CHEMISTRY

BOOKS - MTG CHEMISTRY (ENGLISH)

EQUILIBRIUM

Mcq

1. Which of the following is not a general characteristic of equilibrium involving physical processes ?

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

B. (b) The equilibrium is dynamic in nature.

C. (c) Measurable properties of the system keep changing.

D. (d) Equilibrium can be attained from both sides of the reaction.

Answer: C

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2. Match the colume I with column II and mark the appropriate choice.

	Column I		Colu
(A)	Liquid $\Longleftrightarrow$ Vapour	(i)	Satu
(B)	Splid $\Longleftrightarrow$ Liquid	(ii)	Boili
(C)	Solid $\Longleftrightarrow$ Vapour	(iii)	Subli
(D)	Solute(s) $\Longleftrightarrow$ Solute(solution)	(iv)	Melt

A. $(A) \to (i), (B) \to (iii), (C) \to (ii), (D) \to (iv)$

B. $(A) \to (ii), (B) \to (iv), (C) \to (iii), (D) \to (i)$

C. $(A) \to (iv), (B) \to (ii), (C) \to (i), (D) \to (iii)$

D. $(A) \to (iii), (B) \to (iv), (C) \to (ii), (D) \to (i)$

Answer: B

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3. A reaction is said to be in equilibrium when

A. (a) the rate of transformation of reactants to products is equal to the rate of transformation of products to the reactants

B. (b) $50\ \%$ of the reactants are converted to products

C. (c) the reaction is near completion and all the reactants are converted to products

D. (d) the volume of reactants is just equal to the volume of the products.

Answer: A

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4. Which of the following is not true about a reversible reaction ?

A. (a) The reaction does not proceed to completion.

B. (b) It cannot be influenced by catalyst

C. (c) Number of moles of reactants and products is always equal.

D. (d) It can be attained only in a closed container.

Answer: C

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5. For the reaction : $PCl_5(g) \rightarrow PCl_3(g) + Cl_2(g)$:

A. (a) Equal volumes of PCl_5, PCl_3 and Cl_2 are present.

B. (b) Equal masses of PCl_5, PCl_3 and Cl_2 are present.

C. (c) The concentrations of PCl_5, PCl_3 and Cl_2 become constant.

D. (d) Reaction stops

Answer: C

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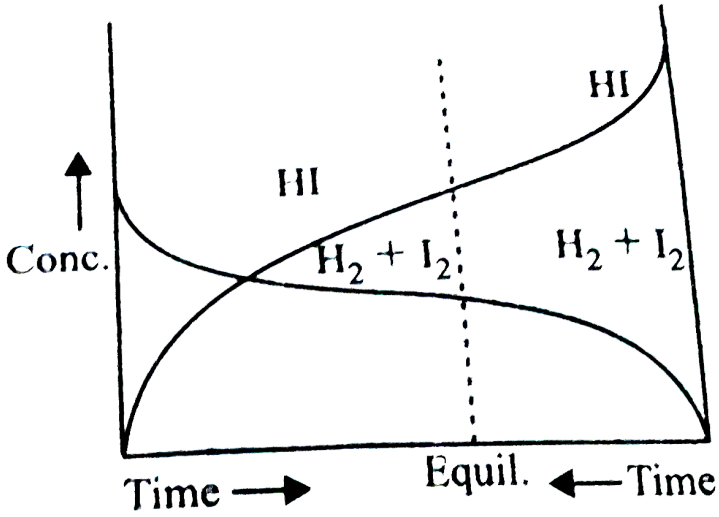
6. Consider the following graph and mark the correct statement.



A. Chemical equilibrium in the reaction, $H_2 + I_2 \Leftrightarrow 2HI$ can be attained from either directions.

B. Equilibrium can be obtained when H_2 and I_2 are mixed in an open vessel.

C. The concentration of HI keeps increasing with time.

D. We can find out equailibrium concentration of H_2 and I_2 from the given graph.

Answer: A

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7. For the reaction, $2SO_{2(g)} + O_{2(g)} \Leftrightarrow 2SO_{3(g)}$ What is K_c when the equilibrium concentration of $[SO_2] = 0.60M, [O_2] = 0.82M$ and $[SO_3] = 1.90M$?

A. (a) $12.229 Lmol^{-1}$

B. (b) $24.5 Lmol^{-1}$

C. (c) $36.0 Lmol^{-1}$

D. (d) $2.67 \times 10^3 Lmol^{-1}$

Answer: A

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8. PCl_5, PCl_3 and Cl_2 are at equilibrium at 500 K with concentration $2.1M$ PCl_3, $2.1M$ Cl_2 and $1.9M$ PCl_5.

The equilibrium constant for the given reaction is

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

A. (a) 2.32

B. (b) 1.79

C. (c) 4.2

D. (d) 3.8

Answer: A

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9. For the following reaction :

$NO_{(g)} + O_{3(g)} \Leftrightarrow NO_{2(g)} + O_{2(g)}$

The value of K_c is 8.2×10^4. What will be the value of K_c for the reverse reaction ?

A. (a) 8.2×10^4

B. (b) $\frac{1}{8.2 \times 10^4}$

C. (c) $\left(8.2 \times 10^4\right)$

D. (d) $\sqrt{8.2 \times 10^4}$

Answer: B

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10. If the equilibrium constant for the given reaction is 0.25 $NO \Leftrightarrow \frac{1}{2}N_2 + \frac{1}{2}O_2$, then the equilibrium constant for the reaction $\frac{1}{2}N_2 + \frac{1}{2}O_2 \Leftrightarrow NO$ will be

A. (a) 1

B. (b) 2

C. (c) 3

D. (d) 4

Answer: D

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11. If the equilibrium constant for the reaction,

$2XY \Leftrightarrow X_2 + Y_2$ is 81,

what is the value of equilibrium constant for the reaction

$XY \Leftrightarrow \frac{1}{2}X_2 + \frac{1}{2}Y_2$

A. (a) 81

B. (b) 9

C. (c) 6561

D. (d) 40.5

Answer: B

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12. If the value of equilibrium constant K_c for the reaction, $N_2 + 3H_2 \Leftrightarrow 2NH_3$ is 7. The equilibrium constant for the reaction $2N_2 + 6H_2 \Leftrightarrow 4NH_3$ will be

A. (a) 49

B. (b) 7

C. (c) 14

D. (d) 28

Answer: A

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13. At 473 K,K_c for the reaction

$PCl_{5(g)} \Leftrightarrow PCl_{3(g)}Cl_{2(g)}$ is 8.3×10^{-3}. What will be the value of K_c for the formation of PCl_5 at the same temperature ?

A. (a) 8.3×10^3

B. (b) 120.48

C. (c) 8.3×10^{-3}

D. (d) 240.8

Answer: B

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14. Which of the following is an example of homogeneous equilibrium ?

A. (a) $2SO_{2(g)} + O_{2(g)} \Leftrightarrow 2SO_{3(g)}$

B. (b) $C_{(s)} + H_2O_{(g)} \Leftrightarrow CO_{(g)} + H_{2(g)}$

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

D. (d) $NH_4NS_{(s)} \Leftrightarrow NH_{3(g)} + H_2S_{(g)}$

Answer: A

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15. Which of the following relations between the reactions and equilibrium constant for a general reaction $aA + bB \Leftrightarrow cC + dD$ is not correct ?

A. (1) $aA + bB \Leftrightarrow cC + dD : K_c$

B. (2) $cC + dD \Leftrightarrow aA + bB : K_c' = \frac{1}{K_c}$

C. (3) $naA + nbB \Leftrightarrow ncC + ndD : K_c'' = K_c^n$

D. (4) $aA + bB \Leftrightarrow cC + dD : K_c = K_p$

Answer: D

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16. 1 mole of NO 1 mole of O_3 are taken in a 10 L vessel and heated. At equilibrium, $50\,\%$ of NO (by mass) reacts with O_3 according to the equation :

$NO_{(g)} + O_{3(g)} \Leftrightarrow NO_{2(g)} + O_{2(g)}$.

What will be the equilibrium constant for this reaction ?

A. (a) 1

B. (b) 2

C. (c) 3

D. (d) 4

Answer: A

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17. When sulphur is heated at 900 K, S_8 is converted to S_2. What will be the equilibrim constant for the reaction if initial pressure of 1 atm falls by $25\ \%$ at equilibrium ?

A. (a) $0.75atm^3$

B. (b) $2.55atm^3$

C. (c) $25.0atm^3$

D. (d) $1.33atm^3$

Answer: D

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18. 5 moles of PCl_5 are heated in a closed vessel of 5 litre capacity. At equilibrium $40\ \%$ of PCl_5 is found to be dissociated. What is the value of K_c ?

A. (a) 0.266 M

B. (b) 0.133 M

C. (c) 2.5 M

D. (d) 0.20 M

Answer: A

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19. For a reaction, $2SO_{2(g)} + O_{2(g)} \Leftrightarrow 2SO_{3(g)}$, 1.5 moles of SO_2 and 1 mole of O_2 are taken in a 2 L vessel. At equilibrium the concentration of SO_3 was found to be 0.35 mol L^{-1} The K_c for the reaction would be

A. (a) 5.1L mol^{-1}

B. (b) 1.4L mol^{-1}

C. (c) 0.6L mol^{-1}

D. (d) 2.35L mol^{-1}

Answer: A

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20. 18.4 g of N_2O_4 is taken in a 1 L closed vessel and heated till the equilibrium is reached.

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

At equilibrium it is found that 50% of N_2O_4 is dissociated . What will be the value of equilibrium constant?

A. (a) 0.2

B. (b) 2

C. (c) 0.4

D. (d) 0.8

Answer: C

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21. 5 moles of SO_2 and 5 moles of O_2 react in a closed vessel. At equilibrium 60% of the SO_2 is consumed . The total number of gaseous moles$(SO_2, O_2 \text{ and } SO_3)$ in the vessel is :-

A. 5.1

B. 3.9

C. 10.5

D. 8.5

Answer: D

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22. At 500 K, the equilibrium costant for the reaction $H_{2(g)} + I_{2(g)} \Leftrightarrow 2HI_{(g)}$ is 24.8 If $\frac{1}{2} mol/L$ of HI is present at equilibrium, what are the concentrations of H_2 and I_2, assuming that we started by taking HI and reached the equilibrium at 500 K ?

A. 0.068mol L^{-1}

B. 1.020mol L^{-1}

C. 0.10mol L^{-1}

D. 1.20mol L^{-1}

Answer: C

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23. In the system $X + 2Y \Leftrightarrow Z$, the equilibrium concentration are,

$[X] = 0.06 \ \ \text{mol L}^{-1}$, $[Y] = 0.12 \ \ \text{mol L}^{-1}$,

$[Z] = 0.216 \ \ \text{mol L}^{-1}$. Find the equilibrium constant of the reaction.

A. 250

B. 500

C. 125

D. 273

Answer: A

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24. For the reaction $a + b \Leftrightarrow c + d$, initially concentrations of a and b are equal and at equilibrium the concentration of will be twice of that of a. What will be equilibrium constant for the reaction ?

A. 2

B. 9

C. 4

D. 3

Answer: C

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25. In the relation, $K_p = K_c(RT)^{\Delta n}$ the value of Δn is

A. number of moles of gaseous reactants-number of moles of gaseous products in a balanced equation

B. number of moles of gaseous products - number of moles of gaseous reactants in a balanced equation

C. number of moles of gaseous products $\times$ number of moles of gaseous reactants in a balanced equation

D. number of moles of gaseous reactants + number of moles of gaseous products in balanced equation

Answer: B

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26. For which of the following reaction $K_p = K_c$?

A. $PCl_{3(g)} + Cl_{2(g)} \Leftrightarrow PCl_{4(g)}$

B. $H_{2(g)} + Cl_{2(g)} \Leftrightarrow 2HCl_{(g)}$

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

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

Answer: B

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27. For the reaction $2NO_{2(g)} \Leftrightarrow N_2O_{4(g)}$, K_p / K_c is equal to

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

B. $\sqrt{RT}$

C. RT

D. $(RT)^2$

Answer: A

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28. For the reaction $N_{2(g)} + O_{2(g)} \Rightarrow NO_{(g)}$, the value of K_c at 800° C is 0.1 . What is the value of K_p at this temperature ?

A. 0.5

B. 0.01

C. 0.05

D. 0.1

Answer: D

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29. At 350 K, K_p for the reaction given below is $3.0 \times 10^{10} \text{bar}^{-1}$ at equilibrium. What be the value of K_c at this temperature ?

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

A. $7.4 \times 10^{11} \text{L mol}^{-1}$

B. $8715 \times 10^{10} \text{L mol}^{-1}$

C. 0.08L mol^{-1}

D. $8.715 \times 10^{11} \text{L mol}^{-1}$

Answer: D

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30. The value of K_c for the following equilibrium is

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

Given $K_p = 167$ bar at 1073 K.

A. $1.896 \ \ \text{mol L}^{-1}$

B. $4.38 \times 10^{-4} \ \ \text{mol L}^{-1}$

C. $6.3 \times 10^{-4} \ \ \text{mol L}^{-1}$

D. $6.626 \ \ \text{mol L}^{-1}$

Answer: A

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31. Calculate K_p for the equilibrium,

$NH_4HS_{(s)} \Leftrightarrow NH_{3(g)} + H_2S_{(g)}$

if the total pressure inside reaction vessel s 1.12 atm at $105.^\circ C$.

A. 0.56

B. 1.25

C. 0.31

D. 0.63

Answer: C

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32. $NH_4COONH_4(s) \Leftrightarrow 2NH_3(g) + CO_2(g)$. If equilibrium pressure is 3 atm for the above reaction, K_p will be

A. 27

B. 4

C. 3

D. 9

Answer: B

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33. The expression for equilibrium constant, K_c for the following reaction is

$$2Cu(NO_3)_{2(s)} \Leftrightarrow 2CuO_{(s)} + 4NO_{2(g)} + O_{2(g)}$$

A. $K_c = \dfrac{\left[CuO_{(s)}\right]^2\left[NO_{2(g)}\right]^4\left[O_{2(g)}\right]}{\left[Cu(NO_3)_{2(s)}\right]^2}$

B. $K_c = \dfrac{\left[NO_{2(g)}\right]^4\left[O_{2(g)}\right]}{\left[Cu(NO_3)_{2(g)}\right]^2}$

C. $K_c = \left[NO_{2(g)}\right]^4\left[O_{2(g)}\right]$

D. $K_c = \dfrac{\left[CuO_{(s)}\right]^2}{\left[Cu(NO_3)_{2(g)}\right]^2}$

Answer: C

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34. The expression for equilibrium constant, K_c for the following reaction is

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

A. $K_c = \frac{[Fe(OH)_3]}{[Fe^{3+}][OH^-]^3}$

B. $K_c = \frac{[Fe(OH)_3]}{[Fe^{3+}][OH^-]}$

C. $K_c = \frac{1}{[Fe^{3+}][OH^-]^3}$

D. $K_c = [Fe(OH)_3]$

Answer: C

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

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

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

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

D. d. $K_c = [O_2]^5$

Answer: B

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36. $N_2O_{4(g)} \Rightarrow 2NO_2, K_c = 5.7 \times 10^{-9}$ at 298 K. At equilibrium :-

A. a. concentration of NO_2 is higher than that of N_2O_4

B. b. concentration of N_2O_4 is higher than that of NO_2

C. c. both N_2O_4 and NO_4 have same concentration

D. d. concentration of N_2O_4 and NO_2 keeps on changing.

Answer: B

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37. In the following reaction:

$2NO_{(g)} + Cl_{2(g)} \Leftrightarrow 2NOCl_{(g)}$

it is observed that equilibrium is not attained and the rate of forward reaction is greater than rate of backward reaction. Which of the following

is true for the reaction ? (A) K p = Q p (B) Q p > K p (C) Q p < K p (D) Q p = 0

A. $K_p = Q_p$

B. $Q_p > K_p$

C. $Q_p < K_p$

D. $Q_p = 0$

Answer: C

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38. 0.6 moles of PCl_5, 0.3 mole of PCl_3 and 0.5 mole of Cl_2 are taken in a 1 L flask to obtain the following equilibrium ,

$PCl_{5(g)} \Rightarrow PCl_{3(g)} + Cl_{2(g)}$ If the equilibrium constant K_c for the reaction is 0.2 Predict the direction of the reaction.

A. a. Forward direction

B. b. Backward direction

C. c. Direction of the reaction cannot be predicted

D. d. Reaction does not move in any direction.

Answer: B

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39. The correct relationship between free energy change in a reaction and the corresponding equilibrium constant K_c is:

A. $\Delta G = RT\ln K_c$

B. $-\Delta G = RT\ln K_c$

C. $\Delta G^\circ = RT\ln K_c$

D. $-\Delta G^\circ = RT\ln K_c$

Answer: D

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40. For a reversible reaction at 298 K the equilibrium constant K is 200.

What is value of ΔG° at 298 K ?

A. a. $-13.13kcal$

B. b.-0.13kcal`

C. c. $-3.158kcal$

D. d. $-0.413kcal$

Answer: C

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41. The following reaction is at equilibrium ,

$$\underset{\text{Yellow}}{Fe^{3+}_{(aq)}} + \underset{\text{Colourless}}{SCN_{(aq)}} \Rightarrow \underset{\text{Deep red}}{[Fe(SNC)]^{2+}_{(aq)}}$$

$$K_c = \frac{[Fe(SCN)]}{[Fe^{3+}][SCN]}$$

In the above reaction , colour intensity of red colour can be increased by

:- (A) addition of KSCN (B) addition of oxalic acid which reacts with F e 3 +

ions (C) addition of H g 2 + ions which react with S C N − ions (D)red colour intensity cannot be changed

A. addition of KSCN

B. addition of oxalic acid which reacts with Fe^{3+} ions

C. addition of Hg^{2+} ions which react with SCN^{-} ions

D. red colour intensity cannot be changed.

Answer: A

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42. Consider the equilibrium set up :

$2H_{2(g)} + CO_{(g)} \Leftrightarrow CH_3OH_{(g)}$

What will be the effect of the following on the equilibrium of the reaction ?

(i) Addition of H_2 (ii) Addition of CH_3OH

(iii) Removal of CO (iv) Removal of CH_3OH

A.

	(i)	(ii)	(iii)
(a)	Forward direction	Backward direction	Backward direction

B.

	(i)	(ii)	(iii)
(a)	Backward direction	Backward direction	Forward direction

C.

	(i)	(ii)	(iii)
(a)	Forward direction	Forward direction	Backward direction

D.

	(i)	(ii)	(iii)
(a)	Backward direction	Forward direction	Forward direction

Answer: A

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43. Formation of ClF_3 from Cl_2 and F_2 is an exothermic process . The equilibrium system can be represented as

$Cl_{2(g)} + 3F_{2(g)} \Rightarrow 2ClF_{3(g)}, \Delta H = -329kJ$ Which of the following will increase quantity of ClF_3 in the equilibrium mixture ? i(A)ncrease in

temperature, decrease in pressure, addition of C l 2 (B)Decrease in temperature and pressure, addition of C l F 3 (C)Increase in temperature and pressure, removal of C l 2 (D) Decrease in temperature, increase in pressure, addition of F 2

A. Increase in temperature, decrease in pressure addition of Cl_2

B. Decrease in temperature and pressure, addition of ClF_3

C. Increase in temperature and pressure, removal of Cl_2

D. Decrease in temperature, increase in pressure, addition of F_2

Answer: D

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44. Which of the following reaction will not affected on increasing the pressure ?

A. $2H_{2(g)} + CO_{(g)} \Leftrightarrow CH_3OH_{(g)}$

B. $4NH_{3(g)} + 5O_{2(g)} \Leftrightarrow 4NO_{(g)} + 6H_2O_{(g)}$

C. $CH_{4(g)} + 2S_{2(g)} \Leftrightarrow CS_{2(g)} + 2H_2S_{(s)}$

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

Answer: C

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45. In which of the following reaction the increase in pressure will favour the increase in products ?

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

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

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

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

Answer: B

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46. In a vessel N_2, H_2 and NH_3 are at equilibrium. Some helium gas is introduction into the vessel so that total pressure increases while temperature and volume remain constant. According to Le Chatelier's principle, the dissociation of NH_3 (A)increases (B)decreases (C)remains unchanged (D)equilibrium is disturbed

A. increases

B. decreases

C. remains unchanged

D. equilibrium is disturbed.

Answer: C

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47. When I_2 dissociates to its atomic from the following reaction occurs :

$I_{2(g)} \Leftrightarrow 2I_{(g)}, \Delta H^\circ = +150 \text{ kJ mol}^{-1}$

The reaction is favoured at (a)low temperature (B)high temperature (C)no change with temperature (D)high pressure

A. low temperature

B. high temperature

C. no change with temperature

D. high pressure.

Answer: B

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48. For the reaction,

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

A. a. introducing an inert gas at constant volume

B. b.introducing Cl_2 at constant volume

C. c. introducing PCl_5 at constant volume

D. d. reducing the volume of the container.

Answer: C

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49. The reaction $2SO_2 + 2O_2 \Leftrightarrow 2SO_3$ will be favoured by

A. a. high temperature and low pressure

B. b. low temperature and high pressure

C. c. high temperature and high pressure

D. d. low temperature and low pressure.

Answer: B

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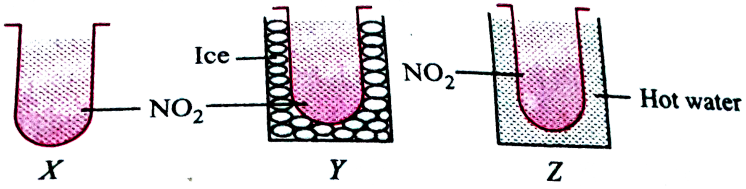
50. In an experiment, NO_2 gas is prepared and taken into 3 test tubes X,Y and Z. NO_2 gas which is brown in colour dimerises into N_2O_4 which is colourless. Test tube X is kept at roop temperature, Y is kept in ice and Z is kept in hot water. What colour changes will you observe in the test tubes and why

$$\underset{\text{Broun}}{2NO_{2(g)}} \Leftrightarrow \underset{\text{Colourless}}{N_2O_{4(g)}}, \Delta H = -57.2\text{kJ mol}^{-1}$$



A. a. In test tube X, brown colour intensifies since backward reaction is favoured at low temperature.

B. b.In test tube Y, brown colour intensifies since backward reaction takes place at roop temperature.

C. c. In test tube Z, brown colour intensifies since high temperature favours the backward reaction.

D. d. Brown colour of test tubes X,Y and remains same since there is no effect of change in temperature on the reaction .

Answer: C

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51. The yield of NH_3 in the reaction $N_2 + 3H_2 \Leftrightarrow 2NH_3, \Delta H = -22.08$kcal is affected by

A. change in pressure and temperature

B. change in temperature and concentration of N_2

C. change in pressure and concentration of N_2

D. change in pressure, temperature and concentration of N_2.

Answer: D

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52. According to Lewis concept acid is(A) proton donor (B)electron pair donor (C)proton acceptor (D)electron pair acceptor

A. proton donor

B. electron pair donor

C. proton acceptor

D. electron pair acceptor .

Answer: D

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53. Which of thef following is not Lewis acid

A. BF_3

B. $AlCl_3$

C. $FeCl_3$

D. PH_3

Answer: D

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54. Conjugate acid of SO_4^{2-} is

A. HSO_4^-

B. H^+

C. H_2SO_4

D. SO_4^{2-}

Answer: A

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55. Which of the following species can act both as an acid as well as a base ?

A. SO_4^{2-}

B. HSO_4^-

C. PO_4^{3-}

D. OH^-

Answer: B

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56. Classify the following as acid or base according to Bronsted - Lowry concept.

(i) CH_3COO^-

(ii) H_3O^+

(iii) SO_4^{2-}

(iv) HCl

A.	(i) Bronsted acid	(ii) Bronsted base	(iii) Bronsted base	(iv) Bronsted acid
B.	(i) Bronsted acid	(ii) Bronsted acid	(iii) Bronsted acid	(iv) Bronsted base

C. (i) Bronsted base | (ii) Bronsted acid | (iii) Bronsted base | (iv) Bronsted acid

D. (i) Bronsted acid | (ii) Bronsted acid | (iii) Bronsted base | (iv) Bronsted base

Answer: C

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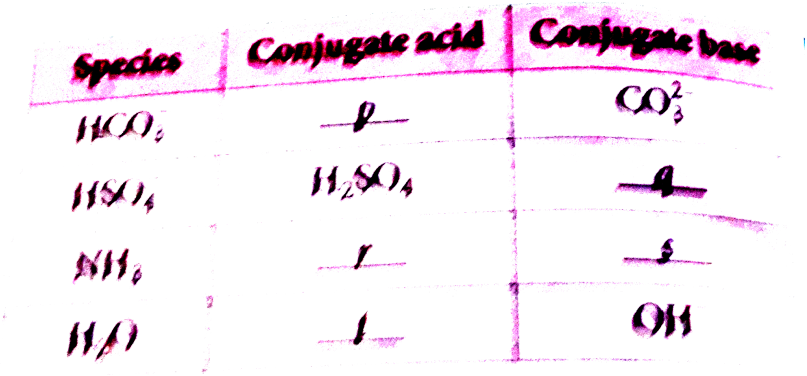
57. Fill in the blanks in the given table with the appropriate choice.



A. p H_2CO_3 | q SO_4^{2-} | r NH_4^+ | s NH_2^- | t H_3O^+

B. p HCO_3^- | q H_2SO_3 | r NH_2^- | s NH_4^+ | t H_3O^+

C. p H_2CO_3 | q H_2SO_3 | r NH_2^- | s NH_4^+ | t H_3O^+

D. p HCO_3^- | q H_2SO_4 | r NH_2^+ | s NH_2^- | t OH^-

Answer: A

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58. Nucleophiles are _____ while electrophiles are _____ .

A. Lewis bases, Lewis acids

B. Lewis acids, Lewis bases

C. Bronsted acids, Bronsted bases

D. Lewis acids Bronsted bases

Answer: A

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59. Which of the following salts will give basic solution on hydrolysis ?

A. NH_4Cl

B. KCl

C. K_2CO_3

D. $(NH_4)_2CO_3$

Answer: C

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60. Which of the following salts with a concentration .1 M will give a basic solution ? (A)Ammonium acetate (B)Ammonium chloride (C)Ammonium sulphate (D)Sodium acetate

A. Ammonium acetate

B. Ammonium chloride

C. Ammonium sulphate

D. Sodium acetate

Answer: D

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61. Which of the following salts does show its correct nature mentioned against it ?

A. KBr solution - Neutral

B. NaCN solution - Acidic

C. NH_4NO_3 solution - Acisdic

D. KF solution - Basic

Answer: B

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62.

Column I	Column II
$(A)CH_3COONa$	(i)Almost neutral$pH > 7$or < 7
$(B)NH_4CI$	(ii)Acidic$pH < 7$
$(C)NaNO_3$	(iii)Alkaline $pH > 7$
$(D)CH_3COONH_4$	(iv)Neutral $pH = 7$

A. $(A) \rightarrow (i), (B) \rightarrow (ii), (C) \rightarrow (iii), (D) \rightarrow (iv)$

B. $(A) \rightarrow (ii), (B) \rightarrow (iii), (C) \rightarrow (iv), (D) \rightarrow (i)$

C. $(A) \rightarrow (iii), (B) \rightarrow (ii), (C) \rightarrow (iv), (D) \rightarrow (i)$

D. $(A) \rightarrow (iv), (B) \rightarrow (i), (C) \rightarrow (iii), (D) \rightarrow (ii)$

Answer: C

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63. The pH of 0.001 M $Ba(OH)_2$ solution will be

A. 2

B. 8.4

C. 11.3

D. 2.7

Answer: C

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64. What will be the pH of 1×10^{-4} M H_2SO_4 solution ?

A. 10.4

B. 3.7

C. 3

D. 13

Answer: B

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65. Solution of a monobasic acid has a pH=5. If one mL of it is diluted to 1 litre, what will be the pH of the resulting solution ?

A. a.3.45

B. b.6.96

C. c.8.58

D. d.10.25

Answer: B

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66. If the pH of a solution is 2, the hydrogen ion concentration in moles per litre is

A. a. 1×10^{-14}

B. b.1×10^{-2}

C. c.1×10^{-7}

D. d.1×10^{-12}

Answer: B

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67. 0.05 mole of NaOH is added to 5 liters of water What will be the pH of the solution ?

A. a.12

B. b.7

C. c. 2

D. d. 10

Answer: A

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68. The concentration of hydrogen ion in a sample of soft drink is $3.8 \times 10^{-3} M$. What is its pH?

A. a. 3.8

B. b. 5.04

C. c. 2.42

D. d.9.2

Answer: C

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69. What is pOH of an aqueous solution with hydrogen ion concentration equal to $3 \times 10^{-5} \ \text{mol L}^{-1}$?

A. a. 9.47

B. b. 4.52

C. c. 12.69

D. d. 11.69

Answer: A

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70. The degree of ionisation of an acid HA is 0.00001 at 0.1 M concentration. Its dissociation constant will be

A. a. 10^{-9}

B. b. 10^{-11}

C. c. 10^{-8}

D. d. 10^{-7}

Answer: B

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71. What will be the ionisation constant of formic acid if its 0.01 M solution is 14.5% ionised ?

A. a. 2.1×10^{-4}

B. b. 14.5

C. c. 0.145

D. d.1.45×10^{-4}

Answer: A

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72. What is the percentage dissociation of 0.1 M solution of acetic acid ?

$\left(K_a = 10^{-5}\right)(A) 10\,\%\,(B) 100\,\%\,(C) 1\,\%\,(D) 0.01\,\%$

A. $10\,\%$

B. $100\,\%$

C. $1\,\%$

D. $0.01\,\%$

Answer: C

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73. NH_4CN is a salt of weak acid $HCN\left(K_a = 6.2 \times 10^{-10}\right)$ and a weak base $NH_4OH\left(K_b = 1.8 \times 10^{-5}\right)$. 1 molar solution of NH_4CN will be :-

A. neutral

B. strongly acidic

C. strongly basic

D. weakly basic.

Answer: D

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74. For poly basic acid , the dissociation constant have a different valves for each step.

$H_3A \Leftrightarrow H^+ + A, Keq = Ka_1$

$H_2A \Leftrightarrow H^+ + A^{-2}, Keq = Ka_2$

$HA^2 \Leftrightarrow H^+ + A^{3-}, Keq = Ka_3$

What is the observed trend of dissociation constant im successive stages ?

A. $K_{a_1} > K_{a_2} > K_{a_3}$

B. $K_{a_1} = K_{a_2} = K_{a_3}$

C. $K_{a_1} < K_{a_2} < K_{a_3}$

D. $K_{a_1} = K_{a_2} + K_{a_3}$

Answer: A

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75. Equimoler solulition of HF, HCOOH and HCN at 298 K have the values of Ka as 6.8×10^{-4}, 1.8×10^{-4} and 4.8×10^{-9} respectively, what will be the order of their acidic strength ? (A)H F > H C N > H C O O H (B)H F > H C O O H > H C N (C)H C N > H F > H C O O H (D)H C O O H > H C N > H F

A. $HF > HCN > HCOOH$

B. $HF > HCOOH > HCN$

C. $HCN > HF > HCOOH$

D. $HCOOH > HCN > HF$

Answer: B

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76. Given below are the dissociation constant values of few acids. Arrange them in order of increasing acidic strength.

$H_2SO_3 = 1.3 \times 10^{-2}, HNO_2 = 4 \times 10^{-4}$

$CH_3COOH = 1.8 \times 10^{-5}, HCN = 4 \times 10^{-10}$

A. a. $HCN < CH_3COOH < HNO_2 < H_2SO_3$

B. b. $CH_3COOH < HNO_2 < HCN < H_2SO_3$

C. c. $CH_3COOH < HCN < H_2SO_3 < HNO_2$

D. d. $HNO_2 < H_2SO_3 < CH_3COOH < HCN$

Answer: A

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77. pK_a of a weak acid is 5.76 and pK_b of a weak base is 5.25. What will be the pH of the salt formed by the two ?

A. 7.255

B. 7.005

C. 10.225

D. 4.255

Answer: A

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78. What is the pH of a solution obtained by mixing 10 mL of 0.1 M HCl and 40 mL 0.2 M H_2SO_4 ?(A) 0.74 (B)7.4 (C)4.68 (D)0.468

A. 0.74

B. 7.4

C. 4.68

D. 0.468

Answer: D

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79. Dissociation constant of CH_3COOH and NH_4OH in squeous solution are 10^{-5} if pH of a CH_3COOH solution is 3, what will be the pH of NH_4OH ?

A. 3.0

B. 4.0

C. 10.0

D. 11.0

Answer: D

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80. An acidic buffer solution can be prepared by mixing solution of

A. sodium acetate and acetic acid

B. ammonium acetate and ammonium hydroxide

C. sodium chloride and sodium hydroxide

D. potassium sulphate and sulphuric acid.

Answer: A

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81. Mark the appropriate choice to fill up the blanks in the given paragraph.

A solution which maintains constant pH when small amounts of acid or base are added is known as a $\underline{(i)}$. A mixture of acetic acid and sodium

acetate acts as (ii) with a pH around (iii) and a mixture of ammonium chloride and ammonium hydroxide acts as (iv) with a pH around (v)

A.

(i)	(ii)	(iii)	(iv)	(v)
buffer capacity	basic buffer	9.25	acidic buffer	4.75

B.

(i)	(ii)	(iii)	(iv)	(v)
buffer solution	acidic buffer	9.25	basic buffer	4.75

C.

(i)	(ii)	(iii)	(iv)	(v)
buffer solution	basic buffer	4.75	acidic buffer	9.25

D.

(i)	(ii)	(iii)	(iv)	(v)
buffer solution	acidic buffer	4.75	basic buffer	9.25

Answer: D

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82. For a reaction, $A_x, B_y \Leftrightarrow xA^{y+} + yB^{x-}$, K_{sp} xan be represented as

A. $\left[A^{y+}\right]^x\left[B^{x-}\right]^y$

B. $[A]^y[B]^x$

C. $[A]^x[B]^y$

D. $[A]^{x+y}[B]^{x-y}$

Answer: A

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83. The solubility product of $BaCl_2$ is 3.2×10^{-9}. What will be solubility in mol L^{-1}

A. 4×10^{-3}

B. 3.2×10^{-9}

C. 1×10^{-3}

D. 1×10^{-9}

Answer: C

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84. Solubility of CaF_2 is 0.5×10^{-4} mol L^{-1}. The value of K_{sp} for the salt is

A. a. 5×10^{-12}

B. b. 2.5×10^{-16}

C. c. 1×10^{-13}

D. d. 5×10^{-13}

Answer: D

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85. Match the column I with column II and mark the appropriate choice.

	Column I		Column II
(A)	$Fe(OH)_3$	(i)	$K_{sp} = s^2$
(B)	Ag_2CrO_4	(ii)	$K_{sp} = 27s^4$
(C)	CH_3COOAg	(iii)	$K_{sp} = 108s^5$
(D)	$Ca_3(PO_4)$	(iv)	$K_{sp} = 4s^3$

A. $(A) \to (iii), (B) \to (ii), (C) \to (iv), (D) \to (i)$

B. $(A) \to (ii), (B) \to (iv), (C) \to (i), (D) \to (iii)$

C. $(A) \to (i), (B) \to (iii), (C) \to (ii), (D) \to (iv)$

D. $(A) \to (iv), (B) \to (i), (C) \to (iii), (D) \to (ii)$

Answer: B

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86. solubility product of radium sulphate is 4×10^{-9}. What will be the solubility of Ra^{2+} in $0.10M\ NaSO_4$?

A. $4 \times 10^{-10} M$

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

C. $4 \times 10^{-5} M$

D. $2 \times 10^{-10} M$

Answer: A

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87. At $20^\circ C$, the Ag^+ ion concentration in a saturated solution Ag_2CrO_4 is $1.5x10^{-4}$ mol / litre. At $20^\circ C$, the solubility product of

Ag_2CrO_4 would be

A. 1.687×10^{-12}

B. 1.75×10^{-10}

C. 3.0×10^{-8}

D. 4.5×10^{-10}

Answer: A

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88. The solubility product of $AgCl$ is 1.56×10^{-10}find solubility in g/ltr

A. 143.5

B. 108

C. 1.57×10^{-8}

D. 1.79×10^{-3}

Answer: D

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89. What will be the solubility of AgCl in 0.05 M NaCl aqueous solution if solubility product of AgCl is 1.5×10^{-10} ?

A. 3×10^{-9} mol L^{-1}

B. 0.05 mol L^{-1}

C. 1.5×10^{-5} mol L^{-1}

D. 3×10^{9} mol L^{-1}

Answer: A

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90. Solubility product expression of salt MX_4 which is sparingly soluble with a solubility s can be given as

A. $256s^5$

B. $16s^3$

C. $5c$

D. $25s^4$

Answer: A

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91. Which of the following is not an application of solubility product ?

A. Predicting precipitation formation

B. Predicting solubility of sparingly soluble salt

C. Predicting pH of a buffer solution

D. Qualitative analysis

Answer: C

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92. Predict if there will be any precipitate by mixing 50 mL of 0.01 M NaCl and 50 mL of 0.01 M $AgNO_3$ solution. The solubility product of AgCl is 1.5×10^{-10}.

A. Since ionic product is greater than solubility product no precipitate will be formed.

B. Since ionic product is lesser than solubility product, precipitation will occur .

C. Since ionic product is greater than solubility product, precipitation will occur.

D. Since ionic product and solubility product are same, precipitation will not occur.

Answer: C

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93. The solubility product of AgCl is 1.8×10^{-10}. Precipitation of AgCl will occur only when equal volumes of solutions of :

A. 10^{-8}M Ag^+ and 10^{-8}M Cl^- ions

B. 10^{-3}M Ag^+ and 10^{-3}M Cl^- ions

C. 10^{-6}M Ag^+ and 10^{-6}M Cl^- ions

D. 10^{-10}M Ag^+ and 10^{-10}M Cl^- ions

Answer: B

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94. Calculate pH at which $Mg(OH)_2$ begins to precipitate from a solution containing $0.10MMg^{2+}$ ions. $\left(K_{SP}ofMg(OH)_2 = 1 \times 10^{-11}\right)$

A. 4

B. 6

C. 9

D. 7

Answer: C

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95. What is minimum concentration of SO_4^{2-} required to precipitate $BaSO_4$ in solution containing 1×10^{-4} mole of Ba^{2+} ? (K_{sp} of $BaSO_4 = 4 \times 10^{-10}$)

A. $4 \times 10^{-10} M$

B. $2 \times 10^{-10} M$

C. $4 \times 10^{-6} M$

D. $2 \times 10^{-3} M$

Answer: C

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96. A solution which is $10^{-3}M$ each in Mn^{2+}, Fe^{2+}, Zn^{2+}, and Hg^{2+} it treated with $10^{-16}M$ sulphide ion. If the K_{sp} of MnS, FeS, $ZnS$and HgS are 10^{-15}, 10^{-23}, 10^{-20},and 10^{-54}, respectively, which one will precipitate first?

A. FeS

B. MnS

C. HgS

D. ZnS

Answer: C

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Hots

1. 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.

A. a. 1.53

B. b. 0.153

C. c. 0.53

D. d. 0.76

Answer: B

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2. 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?

A. Forward

B. Backward

C. At equilibrium

D. Data is insufficient

Answer: B

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

$PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}, \Delta_r H^\circ = 124.0 \text{ kJ mol}^{-1}$

what would be the effect on reaction if the temperature is increased ?

A. Reaction will shift in the backward direction.

B. Reaction will shift in the forward direction.

C. Reaction is in equilibrium.

D. Reaction first moves forward and then remains at equilibrium.

Answer: B

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4. The ionisation constant of benzoic acid $(PhCOOH)$ is 6.46×10^{-5} and K_{sp} for silver benzoate is 2.5×10^{-3}. How many times is silver benzoate more soluble in a buffer of $pH3.19$ compared to its solubility is pure water?

A. a. 4

B. b. 3.32

C. c. 3.01

D. d. 2.5

Answer: B

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5. A solution which is 10^{-3} M each in Mn^{2+}, Fe^{2+}, Zn^{2+} and Hg^{2+} is treated with $10^{-16}M$ sulphide ion. If K_{sp} od MnS, ZnS and HgS are 10^{-15}, 10^{-25}, 10^{-20} and 10^{-54} respectively, which one will precipitate first ?

A. FeS

B. MnS

C. HgS

D. ZnS

Answer: C

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6. What will be the amount of $(NH_4)_2SO_4$ (in g) which must be added to 500 mL of 0.2 M NH_4OH to yield a solution of pH 9.35? $\left[\text{Given,} pK_a \text{of } NH_4^+ = 9.26, pK_b NH_4OH = 14 - pK_a\left(NH_4^+\right)\right]$

A. a. 5.35

B. b. 6.47

C. c. 10.03

D. d. 7.34

Answer: A

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Exemplar Problems

1. We know that the relationship between K_c and K_p is

$K_p = K_c(RT)^{\Delta n}$

What would be the value of Δn for the reaction :

$NH_4Cl_{(s)} \Leftrightarrow NH_{3(g)} + HCl_{(g)}$?

A. 1

B. 0.5

C. 1.5

D. 2

Answer: D

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2. For the reaction $H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$, the standard free energy is $\Delta G^{\Theta} > 0$. the equilibrium constant (k) would be. (A)K = 0 (B)K > 1 (C)K = 1 (D)K < 1

A. $K = 0$

B. $K > 1$

C. $K = 1$

D. $K < 1$

Answer: D

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3. Which of the following is not a general characteristic of equilibrium involving physical processes ? (A)Equilibrium is possible only in a closed system at a given temperature. (B)All measurable properties of system remain constant. (C)All the physical processes stop at equilibrium. (D)The opposing processes occur at the same rate and there is dynamic but stable condition.

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

B. All measurable properties of system remain constant.

C. All the physical processes stop at equilibrium.

D. The opposing processes occur at the same rate and there is dynamic but stable condition.

Answer: C

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4. PCI_5, PCI_3 and CI_2 are in equilibrium at 500 K in a closed container and their concentration are $0.8 \times 10^{-3}\ \text{mol}L^{-1}$ and $1.2 \times 10^{-3}\text{mol}L^{-1}$ and $1.2 \times 10^{-3}\text{mol}L^{-1}$ respectively. The value of K_c for the reaction $PCI_5(g) \Leftrightarrow PCI_3(g) + CI_2(g)$ will be

A. $1.8 \times 10^{3}\text{mol L}^{-1}$

B. 1.8×10^{-3}

C. $1.8 \times 10^{-3}\text{L mol}^{-1}$

D. 0.55×10^{4}

Answer: B

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5. Which of the following statements is incorrect ?

A. In equilibrium mixture of ice and water kept in perfectly insulated flask, amss of ice and water does not change with time.

B. The intensity of red colour increase when oxalic acid is added to a solution containing iron (III) nitrate and potassium thiocyanate.

C. On addition of catalyst, the equilibrium constant value is not affected.

D. Equilibroum constant for a reaction with negative ΔH value decreases as the temperature increases.

Answer: B

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6. When hydrochloric aicd is addded to cobalt and nitrate solution at room temperautre, the following reaction takes place and the reaction mixture becomes blue. On cooling the mixture it becomes pink. On the basis of this information mark the corect ansewer.

$\underset{\text{pink}}{\left[Co(H_2O)_6\right]^{3+}}(aq) + 4CI^- \Leftrightarrow$

$\underset{\text{blue}}{CoCI_4^{2-}}(aq) + 6H_2O(l)$ (A)Δ H > 0 for the reaction (B)Δ H < 0 for the reaction (C)Δ H = 0 for the reaction (D)The sign of Δ H cannot be predicted on the basis of this information

A. $\Delta H > 0$ for the reaction

B. $\Delta H < 0$ for the reaction

C. $\Delta H = 0$ for the reaction

D. The sign of ΔH cannot be predicted on the basis of this information.

Answer: A

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7. The Ph OF NEUTRAL WATER AT $25^\circ C$ is 7.0. As the temperature increases, ionisation of water increases, however the concentration of H^+ ions nad OH^- ions equal. What will be the ph of puire water at

$60^{\circ} C$? (A)Equal to 7.0 (B)Greater than 7.0 (C)Less than 7.0 (D)Equal to zero

A. Equal to 7.0

B. Greater than 7.0

C. Less than 7.0

D. Equal to zero

Answer: C

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8. The ionisation cosntabnt of an acid, K_a is the meaure of strength of an acid. The K_a values of acetic acid, hypochlorous acid and formic acid are 1.74×10^{-5}, 3.0×10^{-8} and 1.8×10^{-4} respectively. Which of the following orders of ph of 0.1 mol dm^{-3} solutions of these acids is correct ? (A)Acetic acid > Hypochlorous acid > Formic acid (B)Hypochlorous acid > Acetic acid > Formic acid (C)Formic acid >

Hypochlorous acid > Acetic acid (D)Formic acid > Acetic acid > Hypochlorous acid

A. Acetic acid $>$ Hypochlorous acid $>$ Formic acid

B. Hypochlorous acid $>$ Acetic acid $>$ Formic acid

C. Formic acid $>$ Hypochlorous acid $>$ Acetic acid

D. Formic acid $>$ Acetic acid $>$ Hypochlorous acid

Answer: B

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9. K_{a1},$K_{a2}$and K_{a3} are the respective ionisation constants for the following reactions.

$H_2S \Leftrightarrow H^+ + HS^-$,$HS^- \Leftrightarrow H^+S^{-2}$

$H_2S \Leftrightarrow 2H^+ + S^{2-}$

The correct relationship between K_{a1},$K_{a2}$and K_{a3} is

A. $K_{a_3} = K_{a_1} \times K_{a_2}$

B. $K_{a_3} = K_{a_1} + K_{a_2}$

C. $K_{a_3} = K_{a_1} - K_{a_2}$

D. $K_{a_3} = K_{a_1} / K_{a_2}$

Answer: A

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10. Acidity of BF_3 can be explained on ths basis of which of the follwoing concepts? (A)Arrhenius concept (B)Bronsted - Lowry concept (C)Lewis concept (D)Bronsted - Lowry as well as Lewis concept

A. Arrhenius concept

B. Bronsted - Lowry concept

C. Lewis concept

D. Bronsted - Lowry as well as Lewis concept

Answer: C

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11. Which of the following is true ?

A. $0.1 \text{ mol dm}^{-3} NH_4OH$ and $0.1 \text{ mol dm}^{-3} HCl$

B. $0.05 \text{ mol dm}^{-3} NH_4OH$ and $0.1 \text{ mol dm}^{-3} HCl$

C. $0.1 \text{mol dm}^{-3} NH_4OH$ and $0.05 \text{ mol dm}^{-3} HCl$

D. $0.1 \text{mol dm}^{-3} CH_3COONa$ and $0.1 \text{ mol dm}^{-3} NaOH$

Answer: C

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12. In which of the following solvents is silver chloride most soluble ?

A. $0.1 \text{mol dm}^{-3} AgNO_3$ solution

B. $0.1 \text{ mol dm}^{-3} HCl$ solution

C. H_2O

D. Aqueous ammonia

Answer: D

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13. What will be the value of pH of 0.01 $\text{mol dm}^{-3} CH_3COOH\left(K_1 = 1.74 \times 10^{-5}\right)$?

A. 3.4

B. 3.6

C. 3.9

D. 3.0

Answer: A

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14. K_a for CH_3COOH is 1.8×10^{-5} and K_b for NH_4OH is 1.8×10^{-5}

The pH of ammonium acetate will be :

A. 7.005

B. 4.75

C. 7.0

D. between 6 and 7

Answer: C

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15. Which of the following options will be correct for the stage of half completion of the reaction : $A \Leftrightarrow B$?

A. $\Delta G^\circ = 0$

B. $\Delta G^\circ > 0$

C. $\Delta G^\circ < 0$

D. $\Delta G^{\circ} = -RT \ln 2$

Answer: A

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16. On increasing the pressure, in which dirction will the gas phase reaction proceed to re-establish equilibrium, is predicated by applying the Le Chatelier's principle. Consider the reaction.

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

Which of the following is correct, if the total pressure at which the equlibrium is established, is increased without changing the temperature ?

A. K will remain same.

B. K will decrease.

C. K will increase.

D. K will increase initially and decrease when pressure is very high.

Answer: A

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17. What will be the correct order of vapour pressure of water, acetone and ether at $30.^{\circ} C$. Given that among these compounds, water has maximum boiling point and ether has minimum boiling point ? (A)Water < Ether < Acetone (B)Water < Acetone < Ether (C)Ether < Acetone < Water (D)Acetone < Ether < Water

A. Water $<$ Ether $<$ Acetone

B. Water $<$ Acetone $<$ Ether

C. Ether $<$ Acetone $<$ Water

D. Acetone $<$ Ether $<$ Water

Answer: B

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18. At 500 K, equlibrium constant, K_c for the following reaction is 5.

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

What would be the equilibrium constant K_c for the reaction $2HI(g) \Leftrightarrow H_2(g) + l_2(g)$

A. 0.04

B. 0.4

C. 25

D. 2.5

Answer: A

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19. In which of the following reactions, the equilibrium reamins unaffected on addition of small amount of argon at constant volume?

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

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

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

D. The equilibrium will remain unaffected in all the three cases.

Answer: D

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Assertion Reason Corner

1. Assertion : When ice and water are kept in a perfectly insulated thermos flask at 273 K and the atmospheric pressure, there is no change in mass of ice and water.

Reason : The system is in static equilibrium.

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

B. If both assertion and reason are true but reason is not the correct explanation of 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. Assertion : The equilibrium constant for the reverse reaction is equal to the inverse of the equilibrium constant for the forward reaction .

Reason : The value of equilibrium constant is independent of initial concentrations of the reactants and products.

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

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3. Assertion : For the reaction : $N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$, $K_p = K_c$

Reason : Concentration of gaseous reactants and products is taken as unity.

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: D

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4. Assertion : K_p can be less than, greater than or equal to K_c

Reason : Relation between K_p and K_c depends on the change in number of moles of gaseous reactants and products (Δn).

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

B. If both assertion and reason are true but reason is not the correct explanation of 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. Assertion : If reaction quotient, Q_c for a particular reaction is greater than K_c the reaction will proceed in the direction of reactants.

Reason : Reaction quotient is defined in the same way as the equilibrium constant K_c except that the concentrations in Q_c are not necessarily equilibrium values. (a)If both assertion and reason are true and reason is the correct explanation of assertion. (b)If both assertion and reason are true but reason is not the correct explanation of assertion. (c)If assertion is true but reason is false. (d)If both assertion and reason are false

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

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6. Assertion : In the dissociation of PCl_5 at constant pressure and temperature addition of helium at equilibrium increases the dissociation of PCl_5.

Reason : Helium reacts with Cl_2 and hence shifts the equilibrium in forward direction.

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: C

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7. Assertion : Weak acids have very strong conjugate bases while strong acids have weak conjugate bases.

Reason : Conjugate acid - base pair differ only by one proton.

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

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8. Assertion :- A solution of NH_4Cl in water is acidic in nature.

Reacon : - Ammonium ions undergo hydroysis to from NH_4OH .

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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9. Statement: The pH of an aqueous solution of acetic acid remains unchanged on the addition of sodium acetate.

Explanation: The ionisation of acetic acid is suppressed by the addition of sodium acetate.

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: D

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10. Assertion : Higher order ionization constants (K_{a_2}, K_{a_3}) are smaller than the lower order ionization constant (K_{a_1}) of polyprotic acid.

Reason : Polyprotic acid solutions contain a mixture of acids.

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

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11. Assertion : Benzoic acid is stronger acid than acetic acid.

Reason : K_a for benzoic acid is 6.5×10^{-5} and for acetic acid is 1.74×10^{-5}.

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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12. Assertion : The strength of haloacids increases in the order : $HI < < HBr < < HCl < < HF$

Reason : Strength of acid HA depends only on the electronegatively difference between H and A.

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: D

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13. Assertion : The pH of NH_4Cl solution in water is less than 7 and pH of CH_3COONa solution is more than 7.

Reason : NH_4Cl is a salt of weak NH_4OH and strong acid HCl whereas CH_3COONa is salt of a weak acid CH_3COOH and strong base NaOH.

(a)If both assertion and reason are true and reason is the correct explanation of assertion. (b)If both assertion and reason are true but reason is not the correct explanation of assertion. (c)If assertion is true but reason is false. (d)If both assertion and reason are false

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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14. Assertion : pH of the buffer solution is not affected by dilution.

Reason : $pH = pK_a + \log \frac{[\text{Conjugate base}]}{[\text{Acid}]}$

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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15. Assertion : The solubility of salts of weak acids like phosphates decreases at lower pH.

Reason : The is because at lower pH concentration of cations increases.

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: D

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Equilibrium In Physical Process

1. Which of the following is not a general characteristic of equilibrium involving physical processes ?

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

B. (b) The equilibrium is dynamic in nature.

C. (c) Measurable properties of the system keep changing.

D. (d) Equilibrium can be attained from both sides of the reaction.

Answer: C

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2. Match the colume I with column II and mark the appropriate choice.

	Column I		Colu
(A)	$\text{Liquid} \Longleftrightarrow \text{Vapour}$	(i)	Satu
(B)	$\text{Splid} \Longleftrightarrow \text{Liquid}$	(ii)	Boili
(C)	$\text{Solid} \Longleftrightarrow \text{Vapour}$	(iii)	Subli
(D)	$\text{Solute(s)} \Longleftrightarrow \text{Solute(solution)}$	(iv)	Melt

A. $(A) \to (i), (B) \to (iii), (C) \to (ii), (D) \to (iv)$

B. $(A) \to (ii), (B) \to (iv), (C) \to (iii), (D) \to (i)$

C. $(A) \to (iv), (B) \to (ii), (C) \to (i), (D) \to (iii)$

D. $(A) \rightarrow (iii), (B) \rightarrow (iv), (C) \rightarrow (ii), (D) \rightarrow (i)$

Answer: B

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Equilibrium In Chemical Process Dynamic Process

1. A reaction is said to be in equilibrium when

A. (a) the rate of transformation of reactants to products is equal to the rate of transformation of products to the reactants

B. (b) $50\ \%$ of the reactants are converted to products

C. (c) the reaction is near completion and all the reactants are converted to products

D. (d) the volume of reactants is just equal to the volume of the products.

Answer: A

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2. Which of the following is not true about a reversible reaction ?

A. (a) The reaction does not proceed to completion.

B. (b) It cannot be influenced by catalyst

C. (c) Number of moles of reactants and products is always equal.

D. (d) It can be attained only in a closed container.

Answer: C

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3. For the reaction : $PCl_5(g) \rightarrow PCl_3(g) + Cl_2(g)$:

A. (a) Equal volumes of PCl_5, PCl_3 and Cl_2 are present.

B. (b) Equal masses of PCl_5, PCl_3 and Cl_2 are present.

C. (c) The concentrations of PCl_5, PCl_3 and Cl_2 become constant.

D. (d) Reaction stops

Answer: C

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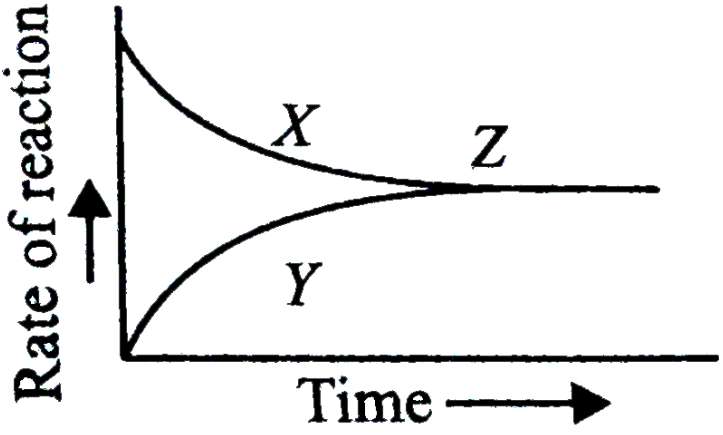
4. Study the given figure and label X,Y, and Z.



A.

X	Y	Z
Backword reaction	Forward reacton	Products

B.

X	Y	Z
Backword reaction	Forward reacton	Equilibrium

C. X Reversible reaction Y Irreversible reacton Z Equilibrium

D. X Forward reaction Y Forward reaction Z Backward reaction

Answer: B

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Law Of Chemical Equilibrium And Equilibrium Constant

1. For the reaction, $2SO_{2(g)} + O_{2(g)} \Leftrightarrow 2SO_{3(g)}$ What is K_c when the equilibrium concentration of $[SO_2] = 0.60M$, $[O_2] = 0.82M$ and $[SO_3] = 1.90M$?

A. (a) $12.229 Lmol^{-1}$

B. (b) $24.5 Lmol^{-1}$

C. (c) $36.0 Lmol^{-1}$

D. (d) $2.67 \times 10^3 Lmol^{-1}$

Answer: A

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2. PCl_5, PCl_3 and Cl_2 are at equilibrium at 500 K with concentration $2.1M\ PCl_3, 2.1M\ Cl_2$ and $1.9M\ PCl_5$.

The equilibrium constant for the given reaction is

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

A. (a) 2.32

B. (b) 1.79

C. (c) 4.2

D. (d) 3.8

Answer: A

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3. For the following reaction :

$NO_{(g)} + O_{3(g)} \Leftrightarrow NO_{2(g)} + O_{2(g)}$

The value of K_c is 8.2×10^4. What will be the value of K_c for the reverse reaction ?

A. (a) 8.2×10^4

B. (b) $\frac{1}{8.2 \times 10^4}$

C. (c) $\left(8.2 \times 10^4\right)$

D. (d) $\sqrt{8.2 \times 10^4}$

Answer: B

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4. If the equilibrium constant for the given reaction is 0.25

$NO \Leftrightarrow \frac{1}{2}N_2 + \frac{1}{2}O_2$, then the equilibrium constant for the reaction $\frac{1}{2}N_2 + \frac{1}{2}O_2 \Leftrightarrow NO$ will be

A. (a) 1

B. (b) 2

C. (c) 3

D. (d) 4

Answer: D

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5. If the equilibrium constant for the reaction,

$2XY \Leftrightarrow X_2 + Y_2$ is 81,

what is the value of equilibrium constant for the reaction

$XY \Leftrightarrow \frac{1}{2}X_2 + \frac{1}{2}Y_2$

A. (a) 81

B. (b) 9

C. (c) 6561

D. (d) 40.5

Answer: B

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6. If the value of equilibrium constant K_c for the reaction, $N_2 + 3H_2 \Leftrightarrow 2NH_3$ is 7. The equilibrium constant for the reaction $2N_2 + 6H_2 \Leftrightarrow 4NH_3$ will be

A. (a) 49

B. (b) 7

C. (c) 14

D. (d) 28

Answer: A

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7. At 473 K,K_c for the reaction

$PCl_{5(g)} \Leftrightarrow PCl_{3(g)}Cl_{2(g)}$ is 8.3×10^{-3}. What will be the value of K_c for the formation of PCl_5 at the same temperature ?

A. (a) 8.3×10^3

B. (b) 120.48

C. (c) 8.3×10^{-3}

D. (d) 240.8

Answer: B

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Homogeneous Equilibrium

1. Which of the following is an example of homogeneous equilibrium ?

A. (a) $2SO_{2(g)} + O_{2(g)} \Leftrightarrow 2SO_{3(g)}$

B. (b) $C_{(s)} + H_2O_{(g)} \Leftrightarrow CO_{(g)} + H_{2(g)}$

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

D. (d) $NH_4NS_{(s)} \Leftrightarrow NH_{3(g)} + H_2S_{(g)}$

Answer: A

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2. Which of the following relations between the reactions and equilibrium constant for a general reaction $aA + bB \Leftrightarrow cC + dD$ is not correct ?

A. (1) $aA + bB \Leftrightarrow cC + dD : K_c$

B. (2) $cC + dD \Leftrightarrow aA + bB : K_c' = \frac{1}{K_c}$

C. (3) $naA + nbB \Leftrightarrow ncC + ndD : K_c'' = K_c^n$

D. (4) $aA + bB \Leftrightarrow cC + dD : K_c = K_p$

Answer: D

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3. 1 mole of NO 1 mole of O_3 are taken in a 10 L vessel and heated. At equilibrium, $50\,\%$ of NO (by mass) reacts with O_3 according to the equation :

$NO_{(g)} + O_{3(g)} \Leftrightarrow NO_{2(g)} + O_{2(g)}$.

What will be the equilibrium constant for this reaction ?

A. (a) 1

B. (b) 2

C. (c) 3

D. (d) 4

Answer: A

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4. When sulphur is heated at 900 K, S_8 is converted to S_2. What will be the equilibrim constant for the reaction if initial pressure of 1 atm falls by

$25\ \%$ at equilibrium ?

A. (a) $0.75atm^3$

B. (b) $2.55atm^3$

C. (c) $25.0atm^3$

D. (d) $1.33atm^3$

Answer: D

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5. 5 moles of PCl_5 are heated in a closed vessel of 5 litre capacity. At equilibrium $40\ \%$ of PCl_5 is found to be dissociated. What is the value of K_c ?

A. (a) 0.266 M

B. (b) 0.133 M

C. (c) 2.5 M

D. (d) 0.20 M

Answer: A

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6. For a reaction, $2SO_{2(g)} + O_{2(g)} \Leftrightarrow 2SO_{3(g)}$, 1.5 moles of SO_2 and 1 mole of O_2 are taken in a 2 L vessel. At equilibrium the concentration of SO_3 was found to be 0.35 mol L^{-1} The K_c for the reaction would be

A. (a) 5.1L mol^{-1}

B. (b) 1.4L mol^{-1}

C. (c) 0.6L mol^{-1}

D. (d) 2.35L mol^{-1}

Answer: A

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7. 18.4 g of N_2O_4 is taken in a 1 L closed vessel and heated till the equilibrium is reached.

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

At equilibrium it is found that 50% of N_2O_4 is dissociated . What will be the value of equilibrium constant?

A. (a) 0.2

B. (b) 2

C. (c) 0.4

D. (d) 0.8

Answer: C

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8. 5 moles of SO_2 and 5 moles of O_2 react in a closed vessel. At equilibrium 60% of the SO_2 is consumed . The total number of gaseous moles$(SO_2, O_2 \text{ and } SO_3)$ in the vessel is :-

A. 5.1

B. 3.9

C. 10.5

D. 8.5

Answer: D

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9. At 500 K, the equilibrium costant for the reaction $H_{2(g)} + I_{2(g)} \Leftrightarrow 2HI_{(g)}$ is 24.8 If $\frac{1}{2} mol/L$ of HI is present at equilibrium, what are the concentrations of H_2 and I_2, assuming that we started by taking HI and reached the equilibrium at 500 K ?

A. 0.068mol L^{-1}

B. 1.020mol L^{-1}

C. 0.10mol L^{-1}

D. 1.20mol L^{-1}

Answer: C

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10. In the system $X + 2Y \Leftrightarrow Z$, the equilibrium concentration are,

$[X] = 0.06 \ \ \text{mol L}^{-1}$, $[Y] = 0.12 \ \ \text{mol L}^{-1}$,

$[Z] = 0.216 \ \ \text{mol L}^{-1}$. Find the equilibrium constant of the reaction.

A. 250

B. 500

C. 125

D. 273

Answer: A

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11. For the reaction $a + b \Leftrightarrow c + d$, initially concentrations of a and b are equal and at equilibrium the concentration of will be twice of that of a. What will be equilibrium constant for the reaction ?

A. 2

B. 9

C. 4

D. 3

Answer: C

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12. In the relation, $K_p = K_c(RT)^{\Delta n}$ the value of Δn is

A. number of moles of gaseous reactants-number of moles of gaseous products in a balanced equation

B. number of moles of gaseous products - number of moles of gaseous reactants in a balanced equation

C. number of moles of gaseous products $\times$ number of moles of gaseous reactants in a balanced equation

D. number of moles of gaseous reactants + number of moles of gaseous products in balanced equation

Answer: B

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13. For which of the following reaction $K_p = K_c$?

A. $PCl_{3(g)} + Cl_{2(g)} \Leftrightarrow PCl_{4(g)}$

B. $H_{2(g)} + Cl_{2(g)} \Leftrightarrow 2HCl_{(g)}$

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

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

Answer: B

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14. For the reaction $2NO_{2(g)} \Leftrightarrow N_2O_{4(g)}$, K_p / K_c is equal to

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

B. $\sqrt{RT}$

C. RT

D. $(RT)^2$

Answer: A

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15. For the reaction $N_{2(g)} + O_{2(g)} \Rightarrow NO_{(g)}$, the value of K_c at 800° C is 0.1 . What is the value of K_p at this temperature ?

A. 0.5

B. 0.01

C. 0.05

D. 0.1

Answer: D

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16. At 350 K, K_p for the reaction given below is $3.0 \times 10^{10} \text{bar}^{-1}$ at equilibrium. What be the value of K_c at this temperature ?

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

A. $7.4 \times 10^{11} \text{L mol}^{-1}$

B. $8715 \times 10^{10} \text{L mol}^{-1}$

C. 0.08L mol^{-1}

D. $8.715 \times 10^{11} \text{L mol}^{-1}$

Answer: D

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Heterogeneous Equilibrium

1. The value of K_c for the following equilibrium is

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

Given $K_p = 167$ bar at 1073 K.

A. $1.896 \ \text{mol L}^{-1}$

B. $4.38 \times 10^{-4} \ \text{mol L}^{-1}$

C. $6.3 \times 10^{-4} \ \text{mol L}^{-1}$

D. $6.626 \ \text{mol L}^{-1}$

Answer: A

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2. Calculate K_p for the equilibrium,

$NH_4HS_{(s)} \Leftrightarrow NH_{3(g)} + H_2S_{(g)}$

if the total pressure inside reaction vessel s 1.12 atm at $105.^\circ C$.

A. 0.56

B. 1.25

C. 0.31

D. 0.63

Answer: C

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3. $NH_4COONH_4(s) \Leftrightarrow 2NH_3(g) + CO_2(g)$. If equilibrium pressure is 3 atm for the above reaction, K_p will be

A. 27

B. 4

C. 3

D. 9

Answer: B

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4. The expression for equilibrium constant, K_c for the following reaction is

$$2Cu(NO_3)_{2(s)} \Leftrightarrow 2CuO_{(s)} + 4NO_{2(g)} + O_{2(g)}$$

A. $K_c = \dfrac{\left[CuO_{(s)}\right]^2\left[NO_{2(g)}\right]^4\left[O_{2(g)}\right]}{\left[Cu(NO_3)_{2(s)}\right]^2}$

B. $K_c = \dfrac{\left[NO_{2(g)}\right]^4\left[O_{2(g)}\right]}{\left[Cu(NO_3)_{2(g)}\right]^2}$

C. $K_c = \left[NO_{2(g)}\right]^4\left[O_{2(g)}\right]$

D. $K_c = \dfrac{\left[CuO_{(s)}\right]^2}{\left[Cu(NO_3)_{2(g)}\right]^2}$

Answer: C

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5. The expression for equilibrium constant, K_c for the following reaction is

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

A. $K_c = \frac{[Fe(OH)_3]}{[Fe^{3+}][OH^-]^3}$

B. $K_c = \frac{[Fe(OH)_3]}{[Fe^{3+}][OH^-]}$

C. $K_c = \frac{1}{[Fe^{3+}][OH^-]^3}$

D. $K_c = [Fe(OH)_3]$

Answer: C

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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. a. $k_c = \frac{[P_4][O_2]^5}{[P_4O_{10}]}$

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

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

D. d. $K_c = [O_2]^5$

Answer: B

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Applications Of Equilibrium Constant

1. $N_2O_{4(g)} \Rightarrow 2NO_2, K_c = 5.7 \times 10^{-9}$ at 298 K. At equilibrium :-

A. a. concentration of NO_2 is higher than that of N_2O_4

B. b. concentration of N_2O_4 is higher than that of NO_2

C. c. both N_2O_4 and NO_4 have same concentration

D. d. concentration of N_2O_4 and NO_2 keeps on changing.

Answer: B

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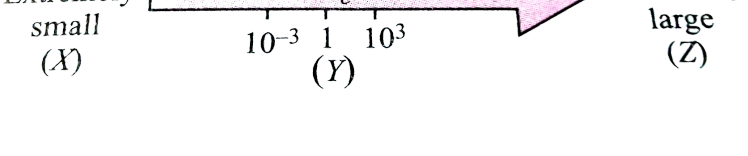
2. Study the figure below and mark the correct statement about K_c and dependence of extent of reaction on it.



A.

X Reaction does not occur Y Reaction processds to completion Z Reactio

B.

X Reaction completes Y Reaction does not occur Z Reactants and produc

C.

X Reaction hardly occurs Y Reactants and products are at equilibrium

D.

X Reaction proceeds to completion Y Reactants and products are at equi

Answer: C

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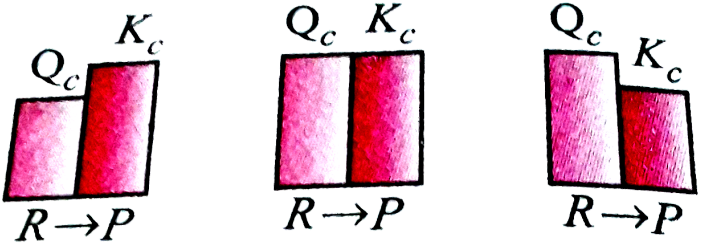
3. Predict the direction of the reaction from comparison of Q_c and K_c

Mark the incorrect statement.



A. If $Q_c < K_c$, reaction goes from left to right.

B. If $Q_c = K_c$, reaction goes from right to left.

C. If $Q_c > K_c$, net reaction goes from right to left.

D. If $Q_c = K_c$, reactants and products are at equilibrium.

Answer: B

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4. In the following reaction:

$2NO_{(g)} + Cl_{2(g)} \Leftrightarrow 2NOCl_{(g)}$

it is observed that equilibrium is not attained and the rate of forward reaction is greater than rate of backward reaction. Which of the following is true for the reaction ? (A) K p = Q p (B) Q p > K p (C) Q p < K p (D) Q p = 0

A. $K_p = Q_p$

B. $Q_p > K_p$

C. $Q_p < K_p$

D. $Q_p = 0$

Answer: C

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5. 0.6 moles of PCl_5, 0.3 mole of PCl_3 and 0.5 mole of Cl_2 are taken in a 1 L flask to obtain the following equilibrium ,

$PCl_{5(g)} \Rightarrow PCl_{3(g)} + Cl_{2(g)}$ If the equilibrium constant K_c for the reaction is 0.2 Predict the direction of the reaction.

A. a. Forward direction

B. b. Backward direction

C. c. Direction of the reaction cannot be predicted

D. d. Reaction does not move in any direction.

Answer: B

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Relation Between Equilibrium Constant Constant Reaction Quotient And Gibbs Energy

1. The correct relationship between free energy change in a reaction and the corresponding equilibrium constant K_c is:

A. $\Delta G = RT\ln K_c$

B. $-\Delta G = RT\ln K_c$

C. $\Delta G^\circ = RT\ln K_c$

D. $-\Delta G^\circ = RT\ln K_c$

Answer: D

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2. For a reversible reaction at 298 K the equilibrium constant K is 200. What is value of ΔG° at 298 K ?

A. a. $-13.13kcal$

B. b.-0.13kcal`

C. c. $-3.158kcal$

D. d. $-0.413 kcal$

Answer: C

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Factors Affecting Equilibria

1. The following reaction is at equilibrium ,

$$\underset{\text{Yellow}}{Fe^{3+}_{(aq)}} + \underset{\text{Colourless}}{SCN_{(aq)}} \Rightarrow \underset{\text{Deep red}}{[Fe(SNC)]^{2+}_{(aq)}}$$

$$K_c = \frac{[Fe(SCN)]}{[Fe^{3+}][SCN]}$$

In the above reaction , colour intensity of red colour can be increased by :- (A) addition of KSCN (B) addition of oxalic acid which reacts with F e 3 + ions (C) addition of H g 2 + ions which react with S C N − ions (D)red colour intensity cannot be changed

A. addition of KSCN

B. addition of oxalic acid which reacts with Fe^{3+} ions

C. addition of Hg^{2+} ions which react with SCN^- ions

D. red colour intensity cannot be changed.

Answer: A

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2. Consider the equilibrium set up :

$2H_{2(g)} + CO_{(g)} \Leftrightarrow CH_3OH_{(g)}$

What will be the effect of the following on the equilibrium of the reaction ?

(i) Addition of H_2 (ii) Addition of CH_3OH

(iii) Removal of CO (iv) Removal of CH_3OH

A.

	(i)	(ii)	(iii)
(a)	Forward direction	Backward direction	Backward direction

B.

	(i)	(ii)	(iii)
(a)	Backward direction	Backward direction	Forward direction

C.

	(i)	(ii)	(iii)	$(i$
(a)	Forward direction	Forward direction	Backward direction	B

D.

	(i)	(ii)	(iii)	$(i$
(a)	Backward direction	Forward direction	Forward direction	B

Answer: A

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3. Formation of ClF_3 from Cl_2 and F_2 is an exothermic process . The equilibrium system can be represented as

$Cl_{2(g)} + 3F_{2(g)} \Rightarrow 2ClF_{3(g)}, \Delta H = -329kJ$ Which of the following will increase quantity of ClF_3 in the equilibrium mixture ? i(A)ncrease in temperature, decrease in pressure, addition of C l 2 (B)Decrease in temperature and pressure, addition of C l F 3 (C)Increase in temperature and pressure, removal of C l 2 (D) Decrease in temperature, increase in pressure, addition of F 2

A. Increase in temperature, decrease in pressure addition of Cl_2

B. Decrease in temperature and pressure, addition of ClF_3

C. Increase in temperature and pressure, removal of Cl_2

D. Decrease in temperature, increase in pressure, addition of F_2

Answer: D

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4. Which of the following reaction will not affected on increasing the pressure ?

A. $2H_{2(g)} + CO_{(g)} \Leftrightarrow CH_3OH_{(g)}$

B. $4NH_{3(g)} + 5O_{2(g)} \Leftrightarrow 4NO_{(g)} + 6H_2O_{(g)}$

C. $CH_{4(g)} + 2S_{2(g)} \Leftrightarrow CS_{2(g)} + 2H_2S_{(s)}$

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

Answer: C

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5. In which of the following reaction the increase in pressure will favour the increase in products ?

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

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

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

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

Answer: B

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6. In a vessel N_2, H_2 and NH_3 are at equilibrium. Some helium gas is introduction into the vessel so that total pressure increases while temperature and volume remain constant. According to Le Chatelier's principle, the dissociation of NH_3 (A)increases (B)decreases (C)remains unchanged (D)equilibrium is disturbed

A. increases

B. decreases

C. remains unchanged

D. equilibrium is disturbed.

Answer: C

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7. When I_2 dissociates to its atomic from the following reaction occurs :

$I_{2(g)} \Leftrightarrow 2I_{(g)}, \Delta H^{\circ} = +150 \text{ kJ mol}^{-1}$

The reaction is favoured at (a)low temperature (B)high temperature (C)no change with temperature (D)high pressure

A. low temperature

B. high temperature

C. no change with temperature

D. high pressure.

Answer: B

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8. For the reaction,

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

A. a. introducing an inert gas at constant volume

B. b.introducing Cl_2 at constant volume

C. c. introducing PCl_5 at constant volume

D. d. reducing the volume of the container.

Answer: C

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9. The reaction $2SO_2 + 2O_2 \Leftrightarrow 2SO_3$ will be favoured by

A. a. high temperature and low pressure

B. b. low temperature and high pressure

C. c. high temperature and high pressure

D. d. low temperature and low pressure.

Answer: B

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10. The yield of NH_3 in the reaction $N_2 + 3H_2 \Leftrightarrow 2NH_3, \Delta H = -22.08$kcal is affected by

A. change in pressure and temperature

B. change in temperature and concentration of N_2

C. change in pressure and concentration of N_2

D. change in pressure, temperature and concentration of N_2.

Answer: D

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Acids Bases And Salts

1. According to Lewis concept acid is(A) proton donor (B)electron pair donor (C)proton acceptor (D)electron pair acceptor

A. proton donor

B. electron pair donor

C. proton acceptor

D. electron pair acceptor .

Answer: D

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2. Which of thef following is not Lewis acid

A. BF_3

B. $AlCl_3$

C. $FeCl_3$

D. PH_3

Answer: D

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3. Conjugate acid of SO_4^{2-} is

A. HSO_4^-

B. H^+

C. H_2SO_4

D. SO_4^{2-}

Answer: A

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4. Which of the following species can act both as an acid as well as a base ?

A. SO_4^{2-}

B. HSO_4^-

C. PO_4^{3-}

D. OH^-

Answer: B

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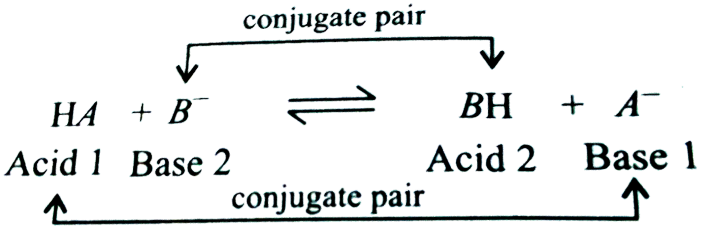
5. According to Bronsted - Lowry concept of acids and bases a conjugate acid - base paie can exist as



Mark the option in which conjugate pair is not correctly matched.

A. a.

Species	Conjugate acid	Conjugate base
HCO_3^-	CO_3^{2-}	H_2CO_3

B. b.

Species	Conjugate acid	Conjugate base
HPO_4^{2-}	$H_2PO_4^-$	PO_4^{3-}

C. c.

Species	Conjugate acid	Conjugate base
NH_3	NH_2^-	NH_4^{1+}

D. d.

Species	Conjugate acid	Conjugate base
HS^-	S^{2-}	H_2S

Answer: B

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6. Classify the following as acid or base according to Bronsted - Lowry concept.

(i) CH_3COO^-

(ii) H_3O^+

(iii) SO_4^{2-}

(iv) HCl

A.	(i) Bronsted acid	(ii) Bronsted base	(iii) Bronsted base	(iv) Bronsted acid
B.	(i) Bronsted acid	(ii) Bronsted acid	(iii) Bronsted acid	(iv) Bronsted base
C.	(i) Bronsted base	(ii) Bronsted acid	(iii) Bronsted base	(iv) Bronsted acid
D.	(i) Bronsted acid	(ii) Bronsted acid	(iii) Bronsted base	(iv) Bronsted base

Answer: C

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7. Nucleophiles are _____ while electrophiles are _____ .

A. Lewis bases, Lewis acids

B. Lewis acids, Lewis bases

C. Bronsted acids, Bronsted bases

D. Lewis acids Bronsted bases

Answer: A

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8. Which of the following salts will give basic solution on hydrolysis ?

A. NH_4Cl

B. KCl

C. K_2CO_3

D. $(NH_4)_2CO_3$

Answer: C

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9. Which of the following salts with a concentration .1 M will give a basic solution ? (A)Ammonium acetate (B)Ammonium chloride (C)Ammonium sulphate (D)Sodium acetate

A. Ammonium acetate

B. Ammonium chloride

C. Ammonium sulphate

D. Sodium acetate

Answer: D

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Ionization Of Acids And Bases

1. Which of the following salts does show its correct nature mentioned against it ?

A. KBr solution - Neutral

B. NaCN solution - Acidic

C. NH_4NO_3 solution - Acisdic

D. KF solution - Basic

Answer: B

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	Column I	Column II
	$(A) CH_3COONa$	(i) Almost neutral $pH > 7$ or < 7
2.	$(B) NH_4CI$	(ii) Acidic $pH < 7$
	$(C) NaNO_3$	(iii) Alkaline $pH > 7$
	$(D) CH_3COONH_4$	(iv) Neutral $pH = 7$

A. $(A) \to (i), (B) \to (ii), (C) \to (iii), (D) \to (iv)$

B. $(A) \to (ii), (B) \to (iii), (C) \to (iv), (D) \to (i)$

C. $(A) \to (iii), (B) \to (ii), (C) \to (iv), (D) \to (i)$

D. $(A) \to (iv), (B) \to (i), (C) \to (iii), (D) \to (ii)$

Answer: C

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3. The pH of 0.001 M $Ba(OH)_2$ solution will be

A. 2

B. 8.4

C. 11.3

D. 2.7

Answer: C

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4. What will be the pH of 1×10^{-4} M H_2SO_4 solution ?

A. 10.4

B. 3.7

C. 3

D. 13

Answer: B

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5. Solution of a monobasic acid has a pH=5. If one mL of it is diluted to 1 litre, what will be the pH of the resulting solution ?

A. a.3.45

B. b.6.96

C. c.8.58

D. d.10.25

Answer: B

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6. If the pH of a solution is 2, the hydrogen ion concentration in moles per litre is

A. a. 1×10^{-14}

B. b.1×10^{-2}

C. c. 1×10^{-7}

D. d. 1×10^{-12}

Answer: B

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7. 0.05 mole of NaOH is added to 5 liters of water What will be the pH of the solution ?

A. a.12

B. b.7

C. c. 2

D. d. 10

Answer: A

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8. The concentration of hydrogen ion in a sample of soft drink is $3.8 \times 10^{-3} M$. What is its pH?

A. a. 3.8

B. b. 5.04

C. c. 2.42

D. d.9.2

Answer: C

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9. What is pOH of an aqueous solution with hydrogen ion concentration equal to $3 \times 10^{-5} \ \text{mol L}^{-1}$?

A. a. 9.47

B. b. 4.52

C. c. 12.69

D. d. 11.69

Answer: A

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10. The degree of ionisation of an acid HA is 0.00001 at 0.1 M concentration. Its dissociation constant will be

A. a. 10^{-9}

B. b. 10^{-11}

C. c. 10^{-8}

D. d. 10^{-7}

Answer: B

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11. What will be the ionisation constant of formic acid if its 0.01 M solution is $14.5\,\%$ ionised ?

A. a. 2.1×10^{-4}

B. b.14.5

C. c.0.145

D. d.1.45×10^{-4}

Answer: A

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12. What is the percentage dissociation of 0.1 M solution of acetic acid ? $\left(K_a = 10^{-5}\right)(A)10\,\%\,(B)100\,\%\,(C)1\,\%\,(D)0.01\,\%$

A. $10\,\%$

B. $100\,\%$

C. $1\,\%$

D. $0.01\ \%$

Answer: C

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13. NH_4CN is a salt of weak acid $HCN\left(K_a = 6.2 \times 10^{-10}\right)$ and a weak base $NH_4OH\left(K_b = 1.8 \times 10^{-5}\right)$. 1 molar solution of NH_4CN will be :-

A. neutral

B. strongly acidic

C. strongly basic

D. weakly basic.

Answer: D

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14. For poly basic acid , the dissociation constant have a different valves for each step.

$H_3A \Leftrightarrow H^+ + A, Keq = Ka_1$

$H_2A \Leftrightarrow H^+ + A^{-2}, Keq = Ka_2$

$HA^2 \Leftrightarrow H^+ + A^{3-}, Keq = Ka_3$

What is the observed trend of dissociation constant im successive stages ?

A. $K_{a_1} > K_{a_2} > K_{a_3}$

B. $K_{a_1} = K_{a_2} = K_{a_3}$

C. $K_{a_1} < K_{a_2} < K_{a_3}$

D. $K_{a_1} = K_{a_2} + K_{a_3}$

Answer: A

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15. Equimoler solulition of HF, HCOOH and HCN at 298 K have the values of Ka as 6.8×10^{-4}, 1.8×10^{-4} and 4.8×10^{-9} respectively, what will be the order of their acidic strength ? (A)H F > H C N > H C O O H (B)H F > H C O O H > H C N (C)H C N > H F > H C O O H (D)H C O O H > H C N > H F

A. $HF > HCN > HCOOH$

B. $HF > HCOOH > HCN$

C. $HCN > HF > HCOOH$

D. $HCOOH > HCN > HF$

Answer: B

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16. Given below are the dissociation constant values of few acids. Arrange them in order of increasing acidic strength.

$H_2SO_3 = 1.3 \times 10^{-2}, HNO_2 = 4 \times 10^{-4}$

$CH_3COOH = 1.8 \times 10^{-5}, HCN = 4 \times 10^{-10}$

A. a. $HCN < CH_3COOH < HNO_2 < H_2SO_3$

B. b. $CH_3COOH < HNO_2 < HCN < H_2SO_3$

C. c. $CH_3COOH < HCN < H_2SO_3 < HNO_2$

D. d. $HNO_2 < H_2SO_3 < CH_3COOH < HCN$

Answer: A

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17. pK_a of a weak acid is 5.76 and pK_b of a weak base is 5.25. What will be the pH of the salt formed by the two ?

A. 7.255

B. 7.005

C. 10.225

D. 4.255

Answer: A

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18. What is the pH of a solution obtained by mixing 10 mL of 0.1 M HCl and 40 mL 0.2 M H_2SO_4 ?(A) 0.74 (B)7.4 (C)4.68 (D)0.468

A. 0.74

B. 7.4

C. 4.68

D. 0.468

Answer: D

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19. Dissociation constant of CH_3COOH and NH_4OH in squeous solution are 10^{-5} if pH of a CH_3COOH solution is 3, what will be the pH of NH_4OH ?

A. 3.0

B. 4.0

C. 10.0

D. 11.0

Answer: D

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Buffer Solutions

1. An acidic buffer solution can be prepared by mixing solution of

A. sodium acetate and acetic acid

B. ammonium acetate and ammonium hydroxide

C. sodium chloride and sodium hydroxide

D. potassium sulphate and sulphuric acid.

Answer: A

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2. Mark the appropriate choice to fill up the blanks in the given paragraph.

A solution which maintains constant pH when small amounts of acid or base are added is known as a $\underline{(i)}$. A mixture of acetic acid and sodium acetate acts as $\underline{(ii)}$ with a pH around $\underline{(iii)}$ and a mixture of ammonium chloride and ammonium hydroxide acts as $\underline{(iv)}$ with a pH around $\underline{(v)}$

A.	(i)	(ii)	(iii)	(iv)	(v)
	buffer capacity	basic buffer	9.25	acidic buffer	4.75
B.	(i)	(ii)	(iii)	(iv)	(v)
	buffer solution	acidic buffer	9.25	basic buffer	4.75
C.	(i)	(ii)	(iii)	(iv)	(v)
	buffer solution	basic buffer	4.75	acidic buffer	9.25
D.	(i)	(ii)	(iii)	(iv)	(v)
	buffer solution	acidic buffer	4.75	basic buffer	9.25

Answer: D

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Solubility Equilibria Of Sparingly Soluble Solids

1. For a reaction, $A_x, B_y \Leftrightarrow xA^{y+} + yB^{x-}$, K_{sp} xan be represented as

A. $\left[A^{y+}\right]^x \left[B^{x-}\right]^y$

B. $[A]^y[B]^x$

C. $[A]^x[B]^y$

D. $[A]^{x+y}[B]^{x-y}$

Answer: A

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2. The solubility product of $BaCl_2$ is 3.2×10^{-9}. What will be solubility in mol L^{-1}

A. 4×10^{-3}

B. 3.2×10^{-9}

C. 1×10^{-3}

D. 1×10^{-9}

Answer: C

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3. Solubility of CaF_2 is 0.5×10^{-4} mol L^{-1}. The value of K_{sp} for the salt is

A. a.5×10^{-12}

B. b.2.5×10^{-16}

C. c.1×10^{-13}

D. d.5×10^{-13}

Answer: D

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4. Match the column I with column II and mark the appropriate choice.

	Column I		Column II
(A)	$Fe(OH)_3$	(i)	$K_{sp} = s^2$
(B)	Ag_2CrO_4	(ii)	$K_{sp} = 27s^4$
(C)	CH_3COOAg	(iii)	$K_{sp} = 108s^5$
(D)	$Ca_3(PO_4)$	(iv)	$K_{sp} = 4s^3$

A. $(A) \rightarrow (iii), (B) \rightarrow (ii), (C) \rightarrow (iv), (D) \rightarrow (i)$

B. $(A) \rightarrow (ii), (B) \rightarrow (iv), (C) \rightarrow (i), (D) \rightarrow (iii)$

C. $(A) \rightarrow (i), (B) \rightarrow (iii), (C) \rightarrow (ii), (D) \rightarrow (iv)$

D. $(A) \rightarrow (iv), (B) \rightarrow (i), (C) \rightarrow (iii), (D) \rightarrow (ii)$

Answer: B

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5. solubility product of radium sulphate is 4×10^{-9}. What will be the solubility of Ra^{2+} in $0.10M\ NaSO_4$?

A. $4 \times 10^{-10} M$

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

C. $4 \times 10^{-5} M$

D. $2 \times 10^{-10} M$

Answer: A

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6. At $20^{\circ} C$, the Ag^{+} ion concentration in a saturated solution Ag_2CrO_4 is $1.5x10^{-4}$ mol $/$ litre. At $20^{\circ} C$, the solubility product of Ag_2CrO_4 would be

A. 1.687×10^{-12}

B. 1.75×10^{-10}

C. 3.0×10^{-8}

D. 4.5×10^{-10}

Answer: A

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7. The solubility product of $AgCl$ is 1.56×10^{-10} find solubility in g/ltr

A. 143.5

B. 108

C. 1.57×10^{-8}

D. 1.79×10^{-3}

Answer: D

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8. What will be the solubility of AgCl in 0.05 M NaCl aqueous solution if solubility product of AgCl is 1.5×10^{-10} ?

A. 3×10^{-9} mol L^{-1}

B. 0.05 mol L^{-1}

C. 1.5×10^{-5} mol L^{-1}

D. 3×10^{9} mol L^{-1}

Answer: A

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9. Solubility product expression of salt MX_4 which is sparingly soluble with a solubility s can be given as

A. $256s^5$

B. $16s^3$

C. $5c$

D. $25s^4$

Answer: A

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10. Which of the following is not an application of solubility product ?

A. Predicting precipitation formation

B. Predicting solubility of sparingly soluble salt

C. Predicting pH of a buffer solution

D. Qualitative analysis

Answer: C

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11. Predict if there will be any precipitate by mixing 50 mL of 0.01 M NaCl and 50 mL of 0.01 M $AgNO_3$ solution. The solubility product of AgCl is 1.5×10^{-10}.

A. Since ionic product is greater than solubility product no precipitate will be formed.

B. Since ionic product is lesser than solubility product, precipitation will occur .

C. Since ionic product is greater than solubility product, precipitation will occur.

D. Since ionic product and solubility product are same, precipitation will not occur.

Answer: C

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12. The solubility product of AgCl is 1.8×10^{-10}. Precipitation of AgCl will occur only when equal volumes of solutions of :

A. $10^{-8}\mathrm{M}$ Ag^{+} and $10^{-8}\mathrm{M}$ Cl^{-} ions

B. 10^{-3}M Ag^{+} and 10^{-3}M Cl^{-} ions

C. 10^{-6}M Ag^{+} and 10^{-6}M Cl^{-} ions

D. 10^{-10}M Ag^{+} and 10^{-10}M Cl^{-} ions

Answer: B

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13. Calculate pH at which $Mg(OH)_2$ begins to precipitate from a solution containing $0.10MMg^{2+}$ ions. $\left(K_{SP}ofMg(OH)_2 = 1 \times 10^{-11}\right)$

A. 4

B. 6

C. 9

D. 7

Answer: C

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14. What is minimum concentration of SO_4^{2-} required to precipitate $BaSO_4$ in solution containing 1×10^{-4} mole of Ba^{2+} ? (K_{sp} of $BaSO_4 = 4 \times 10^{-10}$)

A. $4 \times 10^{-10} M$

B. $2 \times 10^{-10} M$

C. $4 \times 10^{-6} M$

D. $2 \times 10^{-3} M$

Answer: C

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15. A solution which is $10^{-3} M$ each in Mn^{2+}, Fe^{2+}, Zn^{2+}, and Hg^{2+} it treated with $10^{-16} M$ sulphide ion. If the K_{sp} of MnS, FeS, $ZnS$and HgS are 10^{-15}, 10^{-23}, 10^{-20},and 10^{-54}, respectively, which one will precipitate first?

A. FeS

B. MnS

C. HgS

D. ZnS

Answer: C

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Higher Order Thinking Skills

1. 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.

A. a. 1.53

B. b. 0.153

C. c. 0.53

D. d. 0.76

Answer: B

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2. 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?

A. Forward

B. Backward

C. At equilibrium

D. Data is insufficient

Answer: B

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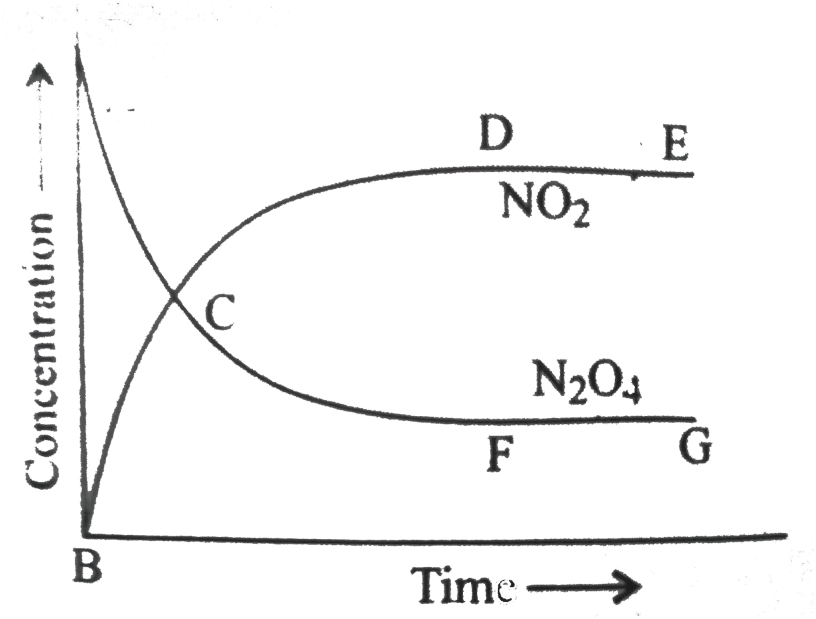
3. $N_2O_4 \Leftrightarrow 2NO_2$, $K_c = 4$. This reversible reaction is studied graphically as shown in the figure. Select the correct statement out of I, II and III.

I : Reaction quotient has maximum value at point A

II : Reaction proceeds left to right at a point when $[N_2O_4] = [NO_2] = 0.1M$

III : $K = Q$ when point D or F is reached:



A. a. I,II

B. b. II,III

C. c. I,III

D. d. I,II,III

Answer: B

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

$PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}, \Delta_r H^\circ = 124.0 \text{ kJ mol}^{-1}$

what would be the effect on reaction if the temperature is increased ?

A. Reaction will shift in the backward direction.

B. Reaction will shift in the forward direction.

C. Reaction is in equilibrium.

D. Reaction first moves forward and then remains at equilibrium.

Answer: B

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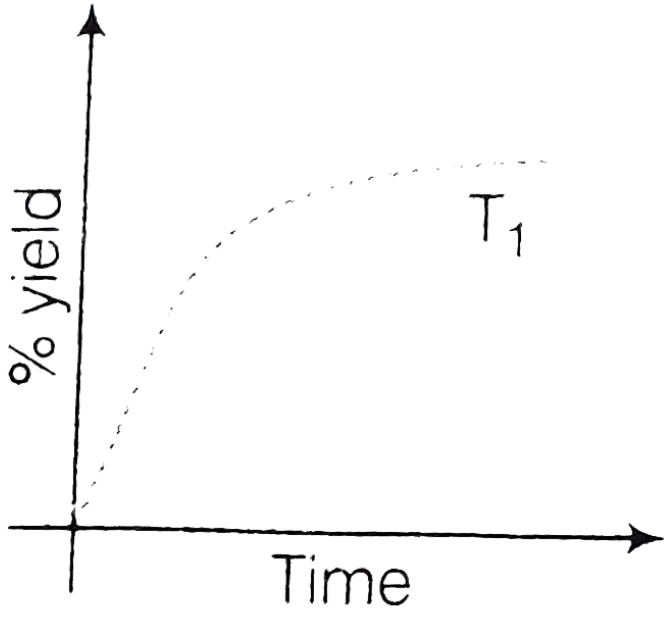
5. The % yield of ammonia as a function of time in the reaction,

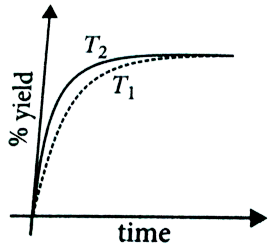
$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)\,'\Delta H < 0$

at (p, T_1) is given below

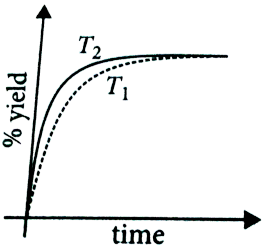


If this reaction is conducted at (p, T_1), with $T_2 > T_1$ the % yield by of ammonia as a function of time is represented by

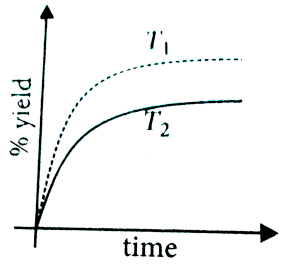
A. a.



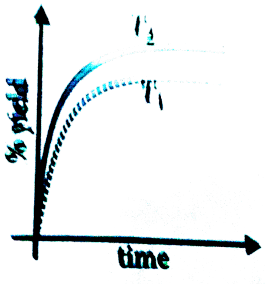
B. b.



C. c.



D. d.



Answer: B

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6. The ionisation constant of benzoic acid $(PhCOOH)$ is 6.46×10^{-5} and K_{sp} for silver benzoate is 2.5×10^{-3}. How many times is silver benzoate more soluble in a buffer of $pH3.19$ compared to its solubility is pure water?

A. a. 4

B. b. 3.32

C. c. 3.01

D. d. 2.5

Answer: B

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7. A solution which is 10^{-3} M each in Mn^{2+}, Fe^{2+}, Zn^{2+} and Hg^{2+} is treated with $10^{-16}M$ sulphide ion. If K_{sp} od MnS, ZnS and HgS are

$10^{-15}, 10^{-25}, 10^{-20}$ and 10^{-54} respectively, which one will precipitate first ?

A. FeS

B. MnS

C. HgS

D. ZnS

Answer: C

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8. What will be the amount of $(NH_4)_2SO_4$ (in g) which must be added to 500 mL of 0.2 M NH_4OH to yield a solution of pH 9.35? $\left[\text{Given,} pK_a \text{of } NH_4^+ = 9.26, pK_b NH_4OH = 14 - pK_a\left(NH_4^+\right)\right]$

A. a. 5.35

B. b. 6.47

C. c. 10.03

D. d. 7.34

Answer: A

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Ncert Exemplar

1. We know that the relationship between K_c and K_p is $K_p = K_c(RT)^{\Delta n}$

What would be the value of Δn for the reaction :

$NH_4Cl_{(s)} \Leftrightarrow NH_{3(g)} + HCl_{(g)}$?

A. 1

B. 0.5

C. 1.5

D. 2

Answer: D

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2. For the reaction $H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$, the standard free energy is $\Delta G^{\Theta} > 0$. the equilibrium constant (k) would be. (A)K = 0 (B)K > 1 (C)K = 1 (D)K < 1

A. $K = 0$

B. $K > 1$

C. $K = 1$

D. $K < 1$

Answer: D

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3. Which of the following is not a general characteristic of equilibrium involving physical processes ? (A)Equilibrium is possible only in a closed system at a given temperature. (B)All measurable properties of system

remain constant. (C)All the physical processes stop at equilibrium. (D)The opposing processes occur at the same rate and there is dynamic but stable condition.

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

B. All measurable properties of system remain constant.

C. All the physical processes stop at equilibrium.

D. The opposing processes occur at the same rate and there is dynamic but stable condition.

Answer: C

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4. PCI_5, PCI_3 and CI_2 are in equilibrium at 500 K in a closed container and their concentration are 0.8×10^{-3} $\text{mol}L^{-1}$ and $1.2 \times 10^{-3}\text{mol}L^{-1}$ and $1.2 \times 10^{-3}\text{mol}L^{-1}$

respectively. The value of K_c for the reaction $PCI_5(g) \Leftrightarrow PCI_3(g) + CI_2(g)$ will be

A. $1.8 \times 10^3 \text{mol L}^{-1}$

B. 1.8×10^{-3}

C. $1.8 \times 10^{-3} \text{L mol}^{-1}$

D. 0.55×10^4

Answer: B

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5. Which of the following statements is incorrect ?

A. In equilibrium mixture of ice and water kept in perfectly insulated flask, amss of ice and water does not change with time.

B. The intensity of red colour increase when oxalic acid is added to a solution containing iron (III) nitrate and potassium thiocyanate.

C. On addition of catalyst, the equilibrium constant value is not affected.

D. Equilibroum constant for a reaction with negative ΔH value decreases as the temperature increases.

Answer: B

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6. When hydrochloric aicd is addded to cobalt and nitrate solution at room temperautre, the following reaction takes place and the reaction mixture becomes blue. On cooling the mixture it becomes pink. On the basis of this information mark the corect answer.

$\underset{\text{pink}}{\left[Co(H_2O)_6\right]^{3+}}(aq) + 4CI^- \Leftrightarrow$

$\underset{\text{blue}}{CoCI_4{}^{2-}}(aq) + 6H_2O(l)$ (A)Δ H > 0 for the reaction (B)Δ H < 0 for the reaction (C)Δ H = 0 for the reaction (D)The sign of Δ H cannot be predicted on the basis of this information

A. $\Delta H > 0$ for the reaction

B. $\Delta H < 0$ for the reaction

C. $\Delta H = 0$ for the reaction

D. The sign of ΔH cannot be predicted on the basis of this information.

Answer: A

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7. The Ph OF NEUTRAL WATER AT $25^\circ C$ is 7.0. As the temperature increases, ionisation of water increases, however the concentration of H^+ ions nad OH^- ions equal. What will be the ph of puire water at $60^\circ C$? (A)Equal to 7.0 (B)Greater than 7.0 (C)Less than 7.0 (D)Equal to zero

A. Equal to 7.0

B. Greater than 7.0

C. Less than 7.0

D. Equal to zero

Answer: C

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8. The ionisation cosntabnt of an acid, K_a is the meaure of strength of an acid. The K_a values of acetic acid, hypochlorous acid and formic acid are 1.74×10^{-5}, 3.0×10^{-8} and 1.8×10^{-4} respectively. Which of the following orders of ph of 0.1 mol dm^{-3} solutions of these acids is correct ? (A)Acetic acid > Hypochlorous acid > Formic acid (B)Hypochlorous acid > Acetic acid > Formic acid (C)Formic acid > Hypochlorous acid > Acetic acid (D)Formic acid > Acetic acid > Hypochlorous acid

A. Acetic acid $>$ Hypochlorous acid $>$ Formic acid

B. Hypochlorous acid $>$ Acetic acid $>$ Formic acid

C. Formic acid $>$ Hypochlorous acid $>$ Acetic acid

D. Formic acid $>$ Acetic acid $>$ Hypochlorous acid

Answer: B

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9. K_{a1},$K_{a2}$and K_{a3} are the respective ionisation constants for the following reactions.

$H_2S \Leftrightarrow H^+ + HS^-$,$HS^- \Leftrightarrow H^+S^{-2}$

$H_2S \Leftrightarrow 2H^+ + S^{2-}$

The correct relationship between K_{a1},$K_{a2}$and K_{a3} is

A. $K_{a_3} = K_{a_1} \times K_{a_2}$

B. $K_{a_3} = K_{a_1} + K_{a_2}$

C. $K_{a_3} = K_{a_1} - K_{a_2}$

D. $K_{a_3} = K_{a_1} / K_{a_2}$

Answer: A

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10. Acidity of BF_3 can be explained on ths basis of which of the follwoing concepts? (A)Arrhenius concept (B)Bronsted - Lowry concept (C)Lewis concept (D)Bronsted - Lowry as well as Lewis concept

A. Arrhenius concept

B. Bronsted - Lowry concept

C. Lewis concept

D. Bronsted - Lowry as well as Lewis concept

Answer: C

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11. Which of the following is true ?

A. $0.1 \text{ mol dm}^{-3} NH_4OH \text{ and } 0.1 \text{ mol dm}^{-3} HCl$

B. $0.05 \text{ mol dm}^{-3} NH_4OH \text{ and } 0.1 \text{ mol dm}^{-3} HCl$

C. $0.1 \text{mol dm}^{-3} NH_4OH$ and 0.05 mol $\text{dm}^{-3} HCl$

D. $0.1 \text{mol dm}^{-3} CH_3COONa$ and 0.1 mol $\text{dm}^{-3} NaOH$

Answer: C

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12. In which of the following solvents is silver chloride most soluble ?

A. $0.1 \text{mol dm}^{-3} AgNO_3$ solution

B. 0.1 mol $\text{dm}^{-3} HCl$ solution

C. H_2O

D. Aqueous ammonia

Answer: D

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13. What will be the value of pH of 0.01 $\text{mol dm}^{-3} CH_3COOH \left(K_1 = 1.74 \times 10^{-5}\right)$?

A. 3.4

B. 3.6

C. 3.9

D. 3.0

Answer: A

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14. K_a for CH_3COOH is 1.8×10^{-5} and K_b for NH_4OH is 1.8×10^{-5}

The pH of ammonium acetate will be :

A. 7.005

B. 4.75

C. 7.0

D. between 6 and 7

Answer: C

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15. Which of the following options will be correct for the stage of half completion of the reaction : $A \Leftrightarrow B$?

A. $\Delta G^{\circ} = 0$

B. $\Delta G^{\circ} > 0$

C. $\Delta G^{\circ} < 0$

D. $\Delta G^{\circ} = -RT \ln 2$

Answer: A

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16. On increasing the pressure, in which dirction will the gas phase reaction proceed to re-establish equilibrium, is predicated by applying the Le Chatelier's principle. Consider the reaction.

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

Which of the following is correct, if the total pressure at which the equlibrium is established, is increased without changing the temperature ?

A. K will remain same.

B. K will decrease.

C. K will increase.

D. K will increase initially and decrease when pressure is very high.

Answer: A

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17. What will be the correct order of vapour pressure of water, acetone and ether at $30.^{\circ} C$. Given that among these compounds, water has maximum boiling point and ether has minimum boiling point ? (A)Water < Ether < Acetone (B)Water < Acetone < Ether (C)Ether < Acetone < Water (D)Acetone < Ether < Water

A. Water $<$ Ether $<$ Acetone

B. Water $<$ Acetone $<$ Ether

C. Ether $<$ Acetone $<$ Water

D. Acetone $<$ Ether $<$ Water

Answer: B

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18. At 500 K, equlibrium constant, K_c for the following reaction is 5.

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

What would be the equilibrium constant K_c for the reaction $2HI(g) \Leftrightarrow H_2(g) + l_2(g)$

A. 0.04

B. 0.4

C. 25

D. 2.5

Answer: A

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19. In which of the following reactions, the equilibrium reamins unaffected on addition of small amount of argon at constant volume?

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

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

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

D. The equilibrium will remain unaffected in all the three cases.

Answer: D

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Assertion And Reason

1. Assertion : When ice and water are kept in a perfectly insulated thermos flask at 273 K and the atmospheric pressure, there is no change in mass of ice and water.

Reason : The system is in static equilibrium.

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

B. If both assertion and reason are true but reason is not the correct explanation of 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. Assertion : The equilibrium constant for the reverse reaction is equal to the inverse of the equilibrium constant for the forward reaction .

Reason : The value of equilibrium constant is independent of initial concentrations of the reactants and products.

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

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3. Assertion : For the reaction : $N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$, $K_p = K_c$

Reason : Concentration of gaseous reactants and products is taken as unity.

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: D

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4. Assertion : K_p can be less than, greater than or equal to K_c

Reason : Relation between K_p and K_c depends on the change in number of moles of gaseous reactants and products (Δn).

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

B. If both assertion and reason are true but reason is not the correct explanation of 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. Assertion : If reaction quotient, Q_c for a particular reaction is greater than K_c the reaction will proceed in the direction of reactants.

Reason : Reaction quotient is defined in the same way as the equilibrium constant K_c except that the concentrations in Q_c are not necessarily equilibrium values. (a)If both assertion and reason are true and reason is the correct explanation of assertion. (b)If both assertion and reason are true but reason is not the correct explanation of assertion. (c)If assertion is true but reason is false. (d)If both assertion and reason are false

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

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6. Assertion : In the dissociation of PCl_5 at constant pressure and temperature addition of helium at equilibrium increases the dissociation of PCl_5.

Reason : Helium reacts with Cl_2 and hence shifts the equilibrium in forward direction.

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: C

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7. Assertion : Weak acids have very strong conjugate bases while strong acids have weak conjugate bases.

Reason : Conjugate acid - base pair differ only by one proton.

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

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8. Assertion :- A solution of NH_4Cl in water is acidic in nature.

Reacon : - Ammonium ions undergo hydroysis to from NH_4OH .

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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9. Statement: The pH of an aqueous solution of acetic acid remains unchanged on the addition of sodium acetate.

Explanation: The ionisation of acetic acid is suppressed by the addition of sodium acetate.

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: D

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10. Assertion : Higher order ionization constants (K_{a_2}, K_{a_3}) are smaller than the lower order ionization constant (K_{a_1}) of polyprotic acid.

Reason : Polyprotic acid solutions contain a mixture of acids.

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

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11. Assertion : Benzoic acid is stronger acid than acetic acid.

Reason : K_a for benzoic acid is 6.5×10^{-5} and for acetic acid is 1.74×10^{-5}.

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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12. Assertion : The strength of haloacids increases in the order : $HI < < HBr < < HCl < < HF$

Reason : Strength of acid HA depends only on the electronegatively difference between H and A.

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: D

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13. Assertion : The pH of NH_4Cl solution in water is less than 7 and pH of CH_3COONa solution is more than 7.

Reason : NH_4Cl is a salt of weak NH_4OH and strong acid HCl whereas CH_3COONa is salt of a weak acid CH_3COOH and strong base NaOH.

(a)If both assertion and reason are true and reason is the correct explanation of assertion. (b)If both assertion and reason are true but reason is not the correct explanation of assertion. (c)If assertion is true but reason is false. (d)If both assertion and reason are false

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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14. Assertion : pH of the buffer solution is not affected by dilution.

Reason : $pH = pK_a + \log \frac{[\text{Conjugate base}]}{[\text{Acid}]}$

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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15. Assertion : The solubility of salts of weak acids like phosphates decreases at lower pH.

Reason : The is because at lower pH concentration of cations increases.

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

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: D

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