CHEMISTRY

JEE (MAIN AND ADVANCED) CHEMISTRY

IONIC EQUILLIBRIUM

Lecture Sheet Exercise I Straight Objective Type Questions

1. Which of the following is an Arrhenius acid ?

A. NH_3

B. SO_2

C. $AICI_3$

D. HNO_3

Answer: D

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2. Which of the following is relatively stronger acid?

A. H_2S

B. HCN

C. HF

D. CH_3COOH

Answer: C

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3. Which of the following is a Bronsted-Lowry acid but not an Arrhenius acid?

A. HCl

B. NH_4^+

C. BF_3

D. CH_3COOH

Answer: B

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4. Which of the following species acts as Bronsted base but not as acid ?

A. CH_3COOH

B. HCO_3^-

C. H_2PO_2

D. $H_2PO_3^-$

Answer: C

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5. Which of the following can act as Lowry-Bronsted acid as well as base?

A. HCl

B. SO_4^{2-}

C. HPO_4^{2-}

D. Br^-

Answer: C

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6. Which of the following is neither Bronsted acid nor Bronsted base?

A. HI

B. HSO_4^-

C. CI^-

D. BF_3

Answer: D

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7. Which of the following is a Bronsted acid but not a Bronsted base ?

A. H_2O

B. NH_3

C. H_2S

D. CHO_3^-

Answer: C

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8. The conjugate base of hydrazoic acid is

A. N^{3-}

B. N_3^-

C. NH_2^-

D. NH_4^+

Answer: B

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9. Identify Bronsted Lowry acids in the reaction given below ?

$[AIH_2O)_6]^{3+} + HCO_3 \rightarrow [A](H_2O)(OH)]^{2+} + H_2CO_3$

A. A,C

B. A,D

C. B,D

D. B,C

Answer: B

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10. Conjugate acid of HPO_4^2, is

A. H_3P_4

B. $H_2PO_4^-$

C. PO_4^{3-}

D. H_3PO_4

Answer: B

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11. In a complex compound ligand acts as

A. Lewis acid

B. Lewis base

C. Lowry-Bronsted acid

D. Arrhenius base

Answer: B

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12. Which of the following species acts as a Lewis acid and also as a Lewis base ?

A. SO_2

B. SCI_4

C. both SO_2 and SCI_4

D. SO_3

Answer: C

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13. The H ion concentration of a solution is 4.75×10^{-5}M. Then the OH ion concentration of the same solution is

A. 4×10^{-5} M

B. 2.5×10^{9} M

C. 1.0×10^{7} M

D. 2.5×10^{-10} M

Answer: D

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14. At 25^{0}C, the hydroxyl ion concentration of a basic solution is 6.75×10^{-3} M.Then the value of K_w is

A. $13.5 \times 10^{-6} M^2$

B. $13.5 \times 10^{-12} M^2$

C. $13.5 \times 10^{-8} M^2$

D. $10^{-14} M^2$

Answer: D

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15. Ionic product of water depends on

A. Volume of the water

B. Amout of salt in water

C. Temperature

D. All the above

Answer: C

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16. At a given temperature, When an acid is added to water then the value of K_w

A. Decreases

B. Increases

C. Remains same

D. First decreases then increases.

Answer: C

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17. Ostwald dilution law is applicable to

A. Strong electrolytes

B. Weak electrolytes

C. Non-electrolytes

D. All types of electrolytes

Answer: B

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18. Conjugate base of $\left[AI(H_2, O)_6\right]^{3+}$, is

A. $\left[AI(H_2O)_6\right]^{2+}$

B. $\left[AI(H_2O)_5OH\right]^{2+}$

C. $\left[AI(H_2O)_4OH\right]^{2}$

D. $\left[AI(H_2O)_4(OH)_2\right]^{2+}$

Answer: B

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19. Which of the following is an acidic salt ?

A. $Na_3, PO_4,$

B. Na_2HPO_3

C. NaH_2PO_2

D. NaH_2PO_4

Answer: D

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20. Glycine exists as the zwitter ion, N^+H_3, CH_2, COO^-. Its conjugate base is

A. NH_2, CH_2COOH

B. NH_2, CH_2COO^-

C. NH_3CH_2COOH

D. NH_3CH_2COOH

Answer: B

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21. Which of the folowing is a Lewis acid ?

A. $HCOO^-$

B. H_2SO_4

C. SiF_4

D. H_2S

Answer: C

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22. Which of the following statements are correct

A. Arrhenius acids are also Bronsted acids but all arrhenius bases are not Bronsted bases

B. All Bronsted bases are also Lewis bases

C. All Bronsted acids are also Lewis acids

D. A strong acid has a weak conjugate base but a strong base has a strong conjugate acid

Answer: A::B

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23. On the basis of Bronsted concepts, which of the following are the correct representations?

A. $CH_3, CH_2OH + HCI \rightarrow CH_3, CH_2, O^+H_2, + CI^-$

B. $CH_3, CH_2OH + NH_2^- \rightarrow CH_3, CH_2, O^+H_2, + NH^{2-}$

C. $CH_3COOH + CH_3O^- \rightarrow CH_3COO^- + CH_3OH$

D. $CH_3COOH + CH_3NH_2 \rightarrow CH_3COO^+H_2 + CH_3NH_2^-$

Answer: A::C

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24. Which of the following statements are correct ?

A. OH^- is a stronger hase than NH_2^-,

B. H_2, O is a stronger base than CH_3, OH

C. CH_3, COO is a stronger base than HCOOH

D. A Lewis acid is a compound that accepts a pair of electrons.

Answer: A::C::D

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25. Select the species which can act as an acid and as base:

A. SO_4^{2-}

B. HS^-

C. HSO_3^-

D. HSO_4^-

Answer: B::C::D

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26. A weak electrolyte obeys Ostwald's dilution law. Select the correct statements.

A. A decrease in concentration of weak acid shows an increase in its degree of dissociation (α)

B. As $c \to 0$ the degree of issociation (α) approaches unity

C. A plot of α versus $\frac{1}{c}$gives a straight line with slope equal to dissociation constant of weak electrolyte

D. A plotof of αversus. gives a straight line with slope equal to dissociation constant of weak electrolye

Answer: A::B::C

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27. The dissolution of ammonia gas in water does not obey Henry's law. On dissolving. a major portion of ammonia molecules unite with H_2, O to form NH_4, OH molecules. A portion of the latter again dissociates into NH_4^+, and OH^- ions. In solution thercfore, we have NH_3, molecules, NH_4, OH molecules and NH_4^+, ions and the following equilibrium exist:

$NH_{3(g)}$ (pressure P and concentration c) $\rightarrow NH_{3(l)} + H_2, O \rightarrow NH_4, OH \rightarrow NH_4^+ \rightarrow , + OH^-$

Let c_1,mol/L of NH_3, pass in liquid state which on dissolution in water forms c_2 mol/ L of NH_4, OH. The solution contains $c_3$mol/L of NH_4^+, ions.

Total concentration of ammonia, which can be determined by volumetric analysis is equal to:

A. c_1

B. $C_1 + C_2 + C_3$

C. $C_1 + C_3$

D. $C_2 - C_3$

Answer: A

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$NH_{3(g)}$ (pressure P and concentration c) $\rightarrow NH_{3(l)} + H_2, O \rightarrow NH_4, OH \rightarrow NH_4^+ \rightarrow , + OH^-$

Let c_1,mol/L of NH_3, pass in liquid state which on dissolution in water forms c_2 mol/ L of NH_4, OH. The solution contains $c_3$mol/L of NH_4^+, ions.

Degree of dissociation of ammonium hydroxide is

A. c_1

B. $\frac{C_3}{C_1}$

C. $\frac{C_3}{C}$

D. $\frac{C_3}{C_2}$

Answer: D

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29. Acid base theories are important to understand the role of many substances in different reactions. Different theories are in practice which have advantages as well as limitations at their level. We always consider most convenient theory under the given conditions.

Which of the following is not Arrhenius acid

A. H_3PO_4

B. HNO_3

C. H_3PO_2

D. H_3BO_3

Answer: A

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30. Acid base theories are important to understand the role of many substances in different reactions. Different theories are in practice which have advantages as well as limitations at their level. We always consider most convenient theory under the given conditions.

Which of the following is not Bronsted base

A. HS^-

B. CH_3COOH

C. HF

D. H_3O^+

Answer: D

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31. Acid base theories are important to understand the role of many substances in different reactions. Different theories are in practice which have advantages as well as limitations at their level. We always consider most convenient theory under the given conditions.

Which of the following is strong conjugate base

A. F^-

B. CI^-

C. Br^-

D. I^-

Answer: A

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32.

List-I	List-II
	In the aqueous medium the ion can be
$(A) HPO_4^{-2}$	P. Arrhenius acid
$(B) CO_3^{-2}$	Q. Bronstead base
$(C) H_2PO_3^{-1}$	R. Amphoteric
$(D) H_2PO_2^{-1}$	S. Bronstead acid

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33.

List-I	List-II
$1(\text{In} H_3PO_4 \text{solution})$	$(C = [H_3PO_4])$
$(A) [H^+]$	P. $\sqrt{K_1 C}$
$(B) \left[H_2PO_4^-\right]$	Q. K_2
$(C) \left[HPO_4^{-2}\right]$	R. $\sqrt{K_1 K_2}$
$(D) \left[PO_4^{-3}\right]$	S. $\frac{K_2 K_3}{\sqrt{K_1 . C}}$

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34.

List-I	List-II
$(A) SiF_4$	P. Lewis acid
$(B) CO_2$	Q. Lewis base
$(C) SO_2$	R. Bronstead acid
$(D) NH_3$	S. Bronstead base

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Lecture Sheet Exercise Ii Straight Objective Type Questions

1. At certain temperature, the H^+ ion concentration of water is 4×10^{-7} 'M then the value of K_w, at the same temperature is

A. $10^{-14} M^2$

B. $4 \times 10^{-14} M^2$

C. $1.6 \times 10^{-13} M^2$

D. $4 \times 10^{-7} M^2$

Answer: C

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2. The no.of H_3, O^+ ions present in 10 ml of water at 25° C is

A. 6.023×10^{-14}

B. $6.023x10^{-14}$

C. $6.023x10^{-19}$

D. $6.023x10^{-19}$

Answer: B

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3. At some high temperature, K_w of water is 10^{-13} Then the P^H of the water at the same temperature is

A. 7.0

B. 6.5

C. 7.5

D. 7.23

Answer: B

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4. At $100^{\circ}C,$ the P^H of pure water is

A. 7

B. Greater than 7

C. less than 7

D. zero

Answer: C

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5. The P^H of a solution is 3.602. Its H^+ ion concentration is

A. $4x10^{-14}$

B. 2.5×10^{-11}

C. 2.5×10^{-4}

D. 5.0×10^{-4}

Answer: C

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6. The $[OH]^-]$ of 0.005 M H_2SO_4 is

A. 2×10^{-12} M

B. 5×10^{-3} M

C. 10^{-2} M

D. 10^{-12}M

Answer: D

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7. The ionic product of water is 10^{-14}, The H^+ ion concentration in 0.1 M NaOH soluiion is

A. 10^{-11} M

B. 10^{-13} M

C. 10^{-1} M

D. 10^{-4} M

Answer: B

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8. The P^H of 0.005 M Ba $(OH)_2$ is

A. 2.301

B. 11.699

C. 12

D. 7

Answer: C

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9. The P^H of 10^{-8} M HCl is

A. 8

B. 6

C. 7

D. 6.98

Answer: D

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10. Each 10^{-3}M of following four acids are taken. Their P^H values are given in brackets. Which of the following is relatively strong acid?

A. $A(3.6)$

B. B(4.2)

C. C(5.4)

D. D(6.8)

Answer: A

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11. The P^H of 0.001 M CH_3,COOH is

A. 3

B. 11

C. Between 3 and 7

D. 7

Answer: C

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12. The P^H of 10^{-3} M mono acidic base, if it is 1% ionised is

A. 5

B. 8

C. 3

D. 9

Answer: D

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13. The P^H of a weak mono basic acid is 5. The degree of ionisation of acid in 0.1 M solution is

A. 10^{-4}

B. 10^{-3}

C. 10^{-2}

D. 10^{-1}

Answer: A

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14. The P^H of HCI is 5. It is diluted by 1000 times. Its P^H will be

A. 5

B. 8

C. 2

D. 43989

Answer: D

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15. The P^H of a solution is 6. Its $\left[H_3, O^4\right]$ is decreased by 1000 times. Its P^H will be

A. 9

B. 6.96

C. 7.04

D. 8

Answer: A

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16. The P^H of a solution is 11. It is diluted by 1000 times. Then the P^H of resulting solution is

A. 8

B. 14

C. 7

D. 7.04

Answer: A

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17. Which of the following are correct?

A. pH of 0.1M HF is more than that of 0.1M HCI

B. pH of pure water is greater than that of 0.1 MHCI

C. pH of water at 25° C is greater than that at 30° C

D. pH of water is 7 at any temperature

Answer: A::B::C

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18. Which are Correct statements ?

A. With increase in temperature pH of water decreases

B. With increase in temperature degree of dissociation of water increase

C. pH of CH,COOH increase on dilution

D. pH of NH_3 , (aq) decrease on dilution

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

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19. Which of the following solution will have pH = 13 on assuming complete dissociation

A. 100 ml of solution of 0.1 N $Mg(OH)_2$

B. 0.56 g of KOH in 100 ml solution

C. 4gof NaOH in 500 ml solution

D. 100 ml of solution of 0.05 M Mg $(OH)_2$

Answer: A::B::D

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20. Which one of the following statement is are true? (at 25° C)

A. $PH + pOH = 14$ for all aqueous solutions

B. pH of 1×10^{-8} MHCI is 8

C. Conjugate base of $H_2PO_4^-$ is HPO_4^-

D. Solution of H_3PO_4 and and NaH_2PO_4 can act as buffer

Answer: A::C::D

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21. 100 ml of 0.1 M NaCl and 100 ml of 0.2 MNaOH are mixed. What is the change in pH of NaCI solution ?

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22. The pH of 0.05 M aqueous solution of diethyl amine is 12.0. The $K_b, = x \times 10^{-3}$ then what is x value?

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23. What is the P^H of a solution obtained by mixing equal volumes of two solution of HCl and KOH with PH values 5 and 9 at 25° C ?

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24. $x \times 10^{-2}$ gm of NaOH should be used up to prepare 200ml of a solution with P^H= 12. Find the value of x

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25. Calculate the change in pH of water when 0.01 mole of NaOH are added in 10 litre water.

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26. Weak acids and bases are not completely ionised when dissolved in polar medium like water

$H \rightarrow H^+ + A^-$

$t_0 \quad C \qquad O \quad O$

$t_{eq} \quad C - C\alpha \quad C\alpha \quad C\alpha$

$K_a = \frac{C\alpha^2}{1-\alpha} = C\alpha^2, \alpha\sqrt{\frac{K_a}{C}}$

$\therefore \frac{\alpha_1}{\alpha_2} = \sqrt{\frac{Ka_1}{Ka_2}}, \frac{\alpha_1}{\alpha_2} = \sqrt{\frac{C_2}{C_1}}$

(For two acids at same conc.) (for same acid at diff conc.)

$\alpha$and α are in the ratio 1:2 at same conc. $Ka_1, \ = 2 \times 10^{-4}$, what will be Ka_2,?

A. 8×10^{-4}

B. 2×10^{-4}

C. 4×10^{-4}

D. 1×10^{-4}

Answer: A

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$$H \rightarrow H^+ + A^-$$

$$\begin{array}{lccc} t_0 & C & O & O \\ t_{eq} & C - C\alpha & C\alpha & C\alpha \end{array}$$

$$K_a = \frac{C\alpha^2}{1-\alpha} = C\alpha^2, \alpha\sqrt{\frac{K_a}{C}}$$

$$\therefore \frac{\alpha_1}{\alpha_2} = \sqrt{\frac{Ka_1}{Ka_2}}, \frac{\alpha_1}{\alpha_2} = \sqrt{\frac{C_2}{C_1}}$$

(For two acids at same conc.) (for same acid at diff conc.)

0.01M $CH_3, COOH$ is 4.24% ionised. What will be the pereentage ionisation of 0.1 $MCH_3, COOH$.

A. $1.33\ \%$

B. $4.23\ \%$

C. $5.24\ \%$

D. $0.33\ \%$

Answer: A

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28. Weak acids and bases are not completely ionised when dissolved in polar medium like water

$$H \rightarrow H^+ + A^-$$

$$\begin{array}{llll} t_0 & C & O & O \\ t_{eq} & C - C\alpha & C\alpha & C\alpha \end{array}$$

$$K_a = \frac{C\alpha^2}{1 - aplha} = C\alpha^2, \alpha\sqrt{\frac{K_a}{C}}$$

$$\therefore \frac{\alpha_1}{\alpha_2} = \sqrt{\frac{Ka_1}{Ka_2}}, \frac{\alpha_1}{\alpha_2} = \sqrt{\frac{C_2}{C_1}}$$

(For two acids at same conc.) (for same acid at diff conc.)

Relative strength of two weak monoprotic acids may be given as

A. $\frac{[H^+]_1}{[H^+]_2}$

B. $\frac{\alpha_1}{\alpha_2}$

C. $\sqrt{\frac{Ka_1}{Ka_2}}$

D. All of the above

Answer: D

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Lecture Sheet Exercise Iii Straight Objective Type Questions

1. Buffer capacity of acidic buffer solution is maximum when

(1) $P^H = P^k$ (2) [salt]= [acid] (3) $p^K = 7$ (4) $\left[H^+\right] = P^k$

A. All are correct

B. (2).(3).(4) are correct

C. (1) and (2) are correct

D. (3) and (2) are correct

Answer: C

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2. To a buffer solution of $CH_3, COOH$ and $CH_3, COONa$, some HCI is added. Then the reaction involved is

A. $CH_3COOH + OH^- \rightarrow CH_3COO^- + H_2O$

B. $CH_3COO^- + H^+ \rightarrow CH_3COOH$

C. $Na^+OH^- \rightarrow NaOH$

D. $CH_3COO^- + Na^+ \rightarrow CH_3COONa$

Answer: B

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3. IM NaCl and IM HCI are present in an aqueous solution. The solution is

A. Not a buffer solution with $p^H < 7$

B. Not a buffer solution with $p^H > 7$

C. A buffer solution with $p^H < 7$

D. A buffer solution with $p^H = 7$

Answer: A

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4. Which of the following pair of solutions does not form a buffer solution?

A. NaH_2PO_4 and Na_2HPO_4

B. H_2CO_3 and $NaHCO_3$

C. NH_4OH and NH_4CI

D. KOH and K_2SO_4

Answer: D

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5. Few drops of HCI is addded to acetic acid buffer. The p^H is maintained constant by

A. CH_3COOH

B. CH_3COO^-

C. Na^+

D. CH_3COONa

Answer: B

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6. Aqueous solution of KCI is neutral because

A. K^+ undergoes hydrolysis

B. CI^- undergoes hydrolysis

C. Both K^+ and CI^- undergo hydrolysis

D. No hydrolysis takes place

Answer: D

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7. Assertion (A): Aqueous solution of ammonium acetate is neutral

Reason(R): Dissociation constants of $NH_4, OH(K_6)$ and that of $CH_3, COOH(K_a)$ are nearly equal.

A. both A & R are true, R is the corect explanation of A

B. both A &R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: A

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8. The nature of 0.1 M solution of sodium bisulphate is

A. Acidic

B. Alkaline

C. Neutral

D. Amphoteric

Answer: A

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9. The no.of hydroxyl ions produced by one molecule of Na_2, CO_3 , on hydrolysis is

A. 4

B. 2

C. 3

D. 0

Answer: B

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10. The nature of aqueous solution of $CuSO_4$, is

A. Acidic

B. Basic

C. Neutral

D. Amphoteric

Answer: A

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11. Aqucous solution of which of the following shows lower P^H ?

A. K_2SO_4

B. $ZnCI_2$

C. KCN

D. CH_3COONH_4

Answer: B

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12. The pH of an aqueous solution of a salt is 10. The salt

A. NaCl

B. NH_4CI

C. CH_3COONa

D. $(NH_4)_2SO_4$

Answer: C

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13. Aqueous solution of potash alum is acidic due to the hydrolysis of

A. K^+

B. AI^{3+}

C. SO_4^{2-}

D. Mg^{2+}

Answer: B

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14. Dissociation of CH_3,COOH is supressed by adding

A. HCI

B. H_2SO_4

C. CH_3COONa

D. Any of the above

Answer: D

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15. Which pair will show common ion effect ?

A. $BaCI_2 + Ba(NO_3)_2$

B. NaCl+HCl

C. $NH_4OH + NH_4CI$

D. AgCN+KCN

Answer: C

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16. Equal volumes of the following solutions are mixed. Which form buffer ?

A. 0.1M HCl, .02M KCN

B. 0.1M KCN, 0.02M HCl

C. 0.1M NH, 0.02M HCl

D. 0.1M $H_3, PO_4, 0.1M$ NaOH

Answer: B::C::D

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17. pH of (HCN + KCN) buffer can be inreased by _____ .

A. Adding HCN

B. Adding KCN

C. Adding limiting KOH

D. Dilution

Answer: B::C::D

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18. Which one of the following is/are buffer solution(s)?

A. $0.8MH_2S + 0.8MKHS$

B. $2MC_6H_5NH_2 + 2MC_6H_5NH_3Br$

C. $3MH_2CO_3 + 3MKHCO_3$

D. $0.05MKCIO_4 + 0.05MHCIO_4$

Answer: A::B::C

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19. Which of the following do not show change in pH on dilution?

A. 0.1 M NaCl

B. $0.1MCH_3COONH_4$

C. $0.1MNaHSO_3$

D. NaH_2PO_2

Answer: A::B::C

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20. Which are acidic salts ?

A. NaH_2PO_3

B. Na_2HPO_3

C. NaH_2PO_2

D. NaH_2PO_2

Answer: A::C

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21. A 0.1 M solution of weak acid HA is 1% dissociated at 25°C To this solution NaA is added till [NaA] = 0.2 M, if the new degree of dissociation of HA =$y \times 10^{-5}$ then what is 'y'?

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22. 0.15 mole of pyridinium chloride has been added into 500 cm^3 of 0.2 M pyridine solution. Calculate pH of the resulting solution, assuming no change in volume. (K, for pyridine = 1.5×10^{-9}M)

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23. A certain buffer solution contains equal concentration of X^- and HX. K_b, for X^- is 10^{-10}. Find the pH of buffer.

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24. Certain weak acid has P^{ka} = 4. Find pH of 0.01M NaA(ag)

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25. The dissociation constant of a substituted benzoic acid at 25^0C is 1.0×10^{-4}. Find the pH of a 0.01M Solution of its sodium salt.

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26. If P^{ka} of acetic acid and P^{kb} of ammonium hydroxide are 4.76 each. Find the pH of ammonium acetate.

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27. Higher the amount of acid or base used to produce a definite change of pH in a buffer solution,higher will be its buffer capacity. Buffer capacity of solution is maximum under the following conditions:

[Salt= [Acid] (in acid buffer), [Salt] = [Base] (in base buffer) pH of a buffer solution lies in the range given below: pH = $pk_a \pm 1$,

In other words, any buffer solution can be used as buffer up to two pH units only, depending upon the value of pK_a, or pK_b,. A buffer is said to be efficient when $pH_a = pK_a$, or pOH= pk_b

Which among the following solution will be the most efficient buffer?

A. 0.1M CH_3,COONa + 0.0IM CH_3,COOH

B. 0.1M NH_4CI+ 0.1 M NH_4 OH

C. 0.0001M HCOOH+0.002M HCOONa

D. All of the above

Answer: B

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[Salt= [Acid] (in acid buffer), [Salt] = [Base] (in base buffer) pH of a buffer solution lies in the range given below: pH = $pk_a \pm 1$,

In other words, any buffer solution can be used as buffer up to two pH units only, depending upon the value of pK_a, or pK_b, . A buffer is said to be efficient when $pH_a = pK_a$, or pOH= pk_b

The bulfer capacity is equal to :

A. $\frac{\Delta n}{\Delta pH}$

B. $\frac{pH}{\Delta n}$

C. $pK_a = \pm 1$

D. none of these

Answer: A

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29. 20 ml 0.1M $CH_3, COOH$ has P^H value 3. It is titrated with 0.1M NaOH

What is $K_a$of CH_3COOH

A. 10^{-5}

B. 10^{-6}

C. 10^{-7}

D. 10^{-8}

Answer: A

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30. What is the p^H of the solution after 50% of acid is neutralised

A. 5

B. 6

C. 7

D. 8

Answer: A

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31. What is $\left[OH^{-1}\right]$ of the solution at the equivalence point at 25° C

A. 7×10^{-6} M

B. 5×10^{-5} M

C. 2×10^{-8} M

D. 4×10^{-6} M

Answer: A

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32. The following aqueous solutions given in column containing 1:1 mole ratios of the respective pairs of substances. Assume all concentrations are I M.

List-I	List-II
$(A) NOH + NH_4OH$	P. A buffer with a pH less
$(B) NaOH + HCI$	Q. A buffer with a pH grea
$(C) HCN(P_{ka} = 9) + KCN$	R. The solution with a pH
$(D) C_6H_5NH_2(P_{ka} = 9.5) + C_6H_5NH_3{}^+Cl^-$	S. The solution with the hi

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33. Match the Column-I with Column-II :

List-I	List-II
$(A) CuSO_4$	P. Cationic interaction
$(B) Na_2CO_3$	Q. Anionic interaction
$(C) FeCI_3$	R. $pH > 7$
$(D) K_2SO_4$	S. pH < 7
	T. No hydrolysis of ions

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Lecture Sheet Exercise Iv Straight Objective Type Questions

1. At 298 K, the K_{xp} value of $Fe(OH)_3$, in aqucous solution is 3.8×10^{-38}. The solubility of Fe^{3+} ions will increase when

A. P^H is increased

B. P^H is 7

C. P^H is decreased

D. Saturated solution is exposed to sun light

Answer: C

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2. In which of the following, the solubility of AgCl will be maximum?

A. $0.1MAgNO_3$

B. water

C. 0.1 M NaCl

D. 1 M NaCl

Answer: B

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3. Among the following statements

a) If two salts have equal solubility then their solubility products are equal.

b) $BaSO_4$, in more soluble in water than in dil. H_2, SO_4

(c)When KI is added to Pbl_2, then the $\left[Pb^{2+}\right]$ decreases

d) In any solution containing AgCI, the value of $\left[Ag^{+}\right]\left[CI^{-}\right]$ is constant at constant temperature.

A. All are correct

B. a, b and d are correct

C. a, c andd are correct

D. b, c and d are correct

Answer: D

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4. The addition of NaCl to AgCI decreases the solubility of AgCl, because

A. K_{sp} of AgCl decreases

B. K_{sp} of AgCI increases

C. Solution becomes unsaturated

D. Ionic product exceeds the K_{sp} value

Answer: D

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5. To Ag_2CrO_4 solution over its own percipitate CrO_4^{2-} ions are added . This results in

A. increase in Ag^+ concentration

B. decrease in Ag^+ concentration

C. increase in solubiity product

D. Shifting of Ag^+ ions from the precipitate into the solution

Answer: B

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6. The solubility product of $BaSO_4$ at 18^0 C is 1.5×10^{-9} . It solubility (mole lit^{-1}) at the same temperature is

A. 1.5×10^{-9}

B. 1.5×10^{-5}

C. 3.9×10^{-9}

D. 3.9×10^{-5}

Answer: D

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7. The solubility of CaF_2 is 2×10^{-4} mole /litre . Its solubility product is

A. 2.0×10^{-4}

B. 4.0×10^{-4}

C. $4 \times 8.0 \times 10^{-12}$

D. 3.2×10^{-4}

Answer: C

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8. If the solubility product of MOH is $1 \times 10^{-10} mol^2 . dm^{-2}$. Then the p^H of the its aqueous solution will be

A. 12

B. 9

C. 6

D. 3

Answer: B

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9. Which of the following is wrong ?

A. Degree of dissociation of a weak electrolyte increases with dilution.

B. Increases in temperature increases the ionisation .

C. Strong electrolytes are ionised completely even at moderate concentrations.

D. Addition of NH_4CI to NH_4 increases the ionisation of the latter .

Answer: D

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10. Ionisation of NH_4 OH is supressed by the addition of NH_4CI because

A. NH_4CI is a salt of WB and SA

B. NH_4CI is a salt of strong base and weak acid

C. Of the common ion effect of NH_4^+ ion

D. None of the above

Answer: C

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11. The molar solubility in mol. lit^{-1} of a sparingly soluble salt MX_4, is S. The corresponding solubility product K_{sp}, is given by the relation

A. $S = (K_{sp}/128)^{\frac{1}{8}}$

B. $S = (218K_{sp})^{1/4}$

C. $S = (256K_{sp})^{1/5}$

D. $S = (K_{sp})/256)^{1/5}$

Answer: D

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12. Let the solubility of an aqueous solution of $Mg(OH)_2$, be "X° then its K_{sp} is

A. $4x^3$

B. $108x^5$

C. $27x^4$

D. $9x$

Answer: A

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13. The correct representation for solubility product of SnS_2 , is

A. $\left[Sn^{4+}\right]\left[S^{2-}\right]^2$

B. $\left[Sn^{4+}\right]\left[S^{2-}\right]$

C. $\left[Sn^{4+}\right]\left[2S^2\right]$

D. $\left[Sn^{4+}\right]\left[2S^2\right]^2$

Answer: A

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14. Which of the following has the lowest value of K at 25° C?

A. $Mg(OH)_2$

B. $Ca(OH)_2$

C. $Ba(OH)_2$

D. $Be(OH)_2$

Answer: D

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15. Which of the following is most soluble ?

A. $Bi_2S_3\left(K_{sp} = 1 \times 10^{-17}\right)$

B. $MnS\left(K_{sp} = 7 \times 10^{-16}\right)$

C. $CuS\left(K_{sp} = 8 \times 10^{-37}\right)$

D. $Ag_2S\left(K_{sp} = 6 \times 10^{-51}\right)$

Answer: A

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16. pH of saturated $Mg(OH)_2$, solution is 12, then

A. Ksp of $M \geq (OH)_2$, is5×10^{-7}

B. Ksp of $Mg(OH)_2$, is5×10^{-14}

C. $\left[Mg^{+2}\right] = 2\left[OH^{-}\right]$

D. $2\left[Mg^{+2}\right] = \left[OH^{-}\right]$

Answer: A::D

Watch Video Solution

17. Which of the following is/are true for an acid- base titration?

A. Indicators catalyse the acid base reactions by releasing or accepting

H^{+} ions.

B. Indicators do not significantly affect the pH of the solution to which they are added.

C. Acid - base reactions do not occur in absence of indicators

D. Indicators have different colours in dissociated and undissociated forms

Answer: B::D

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18. Let the colour of the indicator (Hin colourles) will be visible only when its ionised form (pink) is 25 or more in a solution. Suppose Hln $(pK_{In} = 9.0)$ is added to a solution of pH = 9.6. Predict what will happen. (Take log 2 = 0.3)

A. Pink colour will be visible

B. Pink colour will not be visible

C. % of ionised form will be less than 25%

D. % of ionised form will be more than 25%

Answer: A::D

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19. The dissociation constant of an indicator 'InH' is 10^5. Then

A. The indicator exists in 80% ionic fom at pH value 5.6

B. In alkaline medium the indicator atmost exists in its ionic form

C. For 50% ionisation of the indicator pH 5 must be maintained

D. This indicator is more suitable for weak acid and strong base titration

Answer: A::B::C

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20. A solution which remains in equilibrium with undissolved solute is said to be saturated. The concentration of a saturated solution at a given temperature is called solubility. The product of concentration of ions in a saturated solution of an electrolyte at a given temperature, is called solubility product (K_{sp}). For the electrolyte, $A_x, B_y, : A_x, B_{y(s)} \rightarrow xA^{y+} + y^{Bx-}$, with solubility S, the solubility product $(K_{sp}) = x^x \times y^y \times s^{x+y}$. While calculating the solubility of a sparingly soluble salt in the presence of some strong electrolyte containing a common ion, the common ion concentration is practically equal to that of strong electrolyte. If in a solution, the ionic product of an clectrolyte exceeds its K_{sp}, value at a particular temperature, then precipitation occurs.

The solubility of $PbSO_4$, in water is 0.303 g/l at 25°C, its solubility product at that temperature is

A. $10^{-4}M^2$

B. $9.18 \times 10^{-4}M^2$

C. $10^{-6}M^2$

D. $9.18 \times 10^{-8} M^2$

Answer: C

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21. A solution which remains in equilibrium with undissolved solute is said to be saturated. The concentration of a saturated solution at a given temperature is called solubility. The product of concentration of ions in a saturated solution of an electrolyte at a given temperature, is called solubility product (K_{sp}). For the electrolyte, $A_x, B_y, : A_x, B_{y(s)} \rightarrow xA^{y+} + y^{Bx-}$, with solubility S, the solubility product $(K_{sp}) = x^x \times y^y \times s^{x+y}$. While calculating the solubility of a sparingly soluble salt in the presence of some strong electrolyte containing a common ion, the common ion concentration is practically equal to that of strong electrolyte. If in a solution, the ionic product of an clectrolyte exceeds its K_{sp}, value at a particular temperature, then precipitation occurs.

The solubility of $BaSO_4$, in 0.1 M $BaCl_2$, solution is $(K_{sp}$, of $BaSO_4$, $= 1.5 \times 10^{-9})$

A. $1.5 \times 10^{-9} M$

B. 1.5×10^{-8} M

C. $2.25 \times 10^{-16} M$

D. $2.25 \times 10^{-18} M$

Answer: B

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22. A solution which remains in equilibrium with undissolved solute is said to be saturated. The concentration of a saturated solution at a given temperature is called solubility. The product of concentration of ions in a saturated solution of an electrolyte at a given temperature, is called solubility product (K_{sp}). For the electrolyte, $A_x, B_y, : A_x, B_{y(s)} \rightarrow xA^{y+} + y^{Bx-}$, with solubility S, the solubility product $(K_{sp}) = x^x \times y^y \times s^{x+y}$. While calculating the solubility of a

sparingly soluble salt in the presence of some strong electrolyte containing a common ion, the common ion concentration is practically equal to that of strong electrolyte. If in a solution, the ionic product of an clectrolyte exceeds its K_{sp}, value at a particular temperature, then precipitation occurs.

The solubility of $PbSO_4$, in water is 0.303 g/l at 25°C, its solubility product at that temperature is

A. $\frac{\sqrt{4.8}}{3} \times 10^{-5} M$

B. $\frac{\sqrt{3}}{4.8} \times 10^{-5} M$

C. $\sqrt{3} \times 10^{-6} M$

D. $\sqrt{3} \times 10^{-5}$M

Answer: A

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23. Consider an ionic solid that dissolves in water according to the equation:

$M_nX_{m(s)}\, nM_{aq}^{m+}\, n + mX_{aq}^{n-}$. The equilibrium constant for this reaction, $K_{sp} = \left[M^{m+}\right]^n \left[X^{n-}\right]^m$ is known as the solubility product of M_n, X_m. The form of this euquilibrium is important in understanding effects such as the influence of pH, complex fomation and common ion cffect. Equilibrium constant in solution should be written correctly using activities and not concentrations. The difference between thesc quantities is large in concentrated ionic solutions and K_{sp} is quantitatively reliable as a guide of solubilities only for very dilute solutions, If solubility product of AB type salt is 4×10^{-10} at 18°C, and M.W of AB is 143.5 g/mol.

The solubility in g/lit of AB is

A. 14.35 gm/lit

B. 2.87×10^{-3} gm/lit

C. 1.43 gm / lit

D. 28.7 gm/lit

Answer: B

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24. Consider an ionic solid that dissolves in water according to the equation:

$M_nX_{m(s)}\, nM_{aq}^{m+}\, n + mX_{aq}^{n-}$. The equilibrium constant for this reaction, $K_{sp} = \left[M^{m+}\right]^n \left[X^{n-}\right]^m$ is known as the solubility product of M_n, X_m. The form of this euquilibrium is important in understanding effects such as the influence of pH, complex fomation and common ion cffect. Equilibrium constant in solution should be written correctly using activities and not concentrations. The difference between thesc quantities is large in concentrated ionic solutions and K_{sp} is quantitatively reliable as a guide of solubilities only for very dilute solutions, If solubility product of AB type salt is 4×10^{-10} at 18°C, and M.W of AB is 143.5 g/mol.

If ppt. of AB is washed with 5 lit water, loss in wt. of ppt. of AB is

A. 10^{-4} mol/lit

B. 10^{-4} gm

C. 10^{-4} mol

D. 10^{-4} mg

Answer: C

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25. The solubility product of SrF_2 in water is 8×10^{-10} Calculate its solubility in 0.1 M of aqueous NaF solution. If its solubility is expressed as $y \times 10^{-8}$ then what is the value of 'y' ?

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26. Solubility products of $ACO_3, BSO_4,$ and $ASO_4,$ are $4 \times 10^{-10}, 6 \times 10^{-10}$ and 8×10^{-10} respectively. The solubility product of BCO_3, is x x 10^{-10}, What is x ?

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27. The K, of an indicator HIn is $9x10^4$, The percentage of the basic form of indicator is 10x in a solution of pH = 4. What is x ?

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28. Calculate the pH at which an acid indicator with $K_a, = 1.0 \times 10^{-5}$ changes colour when the indicator concentration is 1.0×10^{-3} M

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29. K_{sp} of $M(OH)_x$, is 27×10^{-12} and its solubility in water is 10^{-3} mol $litre^{-1}$. Find the value of X

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List -I Salt	List -II Kg
$(A) AgCI$	$P.27S^4$
$(B) PbI_2$	$Q.108(S)^5$
$(C) AS_2S_3$	$R.4S^3$
$(D) Ag_3PO_4$	$S.\ S^2$

30.

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Practice Sheet Exercise I Level I Straight Objective Type Questions

1. Of the given anions, the strongest Bronsted base is

A. CIO^-

B. CIO_3^-

C. CIO_2^-

D. CIO_4^-

Answer: A

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2. Which of the following is strong Lewis base?

A. NF_3

B. NCI_3

C. NBr_3

D. NI_3

Answer: D

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3. Dissociation constant of water at 25° C is

A. 1.0×10^{-14}

B. 1×10^{-9}

C. 14

D. 1.8×10^{-16}

Answer: D

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4. One litre of water contains 10 moles of H^+ ions. Degree of ionisation of water (in percentage) is

A. 1.8×10^{-7}

B. 1.8×10^{-9}

C. 3.6×10^{-7}

D. 3.6×10^{-9}

Answer: A

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5. Which of the following statement is not correct?

A. CI^- is a Lewis acid

B. The p^H of 10^{-8} M HCI solution is less than 7

C. The ionic product of water at 25° C is $10^{14}M^2$

D. Bronsted -Lowry theory could not explain the acidic nature of $AICl^3$

Answer: A

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6. For H_3PO_{4+}

$H_3PO_4 \to H_2PO_4^- + H^+(K_1)H_2PO_4 \to HPO_4^- + H^+(K), HPO_4^2 \to$

then

A. $K_1 > K_2 > K_3$

B. $K_1 < K_2 <_3$

C. $K_1K_2 < K_3$

D. $K_1.\ K_2.\ K_3 = K_w$

Answer: A

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7. Which of the following is relatively stronger acid? K, values are given in brackets

A. $HA\left(2 \times 10^{-4}\right)$

B. $HB\left(3 \times 10^{-5}\right)$

C. $HC\left(1.8 \times 10^{-3}\right)$

D. $HD\left(9.6 \times 10^{-10}\right)$

Answer: C

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8. Conjugate base of $\left[Cu(NH_3)_6\right]^{2+}$ is

A. $\left[Cu(NH_3)_3NH_2^-\right.$

B. $\left[Cu(NH_3)_5NH_2\right]^+$

C. $\left[Cu(NH_3)_4NH_2\right]^+$

D. $\left[Cu(NH_3)_4NH_2\right]^{2+}$

Answer: B

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9. The no.of conjugate acid-base pairs present in the aqueous solution of H_3, PO_3 , is

A. 2

B. 3

C. 4

D. 5

Answer: B

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10. $CH_3, COOH_2^+$, is present in the solution of acetic acid in

A. NH_3

B. water

C. Benzene

D. HCl

Answer: D

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11. The solution of acetic acid in benzene contains

A. CH_3COO^-

B. $H_2PO_3^-$

C. $H_2PO_2^-$

D. HPO_4^{2-}

Answer: D

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12. The species which does not have a conjugate base is

A. H_3PO_4

B. $H_2PO_3^-$

C. $H_2PO_2^-$

D. HPO_4^{2-}

Answer: C

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13. The reaction $NH_4^+ + CN \rightarrow HCN(aq) + NH_3(aq)$ proceeds in

A. Forward direction

B. Backward direction

C. In both sides

D. Can not be predicted

Answer: A

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14. Which of the following acts as Lewis acid ?

A. H

B. He

C. S

D. B

Answer: C

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15. Which of the following is relatively strong Lewis acid ?

A. BF_3

B. BCI_3

C. BBr_3

D. BI_3

Answer: D

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Practice Sheet Exercise I Level Ii Straight Objective Type Questions

1. Which of the following is strong Lewis acid?

A. Na^+

B. Mg^{2+}

C. AI^{3+}

D. All show equal strength

Answer: C

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2. The Lewis acidic strength of SO_3 , when compared to SO_2 , is

A. Less

B. More

C. Equal

D. Can not be predicted

Answer: B

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3. Which of the following is wrong?

A. All Bronsted bases are Lewis bases

B. All Lewis acids are Bronsted acids

C. All Arhenius acids are Bronsted acids

D. All Arhenius bases are Bronsted bases

Answer: B

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4. Which of the following statements is true ?

A. HNO_3 is a stronger acid than HNO_2 ,

B. H_3PO_3 is stronger acid than H_2SO_3

C. In aqueous solution HF is stronger acid than HCI

D. $CHIO_4$ is a weaker acid than $HCIO_3$

Answer: A

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5. Strength of a weak acid or a weak base depends upon its

A. Temperature

B. Nature of solvent

C. Degree of dissociation

D. All the above

Answer: D

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6. Among the following, the stronger acid in basic medium is

A. Aniline

B. Phenol

C. Ammonia

D. Benzene

Answer: B

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7. (A): HCl is not acidic in benzene.

(R): Benzene does not accept protons

A. both A & R are true, R is the corect explanation of A

B. both A &R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: A

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8. What is the decreasing order of strength of the bases OH, NH_2 , H-C=C and CH_3, $-CH_2$,

A. $CH_3 - CH_2^- > NH_2^- > H - C \equiv C^- > OH^-$

B. $H - C \equiv C^- > CH_3, -CH,_2^- > NH_2, > OH^-$

C. $OH^- > NH_2^- > H - C \equiv C^- CH_3 - CH_2^-$

D. $NH_2^- > H - C^- > OH^- > CH_3 - CH_2^-$

Answer: A

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9. Which of the following is relatively stronger base? P^{kb} values are given in brackets.

A. AOH (5.8)

B. BOH (6.8)

C. COH (2.4)

D. DOH (10.9)

Answer: C

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10. The cquilibrium constant for the reaction $HONO_{aq} + CN_{sp} \rightarrow HCN_{(aq)} + ONO_{(sp)}$ is 1×10^6 . From the mangitude of this K one can colcude that

A. CN^- is stronger base than ONO^-

B. HCN is a stronger acid than HONO

C. The conjugate base of HONO is ONO^-

D. The conjugate acid of CN^- is HCN

Answer: A::C::D

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11. Which of the following has been arranged correctly in increasing order of acidic strength?

A. $HF < HCI < HBr < HI$

B. $H_3PO_2 < H_3PO_3 < H_3PO_4$

C. $H_3PO_4 < H_2SO_4 < HCIO_4$

D. $NH_3 < PH_3 < AsH_3 < BiH_3$

Answer: A::C::D

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12. Based on the following equilibrium reactions

$HNO_2 + HF \rightarrow H_2F^+ + NO_2^-$

$CH_3COOH + HF \rightarrow F + CH_3COOH_2^+$

$H_2O + CH_3COOH \rightarrow H_3O^+ + CH_3COO^-$

Which are the correct order (s) regarding acid strength

A. $H_2O < CH_3, COOH$

B. $HF < HNO_2$

C. $H_2O < HF$

D. $CH_2COOH < HNO_2$

Answer: A::C::D

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13. Which of the following species formed in acid base reactions can act as Bronsted buses as well as Bronsted acids?

A. $\left[Fe(H_2O)_6\right]^{2+}$

B. HPO_4^{2-}

C. HSO_4^-

D. NH_4^+

Answer: B::C

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14. Any species capable of accepting a lone pair of electrons acts as a lewis acid, where as a species capable of donating a proton acts as a Bronstead acid.

Which of the following is not a lewis acid ?

A. Mg^2

B. SiF_4

C. SO_2

D. NH_4^+

Answer: D

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15. Any species capable of accepting a lone pair of electrons acts as a lewis acid, where as a species capable of donating a proton acts as a

Bronstead acid.

Which of the following can act as a lewis acid as well as a lewis base ?

A. NH_4^+

B. CO

C. CO_2

D. SO_2

Answer: D

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16. Any species capable of accepting a lone pair of electrons acts as a lewis acid, where as a species capable of donating a proton acts as a Bronstead acid.

Which of the following can not act as a Bronstead acid is aqueous medium?

A. $H_2PO_2^-$

B. $H_2PO_3^-$

C. $H_2PO_4^-$

D. HPO_4^{-2I}

Answer: A

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17. Weak acids dissociate partially in aqueous medium. If any common ion is present in the solution, the degree of dissociation of the acid is suppressed however the dissociation constant value remains constant.

In which of the following the degree of dissociation of water is maximum '?

A. 0.1 MNH_3

B. $0.1MCHI$

C. 0.1 MHCN

D. Pure water

Answer: D

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18. Weak acids dissociate partially in aqueous medium. If any common ion is present in the solution, the degree of dissociation of the acid is suppressed however the dissociation constant value remains constant. What is the degree of dissociation of water is 0.0IM HCOOH $\left(K_a = 10^{-6}\right)$ at 25° C?

A. 1.8×10^{-12}

B. 1.8×10^{-14}

C. 0.8×10^{-12}

D. 3.6×10^{-10}

Answer: A

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19.

List-I	List-II
$(A) \mathrm{CCI}_4$	P. Lewis acid
$(B) AICI_3$	Q.Lewis base
$(C) NH_3$	R. Bronsted acid
$(D) HCIO_4$	S. Bronsted base
	T. Neither lewis acid nor Lewis base

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Practice Sheet Exercise Ii Level I Straight Objective Type Questions

1. At certain temperature the K_w of D_2,O is $10^{=-16}$ M. Then the pD of pure D_2,O at that temperature is

A. 7

B. 16

C. 8

D. 6

Answer: C

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2. At 298 K, the $\left[H_2, O^+\right]$ of a solution is 2×10^{-9} M. The nature of the solution is

A. Acidic

B. Basic

C. Neutral

D. Can not be predicted

Answer: B

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3. The P^H of HCI is 1. The amount of NaOH to be added to 100 ml of such a HCI solution to get p^H of 7 is

A. 4g

B. 0.4g

C. 4mg

D. 0.4 mg

Answer: B

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4. The dissociation constant of a weak acid is 10^{-6} . Then the P^H of 0.01 Nof that acid is

A. 2

B. 7

C. 8

D. 4

Answer: D

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5. The degree of dissociation of $0.1NCH_3COOH$ is (given $K_a = 1 \times 10^{-5}$) approximately

A. 10^{-5}

B. 10^{-4}

C. 10^{-3}

D. 10^{-2}

Answer: D

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6. Four grams of NaOH solid are dissolved in just enough water to make I litre of solution. What is the $\left[H^+\right]$. of the solution ?

A. 10^{-2} moles /litre

B. 10^{-1} moles /litre

C. 10^{-12} moles /litre

D. 10^{-13} moles /litre

Answer: D

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7. The P^H of HCI is 3. Then the P^H of NaOH solution having same molar concentration is

A. 3

B. 6

C. 9

D. 11

Answer: D

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8. What is the pH of a solution obtained by dissolving 0.0005 mole of the strong electrolyte, calcium hydroxide, $Ca(OH)_2$, to form 100 ml of a saturated solution (aqueous)? $\left(K_w = 1.0 \times 10^{-14} \text{mole}^2 \text{litre}^{-2}\right)$

A. 9.8

B. 11.7

C. 12.0

D. 3.0

Answer: C

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9. The p^H of 0.1 M NaCI solution is

A. 1

B. 13

C. 7

D. zero

Answer: C

Watch Video Solution

10. The P^H of a solution is 3.0. This solution is diluted by 100 times. Then the P^H of the resulting solution is

A. 5

B. 7

C. 1

D. 11

Answer: A

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11. The P^H of solution is 9. It is times more basic than a solution with P^H = 6.

A. 3

B. 100

C. 1000

D. 15

Answer: C

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12. TheP^H of a I lit solution is 2. It is diluted with water till its p^H becomes 4, How many litres of water is added?

A. 99

B. 9

C. 999

D. 9.9

Answer: A

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Practice Sheet Exercise Ii Level Ii Straight Objective Type Questions

1. 20 ml of 0.4 MH_2, SO_4 , and 80 ml of 0.2 M NaOH are mixed. Then the p^H of the resulting solution is

A. 7

B. 1.097

C. 12.903

D. 11.903

Answer: A

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2. A 0.2M solution of formic acid is 3.2% ionised. Its ionisation constant is

A. 9.6×10^{-3}

B. 2.1×10^{-4}

C. 1.25×10^{-6}

D. 4.8×10^{-5}

Answer: B

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3. The P^H of a dibasic acid is 3.699. Its molarity is

A. 2×10^{-4} M

B. 4×10^{-4} M

C. 2×10^{-3}M

D. 1×10^{-4} M

Answer: D

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4. To change the P^H of a solution from I to 1.301. Which of the following should be adopted?

A. 1 lit of water is to be added

B. 1 kg of water is to be added

C. The volume of the solution should be doubled by adding water

D. The wt of the solute present in the solution should be doubled

Answer: C

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5. 50 ml of H_2, O is added to 50 ml of 1×10^{-3} M barium hydroxide solution. What is the P^H of the resulting solution?

A. 3.0

B. 3.3

C. 11.7

D. 11.0

Answer: D

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6. When 100 ml of N/10 NaOH are added to 50 ml of N/5 HCI, the P^H of the resulting solution is

A. 7

B. Greater than 7

C. less than 7

D. zero

Answer: A

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7. pH of a weakacid in 0.1 M solution is 4.3. Which statements are correct ?

A. its 0.01M solution has pH $>$ 4.3

B. its 0.01M solution has pH $<$ 4.3

C. its 0.01M solution degree of dissociation is morethan in 0.1 M solution

D. its 0.01M solution degree of dissociation is lessthan in 0.1 M solution

Answer: A::C

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8. 100ml of 0.1 M HCl and 100 ml of 0.1 M HOCN are mixed then $\left(K_a = 1.2 \times 10^{-6}\right)$

A. OCN^- concentration in the solution is 1.2×10^{-6}

B. pH of the solution is 1.3

C. solution is a buffer

D. H^+ in the solution is 10^{-6}

Answer: A::B

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9. 100 ml aqueous 0.1 molar $M(CN)_2$, (80% ionized) solution is mixed with 100 ml of 0.05 molar H_2, SO_2 solution (80% ionized). (K_6, of CN" = 10^{-6})

A. pH of the solution is 8

B. the resultant solution is acidic buffer

C. the resultant solution is basic

D. the resultant solution is acidic in nature

Answer: A::B::C

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10. The degree of dissociation of 0.1 M weak acid is 10^{-2} and the degree of dissociation of the same acid in 0.025M concentration is '*', then find 100x. _____ ?

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11. The percentage of dissociation of CH_3, NH_2, in an aqueous solution with $\left[H^+\right] = 10^{-10}$ M in 0.1M concentration is'x'. The value of 10x is _____ ?

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12. The pH of 0.05 M aqueous solution of diethyl amine is 12.0. The $K_b = x \times 10^{-3}$ then what is x value?

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13. Asolution with pH 2.699 is diluted two times, then calculate pH of the resulting solution. [Given antilog of 0.3010 = 2

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14. Find pH of 0.1 M $NaHCO_3$, (P^{kal} & p^{kal} of H_2, CO_3 are 7 & 11)

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15.

List-I	List-II
$(A) 1 \times 10^{-8}$ M KOH	$P.\ pH = 1.3$
$(B) 1 \times 10^{-8}$ MHBr	$Q.\ pH = 6.95$
(C) 1MHCI + 1MNaOH	$R.\ pH = 7.0414$
$(D) 0.02M H_2SO_4$	$S.\ pH = 7$
	acidic solution

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Practice Sheet Exercise Iii Level I

1. For acetic acid and sodium acetate buffer, addition of which of the following increases the P^H ?

A. CH_3COONa

B. H_2O

C. CH_3COOH

D. None of these

Answer: A

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2. A basic buffer solution contains a weak base B and its conjugate acid BH^+. On adding some HCI. which of the following reactions takes place to maintain constant Pt ?

A. $BH^+ \rightarrow B + H^+$

B. $B + H_2O \rightarrow BH^+ + OH^-$

C. $H^+ + OH^- \rightarrow H_2O$

D. $BH^+ + OH^- \rightarrow B + H_2O$

Answer: C

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3. For the buffer solution containing NH_4OH and NH_4CI, P^H of the buffer solution can be increased by

A. Adding some more NH_4, CI

B. Ading some more NH_4, OH

C. Removing NH_4, CI

D. Both b and c

Answer: D

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4. A buffer solution contains a weak acid HA and A . When small quantity of NaOH is added, to keep p^H as constant. which of the following reaction takes place?

A. $Ha \rightarrow H^+ + A^-$

B. $H^+ + A^- \rightarrow HA$

C. $HA + OH^- \rightarrow H_2O + A^-$

D. $A^- H_2O \rightarrow HA + OH^-$

Answer: C

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Practice Sheet Exercise Iii Level Ii

1. 100 ml solution having 0.2 M HA (weak acid, $K_a, = 1.0x10^{-5}$) and 0.2 N NaA, 200 ml of 0.1 M NaOH has been added. Furthermore, diluted to IL.

Which of the following statement is correct?

A. Initially, the solution has pH equal to 5, that is before addition of NaOH

B. In the final solution, the concentration of $\left[OH^{-}\right]$ is 10^{-9} M.

C. After the addition of NaOH, the pH of solution increase by four units.

D. After the addition of base, the solution losses buffering action and can be restored after the addition of acid.

Answer: B

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2. Which of the following is an acidic salt that can form an alkaline solution ?

A. $NaHSO_4$

B. $NaHCO_3$

C. Na_2HPO_3

D. Na_2HPO_4

Answer: A

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3. A solution containing a weak acid and its conjugate acts as an acidic buffer. In a buffer the dissociation of the well acid is suppressed by its conjugate base. ($K_1, K_2,$ and $K_3,$ of H_3PO_4, are $10_{-4}, 10^{-4}, 10^{-13}$ respectively

What is the P^H of a solution obtained by mixing 100ml of $0.1MH(3)PO_4$, and 150ml of 0.IM NaOH

A. 8

B. 9

C. 7

D. 6

Answer: B

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4. A solution containing a weak acid and its conjugate acts as an acidic buffer. In a buffer the dissociation of the well acid is suppressed by its conjugate base. $(K_1, K_2,$ and $K_3,$ of H_3PO_4, are $10_{-4}, 10^{-4}, 10^{-13}$ respectively

Which of the following volume of 0.1 M NaOH added to 100 mlof 0.1M H_3, PO_4, does not form a buffer

A. 50 ml

B. 150 ml

C. 200 ml

D. 250 ml

Answer: C

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5. The weak acids undergo partial ionisation is aqueous medium. However the dissociation of weak acids is suppressed by presence of common ions. But the Ka value of the acid remains constant irrespective of extent of dissociation

What is $\left[CN^{-}\right]$ J in a solution prepared by mixing 100ml 0.1M KCN and 100 ml 0.1 M HCl ? $\left(K_{a}ofHCN = 5 \times 10^{-6}\right)$

A. 5×10^{-4} M

B. 2×10^{-6} M

C. 2×10^{-5} M

D. 4×10^{-6} M

Answer: A

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6. What is the $\left[CN^{-}\right]$ in a solution prepared by mixing 100ml 0.1IM KCN and 100ml 0.2M HCI? $\left(K_x \text{ of } HCN = 5 \times 10^{-6}\right)$

A. 5×10^{-4} M

B. 2×10^{-6} M

C. 5×10^{-6} M

D. 2×10^{-5} M

Answer: C

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7. K_1 and $K_2 of H_2$S are 10^{-3} and 10^{-12} respectively what is $\left[S^{-2}\right]$ in 0.1 M H_2 S buffered at p^H =2

A. 10^{-10} M

B. 10^{-12} M

C. 10^{-11} M

D. 10^{-8} M

Answer: B

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8.

List - I (Salt)	List - II $(k_1 = 10^{-2} k_2 = 10^{-7})$
$(A) NaHSO_3$	(P) Acidic solution
$(B) Na_2HPO_3$	(Q) lkaline solution
$(C) NAH_2PO_3$	(R) pH independent on concentration
$(D) Al(NO_3)_3$	(S) Amphoteric salt

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9.

List - I (mixed in equal volumes)	List - II (Nature of solution)
(A) 0.2M HCN + $0.1M$KOH	(P) Strong base
(B) 0.2M HCl + 0.1M KCN	(Q) basic buffer
$(C) 0.2MNH_3 + 0.1MHCl$	(R) acidic buffer
$(D) 0.2MKOH + 0.1MNH_4Cl$	(S) Strong acid

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10. 20 ml of 0.1 M NH, solution is titrated with 0.025M HCI solution. What is the pH of the reaction mixture at equivalence point at 25°C ? $\left(K_b \text{of } NH_3 \text{is } 2 \times 10^{-6}\right)$.

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11. If the equlibrium constant for the reaction of weak acid HA with strong base is 10^9 then calculate the pH of 0.1 M NaA.

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12. If the change in pH between 50% and 80% neutralisation of a weak acid $\left(P^{Ka} = 6\right)$ by a strong base is given as logr, then find 'x'?

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13. 100ml $0.1MH_3PO_4$ is mixed with S0ml of 0.1M NaOH. What is the pH of the resultant solution? (Successive dissociation constant of H_3PO_4 are $10^{-3}, 10^{-8}$ and 10^{-12} respectively ?

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Practice Sheet Exercise Iv Level I

1. The least soluble compound (salt) of the following is

A. CsCl $\left(K_{sp} = 10^{-12}\right)$

B. HgS $\left(K_{sp} = 1 \times 10^{-52}\right)$

C. $PbCl_2\left(K_{sp} = 1.7 \times 10^{-5}\right)$

D. $ZnS\left(K_{sp} = 1.2 \times 10^{-23}\right)$

Answer: B

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2. The solubility of AgCl in 0.1M NaCl is $\left(K_{sp} \text{ of } AgCl = 1.2 \times 10^{-10}\right)$

A. 0.1 M

B. 1.2×10^{-5}

C. 1.095×10^{-5}

D. 1.2×10^{-9}

Answer: D

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3. The molar solubility of $Pbl_2 \in 0.2MPb(NO_3)_2$ solution in terms of solubility product, K_{sp}

A. $(K_{sp}/0.2)^{1/2}$

B. $(K_{sp}/0.4)^{1/2}$

C. $(K_{sp}/0.8)^{1/2}$

D. $(K_{sp}/0.8)^{1/3}$

Answer: C

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4. Which of the following sulphides has maximum solubility in water?

A. CdS $\left(K_{sp} = 36 \times 10^{-30}\right)$

B. FeS $\left(K_{sp} = 11 \times 10^{-20}\right)$

C. HgS $\left(K_{sp} = 36 \times 10^{-54}\right)$

D. ZnS $\left(K_{sp} = 11 \times 10^{-22}\right)$

Answer: B

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5. Number of moles of CuI $\left(K_{sp} = 5 \times 10^{-12}\right)$ that will dissolve in 1 L of 0.1 M NaI solution is

A. 2.2×10^{-6}

B. 5×10^{-11}

C. 5×10^{-10}

D. 2.2×10^{-5}

Answer: B

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6. pH of $Ba(OH)_2$ Ssolution is 12. Its solubility product is :

A. $10^{-6}M^3$

B. $4 \times 10^{-6}M^3$

C. $0.5 \times 10^{-7}M^3$

D. $5 \times 10^{-7}M^3$

Answer: D

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7. In the lollowing reuction. AgCl +KI $\Leftrightarrow$ KCl + Agl. As Kl is added, the cquilibrium is shifted towards right giving more Agl precipitate, because

A. Both AgCl and Agl are sparingly soluble

B. The K_{sp} of Agl is lower than K_{sp} of AgCl

C. The K_{sp} of Ag I is higher than K_{sp} of AgCl

D. Both AgCl and Agl have same soBubility product

Answer: B

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Practice Sheet Exercise Iv Level Ii Straight Objective Type Qusestion

1. The solubility of solid silver chromate. Ag_2CrO_4 . is determined in three solvents. Substance K_{sp} of $Ag_2CrO_4 = 9 \times 10^{-12}$

(I) pure water (ii) 0.1 M $AgNO_3$ (iii) 0.1 M Na_2CrO_4

Predict the relative solubility of Ag_2CrO_4 in the three solvents:

A. I = II = III

B. I $<$ II $<$ III

C. II = III $<$ I

D. $II < III <$ I

Answer: D

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2. What will be the result if 100 mlL of 0.06 M $Mg(NO_2)_2$ is added to 50 ml. of 0.06 M $Na_2C_2O_4$? [Ksp of $MgC_2O_4 = 8.6 \times 10^{-5}$]

A. A precipitate will not be formed

B. A precipitate will form and an excess of Mg^{2+} ions will remain in the solution

C.)A precipitate will form and an excess of $C_2O_4^{2-}$ ions will remain in the solution

D. A precipitate will form but neither ion is present in excess

Answer: B

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3. Why only As^{+3} gets precipitated as As_2S_3 and not Zn^{2+} as ZnS when H_2S is passed through an acidic solution containing As^{+1} and Zn^{+2}?

A. Solubility product of As_2S_3 is less than that of ZnSs

B. Enough As^{+3} are present in acidie medium

C. Zinc salt does not ionise in acidic medium

D. Solubility product changes in presence of an acid.

Answer: A

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4. In qualitative analysis, to identily the HA group sulphides, HCl is added to salt solution before the addition of H_2S. Because

A. Low S^{2-} ion concentration is required to get ppt

B. High S^{2-} ion concentration is required to get ppt

C. A group metal sulphides have higher values of K_{sp} than that of IVA group metal sulphides

D. p^H value increases

Answer: A

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5. Out of Ca^{2+}, Al^{3+}, Bi^{3+}, Mg^{2+} and Zn^{2+} the reagents NH_4Cl and aqueous NH_3 will precipitate

A. Ca^{2+}, Al^{3+}

B. Al^{3+}, Bi^{3+}

C. Bi^{3+}, Mg^{2+}

D. Mg^{2+}, Zn^{2+}

Answer: B

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6. When HCl gas is passed through a saturated solution of common salt, pure NaCl is precipitated because

A. HCl is highly ionised in solution

B. HCl is highly soluble in water

C. The solubility product of NaCl is lowered by HC

D. The ionic product of $\left[Na^{+}\right]\left[Cl^{-}\right]$ exceeds the solubility product of NaC1

Answer: D

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Practice Sheet Exercise Iv Level Ii

1. $A(OH)_2$ is a partially soluble substance and its K_{sp} value is 4×10^{-12} . Which of the following statement is / are correct ?

A. The solubility is unaffected by pH of the medium

B. Its solubility increases in a buffered medium having pH = 2

C. Its solubility decreases in a buffered medium having pH=9

D. Its saturated solution has pH = 10.3

Answer: B::C::D

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2. Which of the following is/are correct about the solubility?

A. Solubility of CaF_2 is more in buffer solution of pH =3 than in pure water

B. Solubility of ZnS in water depends upon the pH of solution

C. Solubility of AgCl increases in the presence of sodium thiosulphate

D. Solubility of ZnS in the presence of H^+ ion can be derived by K = $\left(\frac{Zn^{2+}[H_2S]}{[H^+]^2}\right.$ where K is equilibrium constant for the reaction, $ZnS_{(s)} + 2H^+_{(aq)} \Leftrightarrow Zn^{2+}_{aq} + H_2S_{(aq)}$

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

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3. Which of the following statement is/are incorrect?

A. Solubility of AgCl is less in 0.5 M KCl solution than in pure water

B. Solubility of AgCl is more in 0.5 M $CaCl_2$ than in pure water

C. Solubility of AgCl is more in IM $AgNO_3$ than in pure water

D. Solubility of AgCl is more in NH_3 than in pure water

Answer: B::C

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4. $K_{sp}(BaSO_4)$ is 1.1×10^{10}. In which case is $BaSO_4$ precipitated ?

A. 100 mL of $4 \times 10^{-3} M$ of $\mathrm{BaCl}_2 + 300 mL of 6.0 \times 10^{-4} M of Na_2SO_4$

B. 100 mL of $4 \times 10^{-4} M$ of $BaCl_2 + 300 mL of 6 \times 10^{-8} M$ of Na_2SO_4

C. 300 mL of 4×10^{-4} M of $BaCl_2$ + 100 mL of 6.0×10^{-8} M of Na_2SO_4

D. in all cases

Answer: A

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5. An acid-base titration consists of the controlled addition of a dissolved base to a dissolved acid (or the reverse). Acid and base react rapidly to neutralize each other. At the equivalence point, equivalents of reacting substances are equal. The pH during a titration changes every time with a drop of titrant added, but the rate of this change varies enormously. A titration curve, graph of pH as a function of the volume of titrant, displays in detail how the pH changes over the course of an acid base titration. Significantly. the pH changes most rapidly near the equivalence point. The exact shape of a titration curve depends on the K_a and K_b of acid and base

The suitable indicator for this titration will be:

A. bromo thymol blue

B. methyl orange

C. methyl red

D. all of these

Answer: D

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The pH at equivalence point is:

A. 11

B. 7

C. 3

D. 2

Answer: B

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7. An acidic indicator ionises as $I_nH \Leftrightarrow \mathrm{In}^- + H^+$. The molecular and ions of the indicator show different colours. The indicator changed it colour if its acidic of basic form completely predominant.

Dissociation constant of an acidic indicator is 10^{-5} . At what p^H 80% of the indicator exists in molecular form ?

A. 4.4

B. 6.6

C. 5.5

D. 3.3

Answer: A

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8. An acidic indicator ionises as $I_nH \Leftrightarrow \mathrm{In}^- + H^+$. The molecular and ions of the indicator show different colours. The indicator changed it colour if its acidic of basic form completely predominant.

An indicator with $P^{K\in}$ = 5 is added to a solution with p^H = 5 . What is the percentage of acidic form of the indicator

A. 0.25

B. 0.5

C. 0.75

D. 1

Answer: B

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9. An acidic indicator ionises as $I_nH \Leftrightarrow \mathrm{In}^- + H^+$. The molecular and ions of the indicator show different colours. The indicator changed it colour if its acidic of basic form completely predominant.

What is the percentage of basic form acidic indicator $\left(p^{ka} = 6\right)$ is an aqeous NaCl solution at 25° C

A. 0.9

B. 0.8

C. 0.6

D. 1

Answer: A

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Practice Sheet Exercise Iv Level Ii Matrix Matching Type Questions

	Column-I	Column$-II$
	$(A) Ag^{+} Cu^{+2}$	$(P) NH_4Cl + NH_4OH$
1.	$(B) Cu^{+2} Mn^{+2}$	$(Q) H_2S / HCl$
	$(C) Fe^{+2} Mg^{+2},$	$(R) HCl$
	$(D) Mg^{+2}, Zn^{+2}$	$NH_4OH + NH_4Cl + H_2S$

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2. A saturated 0.01 M H_2 S solution is buffered at pH =3 with exactly sufficient Pb$(NO_3)_2$ to not precipitate Pbc. K_a of $H_2S = 10^{-23}$, K_{sp} of Pbs = 10^{-28} . The concentration of Pb^{+2} in the solution is 10^{-x} . What is x ?

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3. Calculate the solubility of CaF_2 in water at 298 K which is 70% dissociated. K_{sp} of CaF_2 is 1.7×10^{-10}. If answer is x $\times 10^{-4}$ mol/ltr then x = ____?

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4. At what pH will a 10 −4 M solution of an indicator with K b =1×10 −11 change colour?

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5. What is the minimum pH required to prevent the precipitation of Zn^{+2} in a solution that is 0.01 M $ZnCl_2$ and saturated with 0.1 M H_2 S (Given : K_{sp} ZnS = 10^{-21} and $Ka_1 \times Ka_2$ of $H_2S = 10^{-20}$)

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Additional Practice Exercise Practice Sheet Advanced

1. A solution contains 0.05M of each of NaCl and Na_2, CrO_4,. Solid $AgNO_3$, is gradually added to it. Whichof the following facts true

(Given: $K_{sp}(AgCl) = 1.7 \times 106(-10)M^2$ and $K_{sp}(Ag_2, CrO_4,) = 1.9 \times 10^{-12}M^3$:

A. CI^- ions are precipitated first

B. CrO_4^{2} ions are precipitated together

C. Both Cr^- and CrO_4^{2-} ions are precipitated together

D. The second ion starts precipitating when $\left[1^{st}ion\right] = 2.758 \times 10^{-5}$

Answer: A::D

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2. For a general reaction given below, the value of solubility product can be given us

$$\begin{array}{lll} A_xB_y & = xA^{+y} & +yB^{-x} \\ a & 0 & 0 \\ a-s & xs & ys \end{array}$$

$$K_{sp} = (xs)^x.(ys)^y(\text{ or }) K_{sp} = x^x y^y (S)^{x+y}$$

Solubility product gives us not only an idea about the solubility of an electrolyte in a solvent but also helps in explaining concept of precipitation and calculation $\left[H^+\right]$ ion, $[OH^-]$ ion. It is also useful in qualitative analysis for the idetification and separation of basic radicals

Potussium chromate is slowly aded toa solution containing 0.20M Ag NO_3, and 0.20M $Ba(NO_3)_2$. Describe what happensif the K_{sp} for Ag_2, CrO_4, is 1.1×10^{-12} and the K_{sp} of $BaCiO_4$, is 1.2×10^{-10},

A. Cus

B. Na_2S

C. Zns, Obs, Cus

D. Pbs , Cus

Answer: D

Watch Video Solution

3. For a general reaction given below, the value of solubility product can be given us

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A. The Ag_2, CrO_4, pecipitates irst out of solution and then $BaCrO_4$, preciptates

B. The $BaCrO_4$, pecipitates first out of solution and then Ag_2, CrO_4, preciptates

C. Both Ag_2, CrO_4, and $BaCrO_4$, precipitate simultaneously out of solution

D. Neither Ag_2, CrO_4, nor $BaCrO_4$, precipitates

Answer: A

Watch Video Solution

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$$\begin{array}{lll} A_xB_y & = xA^{+y} & +yB^{-x} \\ a & 0 & 0 \\ a-s & xs & ys \end{array}$$

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What is the molar solubility of $Cu(OH)_2$, in 1.0 M NH_3 if the deep blue complex ion $\left[Cu(NH_3)_4\right]^{2+}$ is formed. The K_{sp}, of $Cu(OH)_2$, is 1.6×10^{-19} and K_3, of $\left[Cu(NH_3)_4\right.$ is 1.1×10^{13}

A. 7.1×10^{-4}M

B. 7.1×10^{-4}M

C. 7.6×10^{-3}M

D. 5.6×10^{-4}M

Answer: B

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5. A certain weak acid has $K_a, = 10^{-5}$. If the equilibrium constant for is its reaction with a strong base is repesented as $y \times 10^{y}$ then find the value of y.

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6. A solution is saturated in $SrCO_3$, and SrF_2. The CO_3^{2-} was found to be 10^{-3} mol/L. If the concentration of Fin solution is represented as $y \times 10^{-2}$ M then what is the value of 'y'?

[Given : $K_{sp}(SrCO_3) = 2.5 \times 10^{-10}, K_{sp}(SrF_2) = 10^{-10}$]

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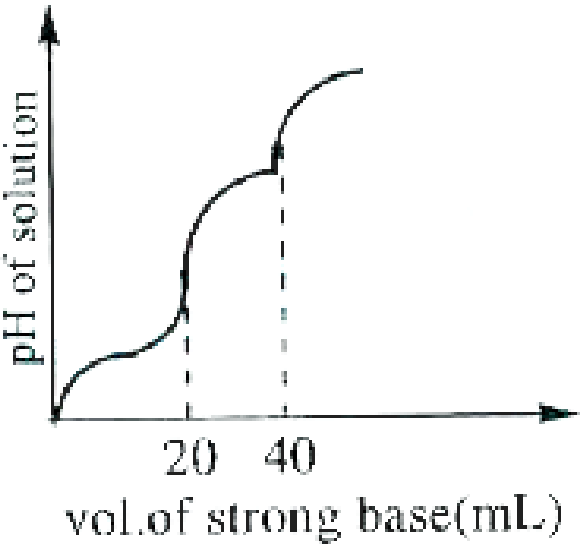
7. 10 mLof H,A (weak diprotic acid) solutions is titrated against 0.1M NaOH. pH of the solution is plotted against volume of strong base added and following observation is made. If pH of the solution at 1^{st} equivalence

point is pH_1 and at 2^{nd} equivalnee point is pH_2, Cal the value $(pH_2, -pH_1)$ at 25°C. Given for H_2, A, $p^{Kal} = 4.6 \& p^{Ka2} = 8$



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8. In a titration to 50mL of 0.2M acetic acid $(K_a, = 1.8 \times 10^{-5})$, 0.2M of V' mlL of NaOH is added to get a resultant solution of pH=4.74 if V =x^2?, what is x?

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9. Find pH of solution prepared by mixing 100ml, 0.1M Na_3, PO_4, and 200m/, 0.1M HCl.

$P^{k_{a1}}$, $P^{k_{a2}}$&$P^{k_{a3}}$of H_3PO_4 are 3,7 & 10 respectively)

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10. pH of aqucous solution of 0.1M, NH_4, CI is found to be 5. The equilibrium constant for the neutralization of NH_4, OH by HCl is 10^y. The value of 'y' is

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11. A solution of $0.01MCd^{2+}$ contains $0.01IMNH_4, OH$. What conc. of NH_4^+ form NH_4Cl is necessry to prevent precipitation of $Cd(OH)_2$? K_{sp}, of $Cd(OH)_2$, $= 2.0 \times 10^{-14}$, K_{sp} of $NH_4OH1.8 \times 10^{-5}$ if answer is 1.272×10^{-x} mol/ltr then x =_____ ?

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