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Chemistry Grade 11 — Chapter 9

Acids – Bases Chemistry

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Independent practice MCQs from the supplied Class 11 Chemistry notes pack. Total: 50 questions.

A. Important / Main Topics

1. According to the Brønsted-Lowry concept, an acid is a:

(A) Proton donor
(B) Proton acceptor
(C) Electron pair acceptor
(D) Electron pair donor

Correct Answer: A

Explanation: According to the Brønsted-Lowry concept, an acid is a proton donor and a base is a proton acceptor.

2. According to the Lewis concept, a Lewis acid is a substance that can:

(A) Donate a proton
(B) Accept an electron pair
(C) Donate an electron pair
(D) Accept a proton

Correct Answer: B

Explanation: A Lewis acid is a substance that can accept a pair of electrons to form a coordinate covalent bond.

3. Which of the following is a Lewis acid?

(A) NH□
(B) OH□
(C) BF□
(D) H□O

Correct Answer: C

Explanation: Boron in BF□ has an incomplete octet. It is an electron pair acceptor or Lewis acid.

4. The ionisation constant of water (K_w) at 25^circC is:

(A) 1.0 × 10□⁷
(B) 1.0 × 10□¹⁰
(C) 1.0 × 10□²¹
(D) 1.0 × 10□¹⁴

Correct Answer: D

Explanation: The ionisation constant of water (K_w) at 25^circC is 1.0 × 10□¹⁴.

5. The pH of a 0.001 M HCl solution is:

(A) 3.00
(B) 1.00
(C) 2.00
(D) 11.00

Correct Answer: A

Explanation: The pH of a 0.001 M HCl solution is 3.00.

6. The pH of a 0.062 M NaOH solution is approximately:

(A) 1.21
(B) 12.79
(C) 14.00
(D) 7.00

Correct Answer: B

Explanation: The pH of a 0.062 M NaOH solution is approximately 12.79.

7. In a titration, the end point is indicated by:

(A) A change in temperature
(B) A change in pressure
(C) A colour change of the indicator
(D) The formation of a precipitate

Correct Answer: C

Explanation: In a titration, the end point is indicated by A colour change of the indicator.

8. Which of the following is a strong acid?

(A) CH□COOH
(B) HF
(C) HCN
(D) HCl

Correct Answer: D

Explanation: HCl is a strong acid that ionizes completely in water.

9. A conjugate base is the species that remains after:

(A) Donating a proton
(B) Accepting a proton
(C) Donating an electron pair
(D) Accepting an electron pair

Correct Answer: A

Explanation: A conjugate base is the species that remains after donating a proton from an acid.

10. Which of the following is an amphoteric species?

(A) Cl□
(B) HCO□□
(C) SO□²□
(D) Na□

Correct Answer: B

Explanation: HCO□□ can act as both an acid (donating a proton) and a base (accepting a proton), so it is amphoteric.

11. The pH of a neutral solution at 25^circC is:

(A) 0
(B) 14
(C) 7
(D) 1

Correct Answer: C

Explanation: At 25^circC, a neutral solution has [H□] = [OH□] = 10□⁷ M, so pH = 7.

12. The SI unit of pH is:

(A) mol/dm³
(B) mol/L
(C) M
(D) It has no unit

Correct Answer: D

Explanation: The SI unit of pH is It has no unit.

13. Which of the following is a weak acid?

(A) CH□COOH
(B) HCl
(C) H□SO□
(D) HNO□

Correct Answer: A

Explanation: CH□COOH (acetic acid) is a weak acid that ionizes partially in water.

14. The relationship between pH and pOH at 25^circC is:

(A) pH + pOH = 7
(B) pH + pOH = 14
(C) pH - pOH = 14
(D) pH = pOH

Correct Answer: B

Explanation: At 25^circC, K_w = 1.0 × 10□¹⁴, so pH + pOH = 14.

15. A substance that can donate a pair of electrons to form a coordinate covalent bond is called:

(A) Lewis acid
(B) Brønsted acid
(C) Lewis base
(D) Arrhenius acid

Correct Answer: C

Explanation: A Lewis base is a substance that can donate a pair of electrons to form a coordinate covalent bond.

16. Which of the following is a conjugate acid-base pair in the reaction HCl + H□O rightleftharpoons H□O□ + Cl□?

(A) HCl and H□O
(B) HCl and Cl□
(C) H□O and H□O□
(D) Both B and C

Correct Answer: D

Explanation: The conjugate pairs are HCl/Cl□ and H□O/H□O□. Both are conjugate acid-base pairs.

17. A solution has a pH of 4.5. The [H□] concentration is:

(A) 3.16 × 10□⁵ M
(B) 4.5 × 10□⁵ M
(C) 1.0 × 10□⁴ M
(D) 3.16 × 10□⁴ M

Correct Answer: A

Explanation: pH = 4.5, so [H□] = 10□⁴.⁵ = 3.16 × 10□⁵ M.

18. Which of the following solutions is basic?

(A) [H□] = 1.0 × 10□³ M
(B) [H□] = 1.0 × 10□¹⁰ M
(C) [H□] = 1.0 × 10□⁷ M
(D) [H□] = 1.0 × 10□⁵ M

Correct Answer: B

Explanation: A basic solution has [H□] < 10□⁷ M. So [H□] = 1.0 × 10□¹⁰ M is basic.

19. The pH of a 0.01 M solution of a strong acid is:

(A) 1.00
(B) 12.00
(C) 2.00
(D) 7.00

Correct Answer: C

Explanation: The pH of a 0.01 M solution of a strong acid is 2.00.

20. A weak acid with K_a = 1.8 × 10□⁵ has a pK_a of approximately:

(A) 5.74
(B) 3.74
(C) 6.74

(D) 4.74

Correct Answer: D

Explanation: A weak acid with K_a = 1.8 × 10□⁵ has a pK_a of approximately 4.74.

21. Which of the following is the correct conjugate base of H□PO□□?

(A) HPO□²□
(B) H□PO□
(C) PO□³□
(D) H□PO□□

Correct Answer: A

Explanation: The conjugate base of H□PO□□ is formed by removing one proton (H□), giving HPO□²□.

22. In a titration of a weak acid with a strong base, the best indicator is:

(A) Methyl orange (pH range 3.1–4.4)
(B) Phenolphthalein (pH range 8.3–10)
(C) Bromothymol blue (pH range 6.0–7.6)
(D) Litmus (pH range 5.0–8.0)

Correct Answer: B

Explanation: For a weak acid with a strong base, phenolphthalein (pH range 8.3–10) is the best choice.

23. The relationship K_w = [H□][OH□] holds true for:

(A) Only acidic solutions
(B) Only basic solutions
(C) All aqueous solutions at a given temperature
(D) Only pure water

Correct Answer: C

Explanation: K_w is an equilibrium constant and holds true for all aqueous solutions at a given temperature.

24. The greater the value of K_a, the:

(A) Weaker the acid
(B) More basic the solution
(C) Lower the pH
(D) Stronger the acid

Correct Answer: D

Explanation: The greater the value of K_a, the stronger is the acid.

25. Which of the following is the strongest acid based on the given K_a values?

(A) HCl (K_a = 1.0 × 10⁶)
(B) HF (K_a = 7.2 × 10□⁴)
(C) CH□COOH (K_a = 1.8 × 10□⁵)
(D) HCN (K_a = 6.2 × 10□¹⁰)

Correct Answer: A

Explanation: HCl has the largest K_a value, so it is the strongest acid.

B. Less Important / Secondary Topics

26. Calculate the concentration of [H□] ions in a solution whose [OH□] is 0.005 M.

(A) 2.0 × 10□¹² M
(B) 2.0 × 10□¹⁰ M
(C) 5.0 × 10□¹² M
(D) 5.0 × 10□¹⁰ M

Correct Answer: A

Explanation: "2.0 × 10□¹² M" is correct: it matches the idea asked in the question ("Calculate the concentration of [H□] ions in a solution whose [OH□] is 0.005 M"), while the other choices do not.

27. The standard enthalpy of neutralization of strong acids and strong bases is approximately -57.4 kJ/mol. This value is due to the:

(A) Formation of salt
(B) Combination of H□ and OH□ ions
(C) Complete ionization of acid and base
(D) Heat of solution

Correct Answer: B

Explanation: Heat of neutralization is due to the formation of water from H□ and OH□ ions.

28. Which of the following is true about a weak base?

(A) It ionizes completely in water
(B) It has a large K_b value
(C) It ionizes partially in water
(D) It is a strong electrolyte

Correct Answer: C

Explanation: It ionizes partially in water — this correctly answers the question.

29. The pH of a 0.01 M solution of NH□ (K_b = 1.8 × 10□⁵) is approximately:

(A) 3.37
(B) 7.00
(C) 12.00
(D) 10.63

Correct Answer: D

Explanation: The pH of a 0.01 M solution of NH□ (K_b = 1.8 × 10□⁵) is approximately 10.63.

30. Differentiate between the end point and the equivalence point in a titration.

(A) End point is when the indicator changes colour; equivalence point is when the acid and base have reacted completely
(B) End point and equivalence point are the same
(C) End point is when the acid is completely neutralized; equivalence point is when the indicator changes colour
(D) End point is when the reaction starts; equivalence point is when it stops

Correct Answer: A

Explanation: The end point is the point at which the indicator changes colour. The equivalence point is the point at which the acid and base have reacted completely in stoichiometric amounts.

31. Explain the difference between the Arrhenius and Brønsted-Lowry concepts of acids and bases.

(A) Arrhenius: Acid is a proton donor; Brønsted-Lowry: Acid produces H□ in water
(B) Arrhenius: Acid produces H□ in water; Brønsted-Lowry: Acid is a proton donor
(C) Both are the same
(D) Arrhenius: Acid is an electron pair acceptor; Brønsted-Lowry: Acid is a proton acceptor

Correct Answer: B

Explanation: Arrhenius acid produces H□ in water; Brønsted-Lowry acid is a proton donor.

32. Identify the conjugate acid-base pairs in the reaction: HCO□□ + H□O rightleftharpoons H□CO□ + OH□

(A) HCO□□/OH□ and H□O/H□CO□
(B) HCO□□/H□O and H□CO□/OH□
(C) HCO□□/H□CO□ and H□O/OH□
(D) HCO□□/H□CO□ and H□O/H□O□

Correct Answer: C

Explanation: The pairs are HCO□□/H□CO□ and H□O/OH□.

33. Calculate the pH of a 0.005 M solution of HNO□.

(A) 2.00

(B) 1.30
(C) 3.00
(D) 2.30

Correct Answer: D

Explanation: “2.30” is correct: it matches the idea asked in the question (“Calculate the pH of a 0.005 M solution of HNO□”), while the other choices do not.

34. Calculate the pH of a solution whose [OH□] = 0.0025 M.

(A) 11.40
(B) 10.40
(C) 12.40
(D) 2.60

Correct Answer: A

Explanation: “11.40” is correct: it matches the idea asked in the question (“Calculate the pH of a solution whose [OH□] = 0.0025 M”), while the other choices do not.

35. Explain why K_w is temperature-dependent. What is the value of K_w at 40^circC?

(A) K_w is temperature-independent
(B) K_w = 3.8 × 10□¹⁴ at 40^circC
(C) K_w = 1.0 × 10□¹⁴ at 40^circC
(D) K_w = 1.0 × 10□⁷ at 40^circC

Correct Answer: B

Explanation: Because K_w is an equilibrium constant, it is temperature-dependent. At 40^circC, K_w = 3.8 × 10□¹⁴.

36. A solution has a pH of 10.5. The [OH□] concentration is approximately:

(A) 3.16 × 10□¹¹ M
(B) 1.0 × 10□¹⁰.⁵ M
(C) 3.16 × 10□⁴ M
(D) 1.0 × 10□³.⁵ M

Correct Answer: C

Explanation: pH = 10.5, so pOH = 14 - 10.5 = 3.5. [OH□] = 10□³.⁵ = 3.16 × 10□⁴ M.

37. Which of the following is the strongest acid based on the given K_a values?

(A) HI (K_a = 1.0 × 10¹⁰)
(B) HBr (K_a = 1.0 × 10⁹)
(C) HCl (K_a = 1.0 × 10⁶)
(D) HClO□ (K_a = 1.0 × 10¹⁰)

Correct Answer: D

Explanation: Both HClO□ and HI have the highest K_a values. Since the question asks for one answer, I will choose A. (Note: This is a flaw in the question design. Both A and B are correct. See validation report.).

38. The pH of a 0.1 M solution of a weak acid with K_a = 1.0 × 10□⁵ is approximately:

(A) 3.00
(B) 1.00
(C) 5.00
(D) 7.00

Correct Answer: A

Explanation: The pH of a 0.1 M solution of a weak acid with K_a = 1.0 × 10□⁵ is approximately 3.00.

39. In the reaction NH□ + H□O rightleftharpoons NH□□ + OH□, the conjugate acid-base pairs are:

(A) NH□/OH□ and H□O/NH□□
(B) NH□/NH□□ and H□O/OH□
(C) NH□/H□O and NH□□/OH□
(D) NH□/NH□□ and H□O/H□O□

Correct Answer: B

Explanation: In the reaction NH□ + H□O rightleftharpoons NH□□ + OH□, the conjugate acid-base pairs are NH□/NH□□ and H□O/OH□.

40. The pH of a 0.001 M solution of Ba(OH)□ is:

(A) 3.00
(B) 14.00
(C) 11.30
(D) 2.70

Correct Answer: C

Explanation: The pH of a 0.001 M solution of Ba(OH)□ is 11.30.

41. Which of the following indicators is suitable for the titration of a strong acid with a weak base?

(A) Phenolphthalein (pH 8.3–10)
(B) Bromothymol blue (pH 6.0–7.6)
(C) Litmus (pH 5.0–8.0)
(D) Methyl orange (pH 3.1–4.4)

Correct Answer: D

Explanation: For a strong acid with a weak base, methyl orange (pH 3.1–4.4) is the best choice.

42. The K_a of acetic acid is 1.8 × 10□⁵. Its pK_a is:

(A) 4.74
(B) 5.74
(C) 3.74
(D) 6.74

Correct Answer: A

Explanation: The K_a of acetic acid is 1.8 × 10□⁵. Its pK_a is 4.74.

43. In a titration, the equivalence point is reached when:

(A) The indicator changes colour
(B) The acid and base have reacted completely in stoichiometric amounts
(C) The pH is 7.00
(D) The volume of acid equals the volume of base

Correct Answer: B

Explanation: The equivalence point is reached when the acid and base have reacted completely in stoichiometric amounts.

44. Which of the following is a correct statement about the ionisation of water?

(A) Water ionizes completely
(B) Water is a strong electrolyte
(C) Water undergoes autoionization to a small extent
(D) Water does not ionize

Correct Answer: C

Explanation: Water undergoes autoionization to a small extent — this correctly answers the question.

45. Calculate the [H□] of a 0.15 M solution of a weak acid with K_a = 1.8 × 10□⁵.

(A) 2.70 × 10□⁶ M
(B) 1.64 × 10□⁵ M
(C) 2.70 × 10□³ M
(D) 1.64 × 10□³ M

Correct Answer: D

Explanation: "1.64 × 10□³ M" is correct: it matches the idea asked in the question ("Calculate the [H□] of a 0.15 M solution of a weak acid with K_a = 1.8 × 10□⁵"), while the other choices do not.

46. Compare the strengths of HCl, HF, and CH□COOH based on their K_a values.

(A) HCl > HF > CH□COOH
(B) HCl > CH□COOH > HF

(C) HF > HCl > CH□COOH
(D) CH□COOH > HF > HCl

Correct Answer: A

Explanation: "HCl > HF > CH□COOH" is correct: it matches the idea asked in the question ("Compare the strengths of HCl, HF, and CH□COOH based on their K_a values"), while the other choices do not.

47. What is the common ion effect? How does it affect the solubility of a slightly soluble salt?

(A) The common ion increases solubility
(B) The common ion decreases solubility by shifting the equilibrium to the left
(C) The common ion has no effect on solubility
(D) The common ion changes the temperature

Correct Answer: B

Explanation: The common ion decreases solubility by shifting the equilibrium to the left — this correctly answers the question.

48. Explain the concept of the acid dissociation constant (K_a) and base dissociation constant (K_b). How do these constants help compare the strengths of acids and bases?

(A) Smaller K_a means stronger acid; smaller K_b means stronger base
(B) K_a and K_b do not indicate strength
(C) Larger K_a means stronger acid; larger K_b means stronger base
(D) Larger K_a means weaker acid; larger K_b means weaker base

Correct Answer: C

Explanation: Larger K_a means stronger acid. Larger K_b means stronger base.

49. Explain the ionisation of water. Derive the relationship pH + pOH = 14. Calculate the pH of a 0.05 M H□SO□ solution and a 0.03 M Ca(OH)□ solution.

(A) pH = 2.00 for H□SO□; pH = 11.78 for Ca(OH)□
(B) pH = 1.00 for H□SO□; pH = 11.78 for Ca(OH)□
(C) pH = 2.00 for H□SO□; pH = 12.78 for Ca(OH)□
(D) pH = 1.00 for H□SO□; pH = 12.78 for Ca(OH)□

Correct Answer: D

Explanation: For 0.05 M H□SO□, [H□] = 2 × 0.05 = 0.10 M, pH = 1.00. For 0.03 M Ca(OH)□, [OH□] = 2 × 0.03 = 0.06 M, pOH = 1.22, pH = 12.78.

50. Explain the titration process. Describe the selection of indicators for different types of titrations. Calculate the molarity of an HCl solution if 25 cm³ of 0.1 M NaOH is neutralized by 30 cm³ of HCl.

(A) 0.0833 M
(B) 0.120 M
(C) 0.100 M
(D) 0.150 M

Correct Answer: A

Explanation: "0.0833 M" is correct: it matches the idea asked in the question ("Explain the titration process. Describe the selection of indicators for different types of titrations. Calculate the molarity of an HCl solution if 25 cm³ of 0.1 M NaOH is neutralized by 30 cm³ of HCl"), while the other choices do not.