

ACIDS AND BASES IN AQUEOUS SOLUTIONS 11

- Which of the following best describes a weak acid?
 - An acid which contains only one hydrogen atom in its molecular formula
 - An acid of low concentration
 - A dilute acid
 - An acid which dissociates only partially in aqueous solution

- Which one of the following is NOT a property of a base?
 - Turns red litmus blue.
 - Tastes bitter.
 - Reacts with metal oxides to produce a salt and water.
 - Usually produces hydroxide ions in aqueous solution.
 - Conducts electricity in aqueous solution.

- What is the pH of 0.01 mol L^{-1} solution of hydrochloric acid?
 - Between 7 and 9
 - 7
 - Between 3 and 7
 - 2

- Which one of the following groups contains only BASIC oxides?
 - Na_2O , Al_2O_3 , SO_2
 - MgO , ZnO , CuO
 - Na_2O , MgO , CuO
 - CO_2 , MgO , NO_2

- Which one of the following oxides reacts with both HCl and NaOH ?
 - CuO
 - Al_2O_3
 - MgO
 - CaO

6. Which of the following reactions would not produce hydrogen gas?
- When dilute sodium hydroxide is added to some zinc metal.
 - When dilute hydrochloric acid is added to some zinc metal.
 - When dilute hydrochloric acid is added to aluminium.
 - When dilute hydrochloric acid is added to copper oxide.
7. Consider the following statements.
- Acids are substances which produce hydrogen ions in aqueous solution.
 - Acids are proton donors.
 - Bases are substances which ionise in water to produce hydroxide ions.
 - A base is a proton acceptor.
- Which, if any, are consistent with the Arrhenius theory of acids and bases?
- 1 only.
 - 1 and 2.
 - 2 and 4.
 - 1 and 3.
8. Which of the following examples shows only strong acids?
- Hydrochloric acid, ethanoic acid, sulfuric acid
 - Sulfuric acid, nitric acid, hydrochloric acid
 - Ethanoic acid, carbonic acid, nitric acid
 - Nitric acid, phosphoric acid, sulfuric acid
9. Which of the following is a WEAK base?
- Sodium hydroxide
 - Ammonia
 - Calcium hydroxide
 - Potassium hydroxide
10. A substance which reacts with both acids and bases is said to be
- amphoteric
 - a good oxidising agent
 - an electrolyte
 - hydrated

11. The pH of a solution is a measure of acidity or alkalinity. If a solution has a pH of 3 , this tells us that
- the solution is alkaline.
 - the solution is acidic
 - the solution is neutral
 - the solution is slightly alkaline
12. The hydrogen carbonate ion, HCO_3^- , may act as an acid or a base in aqueous solution. In which one of the equations below is it acting as an acid?
- $\text{HCO}_3^-(\text{aq}) + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3(\text{aq}) + \text{OH}^-(\text{aq})$
 - $\text{HCO}_3^-(\text{aq}) + \text{H}_3\text{O}^+(\text{aq}) \rightleftharpoons \text{H}_2\text{CO}_3(\text{aq}) + \text{H}_2\text{O}$
 - $\text{HCO}_3^-(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{CO}_3^{2-}(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$
 - $\text{HCO}_3^-(\text{aq}) + \text{OH}^-(\text{aq}) \rightleftharpoons \text{H}_2\text{CO}_3(\text{aq}) + \text{O}^{2-}(\text{aq})$
13. Aluminium hydroxide can act as an acid or a base. In which equation below is it acting as an acid?
- $\text{Al}(\text{OH})_3(\text{s}) + 3\text{HCl}(\text{aq}) \rightleftharpoons \text{AlCl}_3(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$
 - $\text{Al}(\text{OH})_3(\text{s}) + \text{NaOH}(\text{aq}) \rightleftharpoons \text{Al}(\text{OH})_4^-(\text{aq}) + \text{Na}^+(\text{aq})$
 - $4\text{Al}(\text{OH})_3(\text{s}) + 6\text{H}_2\text{SO}_4(\text{aq}) \rightleftharpoons 2\text{Al}_2(\text{SO}_4)_3(\text{aq}) + 12\text{H}_2\text{O}$
 - $\text{Al}(\text{OH})_3(\text{s}) + 3\text{H}_3\text{O}^+(\text{aq}) \rightleftharpoons \text{Al}^{3+}(\text{aq}) + 6\text{H}_2\text{O}$
14. Which of the following aqueous solutions has the lowest pH?
- $0.1 \text{ mol L}^{-1} \text{ NaOH}$
 - $0.1 \text{ mol L}^{-1} \text{ HNO}_3$
 - $0.1 \text{ mol L}^{-1} \text{ H}_2\text{SO}_4$
 - $0.1 \text{ mol L}^{-1} \text{ HF}$

The next 2 items refer to the following equations

- I $\text{Mg(s)} + 2\text{H}_3\text{O}^+(\text{aq}) \rightarrow \text{Mg}^{2+}(\text{aq}) + \text{H}_2(\text{g}) + 2\text{H}_2\text{O}$
- II $\text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow 2\text{H}_2\text{O}$
- III $\text{HS}^-(\text{aq}) + \text{H}_3\text{O}^+(\text{aq}) \rightarrow \text{H}_2\text{S}(\text{aq}) + \text{H}_2\text{O}$

15. Which of the above equation/s represents acid – base reaction/s?
- a) I only
 - b) I and II
 - c) II and III
 - d) II only
 - e) I, II and III.
16. Which of the following is acting as a base?
- a) Mg
 - b) H_3O^+
 - c) H_2S
 - d) HS^-
17. In the neutralization reaction between aqueous solutions of hydrochloric acid and sodium hydroxide, the spectator ions are
- a) $\text{H}^+(\text{aq})$ and $\text{OH}^-(\text{aq})$
 - b) $\text{Na}^+(\text{aq})$ and $\text{H}^+(\text{aq})$
 - c) $\text{Na}^+(\text{aq})$ and $\text{Cl}^-(\text{aq})$
 - d) $\text{OH}^-(\text{aq})$ and $\text{Cl}^-(\text{aq})$
18. Which of the following is a diprotic acid?
- a) HNO_3
 - b) HCl
 - c) H_2CO_3
 - d) H_3PO_4
19. Which of the following does NOT occur when dilute hydrochloric acid is added to zinc metal?
- a) A colourless gas is formed which when passed through limewater causes it to become cloudy.
 - b) A colourless gas is produced which gives a loud “pop” when ignited
 - c) The zinc metal dissolves
 - d) The solution remains colourless

20. Which of the following solutions contains the most hydrogen ions?
- a) 10 mL of 0.1 mol L⁻¹ CH₃COOH
 - b) 10 mL of 0.1 mol L⁻¹ HCl
 - c) 10 mL of 0.1 mol L⁻¹ H₂SO₄
 - d) 10 mL of 0.1 mol L⁻¹ H₂CO₃
21. Which of the following oxides dissolves in water to produce an acidic solution?
- a) CaO
 - b) SO₂
 - c) MgO
 - d) Na₂O
22. In a chemistry laboratory, two reagent bottles are labelled 1M sulfuric acid and 10.0M ethanoic acid. Based on this information and your knowledge of acids, which of the following statement/s uses correct terminology?
- a) The ethanoic acid is more concentrated than the sulfuric acid.
 - b) The ethanoic acid is stronger than the sulfuric acid
 - c) The sulfuric acid solution is weaker than the ethanoic acid solution.
 - d) The ethanoic acid solution is more dilute than the sulfuric acid solution
 - e) Both statements a and b above are correct
23. The pH of distilled water is
- a) 1
 - b) 14
 - c) 7
 - d) less than 7
 - e) greater than 7