

CHEMICAL EQUILIBRIUM -3

1. Arrhenius neutralisation involves

1. formation of dative bond
2. formation of water by the combination of H^+ with OH^-
3. transfer of proton
4. all of these

2. NH_3 is not a base according to

1. Bronsted theory
2. Lewis theory
3. Arrhenius theory
4. Lowry theory

3. Assertion A: According to Bronsted concept H_2O is an amphoteric substance.

Reason R: H_2O molecule can accept as well as donate a proton.

- 1) 'A' and 'R' are true, 'R' is correct explanation of 'A'.
- 2) 'A' and 'R' are true. 'R' is not correct explanation of 'A'.
- 3) 'A' is true and 'R' are false.
- 4) both A and R are false

4. Which of the following can act as both Bronsted acid and a Bronsted base?

- | | | | |
|--------------|---------------|----------------|----------------|
| (i) $HCOO^-$ | (ii) NH_3 | (iii) O^{2-} | (iv) HSO_4^- |
| 1. i and ii | 2. ii and iii | 3. ii and iv | 4. i and iv |

4. Which of the following is only Bronsted - Lowry acid but not an Arrhenius acid ?

- | | | | |
|--------|-------------|-----------|---------------|
| 1) HCl | 2) NH_4^+ | 3) BF_3 | 4) CH_3COOH |
|--------|-------------|-----------|---------------|

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

- | | | | |
|----------------|--------------|----------------|---------------|
| 1) CH_3COO^- | 2) HCO_3^- | 3) $H_2PO_2^-$ | 4) both 1 & 3 |
|----------------|--------------|----------------|---------------|

7. The conjugate base of hydrazoic acid is

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|-------------|------------|-------------|---------------|
| 1) N^{3-} | 2) N_3^- | 3) NH_2^- | 4) $N_3H_2^+$ |
|-------------|------------|-------------|---------------|

8. Conjugate acid of HPO_4^{2-} is

- | | | | |
|--------------|----------------|----------------|--------------|
| 1) H_3PO_4 | 2) $H_2PO_4^-$ | 3) PO_4^{3-} | 4) H_3PO_4 |
|--------------|----------------|----------------|--------------|

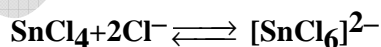
9. The conjugate acid of water is

- | | | | |
|-----------|----------|-------------|-------------|
| 1) OH^- | 2) H^+ | 3) H_3O^+ | 4) H_3O^- |
|-----------|----------|-------------|-------------|

10. In aqueous solution, HCl and HNO_3 are equally strong. This is because

- | | |
|--------------------------------------|-------------------------------------|
| 1) Their basicities are same | 2) Both are oxy acids of non-metals |
| 3) Both have lower molecular weights | 4) Levelling effect of water |

11. Which of the following acts as a Lewis acid in the following reaction



- | | | | |
|-----------|--------------------|-------------|------------|
| 1) Cl^- | 2) $[SnCl_6]^{2-}$ | 3) $SnCl_4$ | 4) $2Cl^-$ |
|-----------|--------------------|-------------|------------|

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

- | | | | |
|-----------|------------|------------|-----------|
| 1) BF_3 | 2) BCl_3 | 3) BBr_3 | 4) BI_3 |
|-----------|------------|------------|-----------|

13. In a complex compound ligand acts as

- 1) Lewis acid 2) Lewis base 3) Lowry-Bronsted acid 4) Arrhenius base

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

- 1) SO₂ 2) SCl₄ 3) both SO₂ and SCl₄ 4) SO₃

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

- 1) Temperature 2) Nature of solvent
3) Degree of dissociation 4) All the above

16. Conjugate base of [Al(H₂O)₆]³⁺ is

- 1) [Al(H₂O)₆]²⁺ 2) [Al(H₂O)₅OH]²⁺
3) [Al(H₂O)₄OH]²⁺ 4) [Al(H₂O)₄(OH)₂]²⁺

17. What is the decreasing order of strength of the bases OH⁻, NH₂⁻, H-C≡C⁻ and CH₃-CH₂⁻

- 1) CH₃ - CH₂⁻ > NH₂⁻ > H - C ≡ C⁻ > OH⁻
2) H - C ≡ C⁻ > CH₃ - CH₂⁻ > NH₂⁻ > OH⁻
3) OH⁻ > NH₂⁻ > H - C ≡ C⁻ > CH₃ - CH₂⁻
4) NH₂⁻ > H - C ≡ C⁻ > OH⁻ > CH₃ - CH₂⁻

18. Which of the following is an acidic salt ?

- 1) Na₃PO₄ 2) Na₂HPO₃ 3) NaH₂PO₂ 4) NaH₂PO₄

19. Which of the following has least tendency to act as Lewis acid ?

- 1) I⁻ 2) I⁺ 3) SnCl₂ 4) AlCl₃

20. Which of the following relatively more strong acid in aqueous solutions ?

- 1) HCl 2) HClO₄ 3) HI 4) all are equally strong.

21. Which of the following is strong Lewis acid?

- 1) Na⁺ 2) Mg²⁺ 3) Al³⁺ 4) All show equal strength

22. Which of the following acts as Lewis acid ?

- 1) Zn²⁺ 2) FeCl₃ 3) CO₂ 4) All the above

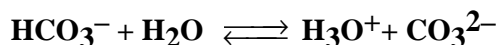
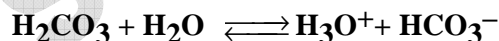
23. Which of the following acts as Lewis base ?

- 1) C₂H₂ 2) C₂H₄ 3) Pyridine 4) All the above

24. The no. of conjugate acid-base pairs present in the aqueous solution of H₃PO₃ is

- 1) 2 2) 3 3) 4 4) 5

25. H₂CO₃ ionises in two stages as represented below



the no. of conjugate acid-base pairs in the above reaction are

- 1) 2 2) 3 3) 4 4) 5

26. A : HCl is not acidic in benzene

R : Benzene does not accept protons

- 1) 'A' and 'R' are true, 'R' is correct explanation of 'A'.
- 2) 'A' and 'R' are true. 'R' is not correct explanation of 'A'.
- 3) 'A' is true and 'R' are false.
- 4) both A and R are false

27.A : H_3O^+ is the strongest acid in aqueous solution

R : water levels the strength of hydronium ion.

- 1) 'A' and 'R' are true, 'R' is correct explanation of 'A'.
- 2) 'A' and 'R' are true. 'R' is not correct explanation of 'A'.
- 3) 'A' is true and 'R' are false.
- 4) both A and R are false

28.A : ClO_4^- is the weakest base

R : In ClO_4^- , chlorine atom is SP^3 hybridised.

- 1) 'A' and 'R' are true, 'R' is correct explanation of 'A'.
- 2) 'A' and 'R' are true. 'R' is not correct explanation of 'A'.
- 3) 'A' is true and 'R' are false.
- 4) both A and R are false

29.A : All Bronsted bases are Lewis bases

R : A species that accepts a proton necessarily should donate a lone pair of electrons.

- 1) 'A' and 'R' are true, 'R' is correct explanation of 'A'.
- 2) 'A' and 'R' are true. 'R' is not correct explanation of 'A'.
- 3) 'A' is true and 'R' are false.
- 4) both A and R are false

30) The number of protons present in 10ml of water at 298K is

- 1) 6.023×10^{14}
- 2) 6.023×10^{16}
- 3) 6.023×10^{19}
- 4) 6.023×10^{21}

31. At 25°C , for an acid

- 1) $[\text{H}^+] > 10^{-7}\text{M}$
- 2) $[\text{OH}^-] < 10^{-7}\text{M}$
- 3) $\text{pH} < 7$
- 4) All the above

32. Ionic product of water depends on

- 1) Volume of the water
- 2) Amount of salt in water
- 3) Temperature
- 4) All the above

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

- 1) Decreases
- 2) Increases
- 3) Remains same
- 4) First decreases then increases.

34. If the ionic product of water is 1.96×10^{-14} at 35°C , What is its value at 10°C

- 1) 1.96×10^{-14}
- 2) 3.92×10^{-14}
- 3) 1.56×10^{-15}
- 4) 1.96×10^{-13}

35. Which of the following is relatively stronger acid? K_a values are given in brackets

- 1) HA (2×10^{-4}) 2) HB (3×10^{-5})
3) HC (1.8×10^{-3}) 4) HD (9.6×10^{-10})

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

- 1) AOH (5.8) 2) BOH (6.8) 3) COH (2.4) 4) DOH (10.9)

37. Which of the following statement is not correct ?

- 1) Cl^- is a Lewis acid
2) The P^H of 10^{-8} M HCl solution is less than 7
3) The ionic product of water at $25^\circ C$ is $10^{-14} M^2$
4) Bronsted - Lowry theory could not explain the acidic nature of $AlCl_3$

38. Which of the following statement is correct?

- 1) Bronsted - lowry theory could not explain the acidic nature of BCl_3
2) The P^H of 0.01M NaOH solution is 2
3) The ionic product of water at $25^\circ C$ is $10^{-10} M^2$
4) The P^H of a solution can be calculated using the equation $P^H = +\log[H^+]$

39. The P^H of a solution of H_2O_2 is 6.0 . Some Cl_2 gas is bubbled into this solution. Which of the following is correct?

- 1) The P^H of the resultant solution becomes 8
2) H_2 gas is liberated
3) The P^H of the resultant solution becomes less than 6.0 and O_2 gas is liberated.
4) Cl_2O is formed in the resultant solution.

40. Which of the following is correct.

- 1) The P^H of one liter solution containing 0.49g of H_2SO_4 is 2.0
2) The conjugate base of H_2S is S^{2-}
3) BF_3 is a Lewis base
4) CH_3COO^- is amphoteric ion.

41. Which on of the following statements is not correct ?

- 1) $P^H + P^{OH} = 14$ for all aqueous solutions
2) The P^H of 10^{-8} M HCl is 8
3) The solution with $P^H=3$ is 100 times more acidic than the solution with $P^H=5$
4) The conjugate base of $H_2PO_4^-$ is HPO_4^{2-}

42. Ostwald dilution law is applicable to

- 1) Strong electrolytes 2) Weak electrolytes
3) Non - electrolytes 4) All types of electrolytes

43. The correct expression for Ostwald's dilution law is

- 1) $K_a = \frac{\alpha^2}{(1-\alpha)V}$ 2) $K_a = \alpha^2 \cdot V$ 3) $K_a = \frac{\alpha^2}{1-V}$ 4) $K_a = \frac{\alpha^2}{C(1-\alpha)}$

44. For a weak acid, the concentration of H^+ ions is given by

- 1) $\sqrt{K_a \cdot C}$ 2) K_a/C 3) $\sqrt{K_a/C}$ 4) $\sqrt{C/K_a}$

45. Which of the following is wrong ?

- 1) Degree of dissociation of a weak electrolyte increases with dilution.
- 2) Increase in temperature increases the ionisation.
- 3) Strong electrolytes are ionised completely even at moderate concentrations.
- 4) Addition of NH_4Cl to NH_4OH increases the ionisation of the latter.

46. Dissociation constant of water at $25^\circ C$ is

- 1) 1.0×10^{-14} 2) 1×10^{14} 3) 14 4) 1.8×10^{-16}

Solution; $K_a = K_w \times 18/1000$

47. One litre of water contains 10^{-7} moles of H^+ ions. Degree of ionisation of water (in percentage) is

- 1) 1.8×10^{-7} 2) 1.8×10^{-9} 3) 3.6×10^{-7} 4) 3.6×10^{-9}

Solution; One litre of water i.e 1000/18 moles contains 10^{-7} moles of H^+ ions

Then 100 moles of water contains $(100 \times 18/1000)10^{-7} = 1.8 \times 10^{-7}\%$

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

- 1) 2.301 2) 11.699 3) 12 4) 7

Solution; $N = M \times \text{acidity} = 0.005 \times 2 = 0.01 = 10^{-2}$, $P^{OH} = -\log 10^{-2} = 2$ and $P^H = 14 - 2 = 12$

49. Equal volumes of two solutions with $P^H = 3$ and $P^H = 11$ are mixed. Then the P^H of resulting solution is

- 1) 8 2) 7 3) 6 4) 0

Solution; $P^H = 3$ i.e $[H^+] = 10^{-3}$ and $P^H = 11$ i.e $P^{OH} = 3$. As $P^H = P^{OH}$, solution is neutral.

50. 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

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

Solution; As solution is diluted by 100 times, P^H increased by $\log 100$ i.e 2 units.

KEY

1) 2 2) 3 3) 1 4) 3 5) 2 6) 4 7) 2 8) 2 9) 4 10) 4

11) 3 12) 4 13) 2 14) 3 15) 4 16) 2 17) 1 18) 4 19) 1 20) 4

21) 3 22) 4 23) 4 24) 4 25) 2 26) 1 27) 1 28) 2 29) 1 30) 1

31) 4 32) 3 33) 3 34) 3 35) 3 36) 3 37) 1 38) 1 39) 3 40) 1

41) 2 42) 2 43) 1 44) 1 45) 4 46) 4 47) 1 48) 3 49) 2 50) 1