1. The conjugate acid of NH_2^- is

(1) NH_3 (2) NH_2OH

(3) NH_4^+ (4) N_2H_4

2. Which of the following is not a Bronsted acid:-

(1) $CH_3NH_4^+$ (2) CH_3COO^-

(3) H_2O (4) HSO_4^-

3. In the reaction

$HNO_3 + H_2O \rightleftharpoons H_3O^+ + NO_3^-$, the conjugate base of HNO_3 is :-

(1) H_2O (2) H_3O^+

(3) NO_3^- (4) H_3O^+ and NO_3^-

4. Out of the following, amphiprotic species in aqueous medium are

I: HPO_3^{2-} II OH^-

III $H_2PO_4^-$ IV HCO_3^-

(1) I, III, IV (2) I and III

(3) III and IV (4) All

5. When ammonia is added to water, it decreases the concentration of which of the following ion

(1) OH^- (2) H_3O^+

(3) NH_4^+ (4) NH_4^+ & OH^-

6. Which of the following pair is Lewis acid & Lewis base & Product of these is also Lewis base

(1) BF_3 , NH_3 (2) $SiCl_4$, $2Cl^-$

(3) $CH_3^{\oplus}$, $^{\ominus}OC_2H_5$ (4) All of these

7. Ionic product of water will increase, if :-

(1) Pressure is decreased

(2) H^+ is added

(3) OH^- is increased

(4) Temperature is increased

8. At 60°C, pure water has $[H_3O^+]=10^{-6.7}$mol/lit. what is the value of K_W at 60°C :-

(1) 10^{-6} (2) 10^{-12} (3) 10^{-67} (4) $10^{-13.4}$

9. The pH of solution is increased from 3 to 6. Its H^+ ion conc. will be :-

(1) Reduced to half

(2) Doubled

(3) Reduced by 1000 times

(4) Increased by 1000 times

10. Degree of dissociation of 0.1 N CH_3COOH is :- (Dissociation constant = 1×10^{-5})

(1) 10^{-5} (2) 10^{-4} (3) 10^{-3} (4) 10^{-2}

11. The pH of a 0.02 M ammonia solution which is 5% ionised will be :-

(1) 2 (2) 11 (3) 5 (4) 7

12. The pH of an aqueous solution of 1.0 M solution of a weak monoprotic acid which is 1% ionised is

(1) 1 (2) 2 (3) 3 (4) 11

13. The concentration of $[H^+]$ and concentration of $[OH]^-$ of a 0.1 M aqueous solution of 2% ionised weak acid is [ionic product of water $=1 \times 10^{-14}$]

(1) 0.02×10^{-3} M and 5×10^{-11} M

(2) 1×10^{-3} M and 3×10^{-11} M

(3) 2×10^{-3} M and 5×10^{-12} M

(4) 3×10^{-2} M and 4×10^{-13} M

14. What is the quantity of NaOH present in 250 cc of the solution, so that it gives a pH = 13 :-

(1) 10^{-13} g (2) 10^{-1} g (3) 1.0 g (4) 4.0 g

15. An aqueous solution of HCl is 10^{-9} M HCl. The pH of the solution should be:-

(1) 9 (2) Between 6 and 7

(3) 7 (4) Unpredictable

16. Which one of the following has highest pH:-

(1) Distilled water

(2) 1 M NH_3

(3) 1 M NaOH

(4) Water saturated with chlorine

17. 8 gm NaOH and 4.9 gm H_2SO_4 are present in one litre of the solution. What is its pH

(1) 1 (2) 13 (3) 12 (4) 2

18. 10 ml of $\frac{M}{200}$ H_2SO_4 is mixed with 40 ml of $\frac{M}{200}$ H_2SO_4. The pH of the resulting solution is

(1) 1 (2) 2

(3) 2.3 (4) none of these

19. Which of the following solution will have pH close to 1.0?

(1) 100 ml of M/100 HCl + 100 ml of M/10 NaOH

(2) 55 ml of M/10 HCl + 45 ml of M/10 NaOH

(3) 10 ml of M/10 HCl + 90 ml of M/10 NaOH

(4) 75 ml of M/5 HCl + 25 ml of M/5 NaOH

20. A solution with pH 2.0 is more acidic than the one with pH 6.0 by a factor of:

(1) 3 (2) 4 (3) 3000 (4) 10000

21. The first and second dissociation constants of an acid H_2A are 1.0×10^{-5} and 5.0×10^{-10} respectively. The overall dissociation constant of the acid will be:

(1) 5.0×10^{-5} (2) 5.0×10^{15}

(3) 5.0×10^{-15} (4) 0.2×10^{5}

22. pH of an aqueous solution of NaCl at 85°C should be

(1) 7 (2) > 7 (3) < 7 (4) 0

23. The degree of hydrolysis of a salt of weak acid and weak base in it's 0.1 M solution is found to be 50%. If the molarity of the solution is 0.2 M, the percentage hydrolysis of the salt should be

(1) 100% (2) 50%

(3) 25% (4) none of these

24. If 40 ml of 0.2 M KOH is added to 160 ml of 0.1 M HCOOH [$K_a = 2 \times 10^{-4}$], the pOH of the resulting solution is

(1) 3.4 (2) 3.7

(3) 7 (4) 10.3

25. The pK_a of a weak acid (HA) is 4.5. The pOH of an aqueous buffered solution of HA in which 50% of the acid is ionized is :

(1) 4.5 (2) 2.5

(3) 9.5 (4) 7.0

26. To a 50 ml. of 0.05M formic acid, how much volume of 0.10M sodium formate must be added to get a buffer solution of pH = 4.0 ?

(pK_a of the acid is 3.7) (log2 = 0.3)

(1) 40 ml. (2) 4 ml.

(3) 50 ml. (4) 100 ml.

27. Which can act as buffer :-

(1) NH_4OH + NaOH

(2) HCOOH + HCl

(3) 40 ml. of 0.1 M NaCN + 20 ml. of 0.1 M HCl

(4) All of them

28. Calculate the pH of a buffer prepared by mixing 600 cc of 0.6 M NH_3 and 400 cc of 0.5 M NH_4Cl. K_b for $NH_3 = 1.8 \times 10^{-5}$, (log 1.8 = 0.26)

(1) 11.3 (2) 9.0 (3) 9.52 (4) 5

29. When 0.02 moles of NaOH are added to a litre of buffer solution, its pH changes from 5.75 to 5.80. What is its buffer capacity :-

(1) 0.4 (2) 0.05 (3) – 0.05 (4) 2.5

30. Calculate the pH range in which an acid indicator with K_{acid} (indicator) = 1.0×10^{-5} changes colour when the concentration of the indicator is 1×10^{-3}M.

(1) 5 ± 1 (2) 11 ± 1 (3) 3 ± 1 (4) 8 ± 1

ANSWER KEY Exercise-I

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**1**	**2**	**3**	**3**	**2**	**3**	**4**	**4**	**3**	**4**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**2**	**2**	**3**	**3**	**2**	**3**	**2**	**2**	**4**	**4**
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	**3**	**3**	**2**	**4**	**3**	**3**	**3**	**3**	**1**	**1**

PREVIOUS YEARS' QUESTIONS EXERCISE-II

1. The pH of 0.1 M solution of the following salts increases in the order **[JEE 1999]**

(1) NaCl < NH_4Cl < NaCN < HCl

(2) HCl < NH_4Cl < NaCl < NaCN

(3) NaCN < NH_4Cl < NaCl < HCl

(4) HCl < NaCl < NaCN < NH_4Cl

2. The solubility of $Mg(OH)_2$ is x mole/lit. then its solubility product is- **[AIEEE-2002]**

(1) x^3 (2) $5x^3$ (3) $4x^3$ (4) $2x^2$

3. 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}, MnS, FeS, ZnS and HgS are 10^{-15}, 10^{-23}, 10^{-20} and 10^{-54} respectively, which one will precipitate first ? **[JEE 2003]**

(1) FeS (2) MnS (3) HgS (4) ZnS

4. The solubility in water of a sparingly soluble salt AB_2 is 1.0×10^{-5} mol L^{-1}. Its solubility product will be **[AIEEE-2003]**

(1) 1×10^{-15} (2) 1×10^{-10}

(3) 4×10^{-15} (4) 4×10^{-10}

5. The molar solubility in mol L^{-1} of a sparingly soluble salt MX_4 is 's'. The corresponding solubility product is K_{SP}. 's' is given in terms of K_{SP} by relation : **[AIEEE-2004]**

(1) $s = (K_{SP} / 128)^{1/4}$ (2) $s = (128K_{SP})^{1/4}$

(3) $s = (256K_{SP})^{1/5}$ (4) $s = (K_{SP}/256)^{1/5}$

6. The solubility product of a salt having general formula MX_2, in water is : 4×10^{-12}. The concentration of M^{2+} ions in the aqueous solution of the salt is - **[AIEEE-2005]**

(1) 1.0×10^{-4} M

(2) 2.0×10^{-6} M

(3) 4.0×10^{-10} M

(4) 1.6×10^{-4} M

7. Hydrogen ion concentration in mol/L in a solution of pH = 5.4 will be - **[AIEEE-2005]**

(1) 3.88×10^{6}

(2) 3.98×10^{8}

(3) 3.98×10^{-6}

(4) 3.68×10^{-6}

8. In a saturated solution of the sparingly soluble strong electrolyte $AgIO_3$ (molecular mass = 283) the equilibrium which sets in is - **[AIEEE-2007]**

$$AgIO_3 \rightleftharpoons Ag^{+}_{(aq)} + IO^{-}_{3(aq)}$$

If the solubility product constant K_{sp} of $AgIO_3$ at a given temperature is 1.0×10^{-8}, what is the mass of $AgIO_3$ contained in 100 ml of its saturated solution ?

(1) 28.3×10^{-2} g (2) 2.83×10^{-3}g

(3) 1.0×10^{-7} g (4) 1.0×10^{-4} g

9. The pK_a of a weak acid, HA, is 4.80. The pK_b of a weak base, BOH, is 4.78. The pH of an aqueous solution of the corresponding salt. BA, will be - **[AIEEE-2008]**

(1) 9.58 (2) 4.79 (3) 7.01 (4) 9.22

10. Solid $Ba(NO_3)_2$ is gradually dissolved in a 1.0×10^{-4} M Na_2CO_3 solution. At what concentration of Ba^{2+} will a precipitate begin to form?

(K_{SP} for Ba CO_3 = 5.1×10^{-9}) **[AIEEE-2009]**

(1) 8.1×10^{-8} M (2) 8.1×10^{-7} M

(3) 4.1×10^{-5} M (4) 5.1×10^{-5} M

11. Solubility product of silver bromide is 5.0×10^{-13}. The quantity of potassium bromide (molar mass taken as 120 g mol^{-1}) to be added to 1 litre of 0.05 M solution of silver nitrate to start the precipitation of AgBr is :- **[AIEEE–2010]**

(1) 5.0×10^{-8} g (2) 1.2×10^{-10} g

(3) 1.2×10^{-9} g (4) 6.2×10^{-5} g

12. In aqueous solution the ionization constants for carbonic acid are

$K_1 = 4.2 \times 10^{-7}$ and $K_2 = 4.8 \times 10^{-11}$

Select the correct statement for a saturated 0.034 M solution of the carbonic acid :- **[AIEEE–2010]**

(1) The concentration of H^+ is double that of CO_3^{2-}

(2) The concentration of CO_3^{2-} is 0.034 M

(3) The concentration of CO_3^{2-} is greater than that of HCO_3^-

(4) The concentrations of H^+ and HCO_3^- are approximately equal

13. At 25° C, the solubility product of $Mg(OH)_2$ is 1.0×10^{-11}. At which pH, will Mg^{2+} ions start precipitating in the form of $Mg(OH)_2$ from a solution of 0.001 M Mg^{2+} ions ? **[AIEEE–2010]**

(1) 8 (2) 9 (3) 10 (4) 11

14. The K_{sp} for $Cr(OH)_3$ is 1.6×10^{-30}. The molar solubility of this compound in water is :-

[AIEEE–2011]

(1) $\sqrt[2]{1.6 \times 10^{-30}}$ (2) $\sqrt[4]{1.6 \times 10^{-30}}$

(3) $\sqrt[4]{1.6 \times 10^{-30}/27}$ (4) $1.6 \times 10^{-30}/27$

15. An acid HA ionises as

$$HA \rightleftharpoons H^+ + A^-$$

The pH of 1.0 M solution is 5. Its dissociation constant would be :- **[AIEEE–2011]**

(1) 1×10^{-10} (2) 5

(3) 5×10^{-8} (4) 1×10^{-5}

16. If K_{sp} of CaF_2 at 25°C is 1.7×10^{-10}, the combination amongst the following which gives a precipitate of CaF_2 is :- **[JEE-MAIN(online)–2012]**

(1) 1×10^{-2} M Ca^{2+} and 1×10^{-5} M F^-

(2) 1×10^{-4} M Ca^{2+} and 1×10^{-4} M F^-

(3) 1×10^{-3} M Ca^{2+} and 1×10^{-5} M F^-

(4) 1×10^{-2} M Ca^{2+} and 1×10^{-3} M F^-

17. The pH of a 0.1 molar solution of the acid HQ is 3. The value of the ionization constant, Ka of this acid is :- **[AIEEE–2012]**

(1) 1×10^{-7} (2) 3×10^{-7} (3) 1×10^{-3} (4) 1×10^{-5}

18. How many litres of water must be added to 1 litre of an aqueous solution of HCl with a pH of 1 to create an aqueous solution with pH of 2 ? **[AIEEE–2013]**

(1) 0.1 L (2) 0.9 L (3) 2.0 L (4) 9.0 L

19. Solid $Ba(NO_3)_2$ is gradually dissolved in a 1.0×10^{-4} M Na_2CO_3 solution. At which concentration of Ba^{2+}, precipitate of $BaCO_3$ begins to form ? (K_{sp} for $BaCO_3 = 5.1 \times 10^{-9}$)

[JEE-MAIN(Online)–2013]

(1) 5.1×10^{-5} M (2) 8.1×10^{-7}M

(3) 4.1×10^{-5} M (4) 7.1×10^{-8}M

20. NaOH is a strong base. What will be pH of 5.0×10^{-2}M NaOH solution ? (log2 = 0.3)

[JEE-MAIN(Online)–2013]

(1) 13.70 (2) 13.00 (3) 14.00 (4) 12.70

21. Which one of the following arrangements represents the correct order of solubilities of sparingly soluble salts Hg_2Cl_2, $Cr_2(SO_4)_3$, $BaSO_4$ and $CrCl_3$ respectively ? **[JEE-MAIN(Online)–2013]**

(1) $\left(\frac{K_{sp}}{4}\right)^{\frac{1}{3}}, \left(\frac{K_{sp}}{108}\right)^{\frac{1}{5}}, (K_{sp})^{\frac{1}{2}}, \left(\frac{K_{sp}}{27}\right)^{\frac{1}{4}}$

(2) $(K_{sp})^{\frac{1}{2}}, \left(\frac{K_{sp}}{4}\right)^{\frac{1}{3}}, \left(\frac{K_{sp}}{27}\right)^{\frac{1}{4}}, \left(\frac{K_{sp}}{108}\right)^{\frac{1}{5}}$

(3) $(K_{sp})^{\frac{1}{2}}, \left(\frac{K_{sp}}{108}\right)^{\frac{1}{5}}, \left(\frac{K_{sp}}{27}\right)^{\frac{1}{4}}, \left(\frac{K_{sp}}{4}\right)^{\frac{1}{3}}$

(4) $\left(\frac{K_{sp}}{108}\right)^{\frac{1}{5}}, \left(\frac{K_{sp}}{27}\right)^{\frac{1}{4}}, (K_{sp})^{\frac{1}{2}}, \left(\frac{K_{sp}}{4}\right)^{\frac{1}{3}}$

22. What would be the pH of a solution obtained by mixing 5 g of acetic acid and 7.5 g of sodium acetate and making the volume equal to 500 mL?

[JEE-MAIN(Online)–2013]

(Ka = 1.75×10^{-5}, pKa = 4.76)

(1) $4.76 < pH < 5.0$

(2) $pH < 4.70$

(3) pH of solution will be equal to pH of acetic acid

(4) pH = 4.70

23. Zirconium phosphate $[Zr_3(PO_4)_4]$ dissociates into three zirconium cations of charge +4 and four phosphate anions of charge –3. If molar solubility of zirconium phosphate is denoted by S and its solubility product by K_{sp} then which of the following relationship between S and K_{sp} is correct ?

[JEE-MAIN(Online)–2014]

(1) $S = \{K_{sp}/144\}^{1/7}$

(2) $S = \{K_{sp}/(6912)^{1/7}\}$

(3) $S = (K_{sp}/6912)^{1/7}$

(4) $S = \{K_{sp}/6912\}^7$

24. pK_a of a weak acid (HA) and pK_b of a weak base (BOH) are 3.2 and 3.4, respectively. The pH of their salt (AB) solution is **[JEE-MAIN(Offine)–2017]**

(1) 7.2 (2) 6.9 (3) 7.0 (4) 1.0

25. Addition of sodium hydroxide solution to a weak acid (HA) results in a buffer of pH 6. If ionisation constant of HA is 10^{-5}, the ratio of salt to acid concentration in the buffer solution will be :

[JEE-MAIN(Online)–2017]

(1) 4 : 5 (2) 1 : 10 (3) 10 : 1 (4) 5 : 4

26. 50 mL of 0.2 M ammonia solution is treated with 25 mL of 0.2 M HCl. If pK_b of ammonia solution is 4.75, the pH of the mixture will be:-

[JEE-MAIN(Online)–2017]

(1) 8.25 (2) 4.75 (3) 9.25 (4) 3.75

27. An aqueous solution contains 0.10 M H_2S and 0.20 M HCl. If the equilibrium constants for the formation of HS^- from H_2S is 1.0×10^{-7} and that of S^{2-} from HS^- ions is 1.2×10^{-13} then the concentration of S^{2-} ions in aqueous solution is :

[JEE-MAIN(Offine)–2018]

(1) 3×10^{-20} (2) 6×10^{-21}

(3) 5×10^{-19} (4) 5×10^{-8}

28. A aqueous solution contains an unknown concentration of Ba^{2+}. When 50 mL of a 1 M solution of Na_2SO_4 is added, $BaSO_4$ just begins to precipitate. The final volume is 500 mL. The solubility product of $BaSO_4$ is 1×10^{-10}. What is the original concentration of Ba^{2+} ?

[JEE-MAIN(Offine)–2018]

(1) 2×10^{-9} M (2) 1.1×10^{-9} M

(3) 1.0×10^{-10} M (4) 5×10^{-9} M

29. Following four solutions are prepared by mixing different volumes of NaOH and HCl of different concentrations, pH of which one of them will be equal to 1 ? **[JEE-MAIN(Online)–2018]**

(1) $75\text{mL}\frac{\text{M}}{5}\text{HCl} + 25\text{mL}\frac{\text{M}}{5}\text{NaOH}$

(2) $100\text{mL}\frac{\text{M}}{10}\text{HCl} + 100\text{mL}\frac{\text{M}}{10}\text{NaOH}$

(3) $55\text{mL}\frac{\text{M}}{10}\text{HCl} + 45\text{mL}\frac{\text{M}}{10}\text{NaOH}$

(4) $60\text{mL}\frac{\text{M}}{10}\text{HCl} + 40\text{mL}\frac{\text{M}}{10}\text{NaOH}$

30. The minimum volume of water required to dissolve 0.1 g lead (II) chloride to get a saturated solution (K_{sp} of $PbCl_2$ = 3.2×10^{-8} ; atomic mass of Pb = 207 u) is : **[JEE-MAIN(Online)–2018]**

(1) 0.36 L (2) 0.18 L

(3) 17.98 L (4)1.798 L

PREVIOUS YEARS QUESTIONS				ANSWER KEY						Exercise-II
Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**2**	**3**	**3**	**3**	**4**	**1**	**3**	**2**	**3**	**4**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**3**	**4**	**3**	**3**	**1**	**4**	**4**	**4**	**1**	**4**
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	**1**	**1**	**3**	**2**	**3**	**3**	**1**	**2**	**1**	**2**