frac{\partial}{\partial p} \log K_x\right]$ = ?

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4. One lit of SO_3 was placed in a two litre vessels of a certain temperature. The following equilibrium was established in the vessel $2SO_{3(g)} \Leftrightarrow 2SO_{2(g)} + O_{2(g)}$ the equilibrium mixture reacted with 0.2 mole KMnO, in acidic medium. Kc value is $1.25x10^{-x}$ then the value of x is:

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5. The degree of dissociation of HI at a particular temperature is 0.8. 2M, 16×10^x ml of hypo solution required to neutralise the Iodine present in a equilibrium mixture of a reaction when 2 mole each of H_2 and I_2 are heated in a closed vessel of 2 lit capacity, then the value of x is

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