Solutions - Acids, Bases & Salts

Solved questions

Q1. What are acids?

Ans. A substance is an acid if it dissolves in water to provide hydrogen ions.
Q2. What is a base? Give one example.

Ans. Base is a substance which gives OH ions when dissolved in water. An example of base is NaOH.

Q3. Write the equation for dissociation of hydrochloric acid (HCl) in water.

Ans. $HCl + H_2 \rightarrow H_3O^+ + Cl$
or it can also be written as
$HCl \xrightarrow{H_2O} H^+(aq) + Cl(aq)$

Q4. Which one of these has a higher concentration of H^+ ions?
1M HCl or 1M CH_2COOH

Ans. 1M HCl will have higher concentration of H^+ ions.
Q5. While diluting an acid why is it recommended that the acid should be added to water and not water to the acid?
Or
Why should water be never added dropwise to concentrated sulphuric acid?

Ans. While diluting an acid, water should not be added to a concentrated acid because the heat generated may cause the mixture to splash out.

Q6. How is the concentration of H_3O^+ ions affected when a solution of an acid is diluted?

Ans. The concentration of H_2O^+ ions is reduced when a solution of an acid is diluted.

Q7. How is the concentration of hydroxide ions (OH^-) affected when excess base is dissolved in a solution of sodium hydroxide?

Ans. The concentration of hydroxide ions (OH^-) is increased when excess base is dissolved in a solution of sodium hydroxide.

Q8. What effect does the concentration of H^+ (aq) has on the acidic nature of the solution?

Ans. A solution is more acidic if it has high concentration of H^+ (aq) ions.

Q9. Do basic solutions also have H^+ (aq) ions ? If yes, then why are these basic ?

Ans. Basic solutions also have H^+ (aq) ions. A solution of an acid or a base always contains both H^+ (aq) ions as well as OH (aq) ions. It shows basic character if it has more OH (aq) ions and acidic character if it has more H^+ (aq) ions.

Q10. Choose strong acid and strong base from the following : CH_3COOH, NH_4OH, KOH, HCl

Ans. Strong acid is HCl and strong base is KOH.

Q11. What is meant by pH of a solution?

Ans. pH value of a solution tells about its acidic or basic nature. Values less than 7 represents an acidic solution and above 7 indicates a basic solution.

Q12. Which is more acidic a solution with pH = 6.0 or a solution with pH = 2.0?

Ans. A solution with pH = 2.0 is more acidic.

Q13. Which is more basic, a solution with pH = 9.0 or a solution with pH = 13.0?

Ans. A solution with pH = 13.0 is more basic.

Q14. What effect does an increase in concentration of H^+ (aq) in a solution have on the pH of solution?

Ans. pH of solution decreases when the concentration of H^+ increases.

Q15. How would you show that lemon and tomato contain acids?

Ans. Both, lemon juice and tomato juice turn blue litmus red. It shows that both of them contain acids.

Q16. What is the action of the solution of sodium carbonate towards litmus?

Ans. Solution of sodium carbonate will turn the colour of red litmus into blue indicating that it is alkaline in nature.

Q17. Dry ammonia gas has no action on litmus paper but a solution of ammonia in water turns red litmus paper blue. Why is it so?

Ans. Ammonia in water forms ammonium hydroxide. These hydroxide ions turn red litmus blue.

Q18. What is the action on litmus of:

(a) Dry ammonia gas? (b) Solution of ammonia gas in water?

Ans. (a) Dry ammonia gas has no action on litmus. (b) Solution of ammonia gas in water turns red litmus blue.

Q19. Why should curd and sour substances not be kept in brass and copper vessels?

Ans. Curd and sour substance contain acids which react with brass and copper.

Q20. Why do HCl, HNO_3, etc. show acidic character in aqueous solutions while solutions of compounds like C_2H_5OH and glucose do not show acidic character?

Ans. A substance will show acidic character if it gives H^+ ions when dissolved in water. Among these substances HCl and HNO_3 provide H^+ ions whereas C_2H_5OH and glucose do not give H^+ ions so they do not show acidic character.

Q21. Why does an aqueous solution of an acid conduct electricity?

Ans. Aqueous solution of an acid conducts electricity because it dissociates to provide ions.

Q22. Given two unlabeled bottles, one containing dilute acid and the other water. How would you decide to label them?

Ans. Acid and water can be identified by testing with litmus. Water will not change the colour of red or blue litmus whereas acid will change blue litmus into red.

Q23. Why does distilled water not conduct electricity, whereas rain water does?

Ans. The electric current is carried by ions in solutions. Distilled water has no ions whereas rain water is slightly acidic and contains ions so rain water conducts electricity.

Q24. 10 mL of a solution of NaOH is found to be completely neutralised by 8 mL of a given solution of HCl. If we take 20 mL of the same solution of NaOH, the amount of HCl solution (the same solution as before) required to neutralise it, will be:

Ans. 16 mL. Since the quantity of NaOH solution is doubled, it will require the double quantity of HCl solutions also.

Q25. What happens when carbon dioxide gas is passed through sodium hydroxide solution?

Ans. When carbon dioxide gas is passed through sodium hydroxide solution, sodium carbonate is formed.

$$2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$$

Q26. Name the sodium compound which is used, for softening hard water.

Ans. The sodium compound used for softening hard water is sodium carbonate (Na_2CO_3 . $10H_2O$).

Q27. What is the chemical name and formula of baking soda?

Ans. Chemical name of baking soda is sodium hydrogen carbonate and its formula is $NaHCO_3$.

Q28. A compound 'X' is an important ingredient of an antacid. It is also used in fire extinguishers. Identify 'X'.

Ans. Compound 'X' is sodium hydrogen carbonate ($NaHCO_3$).

Q29. Fresh milk has a pH of 6. How do you think the pH will change as it turns into curd? Explain your answer.
Or
Fresh milk has a pH of 6. When it changes into curd (yogurt) will its pH value increase or decrease? Why?

Ans. The pH will decrease from 6 because it becomes more acidic when milk is converted into curd and more acidic solutions has lower pH value.

Q30. What is the neutralisation reaction? Give two examples.

Ans. When an acid racts with a base to form salt and water, it is called neutralisation reaction. Two examples are (i) the reaction between hydrochloric acid and sodium hydroxide and (ii) the reaction between sodium carbonate and sulphuric acid.

$HCl + NaOH \rightarrow NaCl + H_2O$

$Na_2CO_3 + H_2SO_4 \rightarrow Na_2SO_4 + H_2O + CO_2$

Q31. What happens when crystals of washing soda are left open in dry air? What is this change named as? Name two industries based on use of washing soda.

Ans. When crystals of washing soda are left open in dry air, they lose nine molecules of water of crystallisation and become white powder.

$Na_2CO_3 . 10\ H_2O\ Na_2CO_3 \xrightarrow{air} Na_2CO_3.H_2O + 9\ H_2O$

Washing soda White powder
This change is called efflorescence.
Two industries based on the use of washing soda are:

(i) manufacture of glass

(ii) paper and textile industries.

Q32. What will happen if the solution of sodium hydrogen carbonate is heated ? Give the equation of the reaction involved.
Or
(i) Name the products formed when sodium hydrogen carbonate is heated.
(ii) Write the chemical equation for the reaction involved in the above.

Ans. When the solution of sodium hydrogen carbonate is heated, it decomposes to form sodium carbonate with the evolution of carbon dioxide gas.

$$2NaHCO_3 \xrightarrow{\text{Heat}} Na_2CO_3 + CO_2 + H_2O$$

Q34. How is Plaster of Paris chemically different from gypsum? How may they be interconverted? Write one use of Plaster or Paris. Or
How is Plaster of Paris obtained? What reaction is involved in the setting of a paste of Plaster of Paris?
Or
State the chemical difference between Plaster of Paris and gypsum. Describe their either way inter conversions.

Ans. Plaster of Paris is chemically different from gypsum in terms of water of crystallisation. Gypsum has 2 moles of water per mole of $CaSO_4$, $\left(CaSO_4 \cdot \frac{1}{2}H_2O\right)$. It can also be written as if one mole of water of crystallisation is present for two moles of $CaSO_4$, ($2CaSO_4 \cdot H_2O$).

Gypsum on heating at 373 K gets converted into Plaster of Paris.

$$CaSO_4 \cdot 2H_2O \xrightarrow[373\ K]{\text{Heat}} CaSO_4 + \frac{1}{2} H_2O + 1\ \frac{1}{2} H_2O.$$

Gypsum Plaster or Paris. When Plaster of Paris is mixed with water, it gets converted into gypsum.

$$CaSO_4 + \frac{1}{2} H_2O + 1\ \frac{1}{2} H_2O \xrightarrow[373\ K]{\text{Heat}} CaSO_4 \cdot 2H_2O$$

Plaster of Paris Gypsum Plaster of Paris is used for making statues and for setting of fractured bones.

Q35. Name three compounds of calcium which are used in day-to-day life and write one important use of each of them.

Ans. The three compounds of calcium and their uses are:
(i) Slaked lime [Calcium hydroxide, $Ca(OH)_2$] used for the manufacture of bleaching power.

(ii) Bleaching powder [Calcium oxychloride, $CaOCl_2$] used as bleaching agent in laundry.

(iii) Plaster of Paris [Calcium sulphate hemihydrate, $CaSO_4.\frac{1}{2}H_2O$] used to plaster the fractured bones.

Previous Years' Board Questions

Q36. A chemical compound having smell of chlorine is used to remove yellowness of white clothes in laundries. Name the compound and write the chemical equation involved in its preparation.

Ans. The compound is bleaching power ($CaOCl_2$). It removes yellowness from clothes due to its bleaching action. For details, consult text part.

Q37. Explain giving reasons:
(i) Tartaric acid is a component of baking powder used in making cakes. [CBSE Sample paper 2003]
(ii) Gypsum, $CaSO_4.2H_2O$ is used in the manufacture of cement. [CBSE Sample paper 2003]

Ans. (i) Role of tartaric acid in baking powder (mixture of tartaric acid and sodium hydrogen carbonate) is to neutralise sodium carbonate formed upon heating sodium hydrogen carbonate.

$$2NaHCO_3 \xrightarrow{\text{Heat}} Na_2CO_3 + H_2O + CO_2$$

Sod. Hydrogen carbonate Sod. Carbonate

(ii) The role of gypsum ($CaSO_4.2H_2O$) in the manufacture of cement is to slow down the process of setting of cement.

Q38. What happens when crystals of washing soda are exposed to air? [CB.S.E. Delhi 2003; CB.S.E. All India 2005]

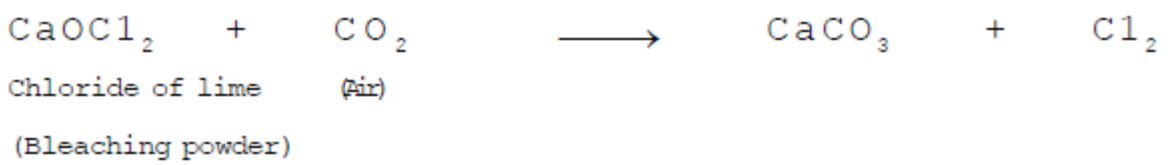
Ans. Washing soda undergoes efflorescence and as a result loses nine molecules of water to form white powder.

$$\underset{\text{Washing soda}}{Na_2CO_3 . 10H_2O} \xrightarrow{(Air)} \underset{\text{Washing powder}}{Na_2CO_3 . H_2O} + 9H_2O$$

(white crystals) (white powder)

Q39. How is chloride of lime chemically different from calcium chloride? Why does chloride of lime gradually lose its chlorine when kept exposed to air?

Ans. Chloride of lime is calcium oxy chloride [(Ca(OCl)Cl] also known as bleaching powder. Calcium chloride is $CaCl_2$. Bleaching powder loses its chlorine on exposure to air because CO_2 present in air reacts with it to evolve chlorine as follows:



Q40. What is the chemical name of washing soda? Name three raw materials used in making washing soda by Solvay process.

Ans. Chemical name: Sodium carbonate dehydrate ($Na_2CO_3.10\ H_2O$).
Raw materials: Brine, lime stone, ammonia.

Q41. State the chemical property in each case on which the following uses of baking soda are based
(i) as an antacid.
(ii) as a constituent of baking powder.

Ans. (i) It is weakly alkaline in nature and neutralizes acid (HCl) formed in the stomach.

$$NaHCO_3 + HCl \longrightarrow NaCl + H_2O + CO_2$$

(ii) It evolves CO_2 in the form of bubbles when cake is made by baking. As a result, the cake becomes porous as well as fluffy.

$$2\ NaHCO_3 \xrightarrow{heat} Na_2CO_3 + H_2O + CO_2.$$

Q42. How is Plaster of Paris obtained? What reactions are involved in the setting of Plaster of Paris?

Ans. For answer, consult text part.

Q43. How is Plaster of Paris chemically different from gypsum? How may these be inter converted? Write one use of Plaster of Paris.

Ans. For details, consult text-part.

Q44. Name two industries based on the uses of washing soda.

Ans. The two industries are: glass industry and paper industry.

Q45. Write chemical name and formula of washing soda. What are the raw materials used for its manufacture by Solvay, process? What happens when, crystals of washing soda are exposed to air?

Ans. For answer, consult text part.

Q46. (a) Name the two chief chemicals used for making a soda acid fire extinguisher.
(b) How does the soda-acid fire extinguisher help to extinguish the fire?

Ans. (a) The two chief chemicals are; sodium hydrogen carbonate ($NaHCO_3$) and sulphuric acid (H_2SO_4)

(b) For the details of the operation, consult text part.

Q47. What is efflorescence? Give an example.

Ans. For details, consult text part.

Q48. (a) An aqueous solution has a pH value of 7.0. Is this solution acidic, basic or neutral?
(b) If H^+ concentration of a solution is 1×10^{-2} mol L^{-1}, what will be its pH value?
(c) Which has a higher pH value: I—M HCl or I—M NaOH solution?

Ans. (a) The solution with pH value of 7.0 is neutral in nature

(b) Given: $[H^+] = 1 \times 10^{-2}$ mol $L^{-1} = 10^{-2}$ M.

pH = $\log\left[\frac{1}{H^+}\right]$ = -log$[H^+]$ = -log$[10^{-2}]$ = (-2) log 10 = 2

(c) 1 M NaOH solution (basic) has higher pH value than 1 M HCI solution (acidic).

Q49. Out of calcium compounds calcium carbonate, quick lime and slaked lime, which one can be used for removing moisture from ammonia gas and why?

Ans. Quick lime (CaO) can be used to remove moisture from ammonia gas because of its hygroscopic nature. Therefore, it can act as the best dehydrating agent for ammonia.

Q50. (a) Name the raw materials used in the manufacture of sodium carbonate by Solvay process.
(b) How is sodium hydrogen carbonate formed during Solvay process separated from a mixture of NH_4Cl and $NaHCO_3$?
(c) How is sodium carbonate obtained from sodium hydrogen carbonate?

Ans. (a) The raw materials used are: NaCl, lime stone or $CaCO_3$ and NH_3.

(b) Sodium hydrogen carbonate ($NaHCO_3$) is sparingly soluble or less soluble in water and gets separated as a precipitate while NH_4Cl remains in solution. The precipitate is removed by filtration.

(c) Sodium hydrogen carbonate is converted to sodium carbonate upon heating.

$$2NaHCO_3 \xrightarrow{heat} Na_2CO_3 + H_2O + CO_2$$

For further details, consult text part.

Q51. (a) What is the action of red litmus on (i) dry ammonia gas (ii) solution of ammonia gas in water
(b) State the observations you would make on adding ammonium hydroxide to aqueous solution of
(i) ferrous sulphate (ii) aluminium chloride.

Ans. (a) (i) Red litmus has no action on dry ammonia gas, because it does not release any hydroxyl ions (OH^-)

(ii) When passed through water, ammonia (NH_3) is converted to ammonium hydroxide (NH_4OH). It dissociates to give hydroxyl ions (OH) and the solution is basic in nature. Red litmus acquires a blue colour.

(b) (i) A green precipitate of ferrous hydroxide will be formed by double decomposition reaction.

$$FeSO_4(aq) + 2NH_4OH(aq) \longrightarrow \underset{\text{(Green ppt.)}}{Fe(OH)_2} + (NH_4)_2SO_4(aq)$$

(ii) A white precipitate of aluminium hydroxide will be formed by double decomposition reaction.

$$AlCl_3(aq) + 3NH_4OH(aq) \longrightarrow \underset{\text{(White ppt.)}}{Al(OH)_3} + 3NH_4Cl(aq)$$

Q52. How will you test for the gas which is liberated when hydrochloric acid reacts with an active metal?

Ans. Hydrogen gas is evolved when hydrochloric acid reacts with an active metal such as sodium, potassium,

$$Mg(s) + 2HCl\,(aq) \rightarrow MgCl_2\,(aq) + H_2\,(g)$$

calcium or magnesium. In order to test the gas, bring either a burning match stick or candle near the gas. The gas will immediately catch fire.

Q53. What is `baking powder'? How does it make cake soft and spongy?

Ans. For answer consult text part.

Q54. Name the gas evolved when dilute HCl reacts with sodium hydrogen carbonate. How is it recognised?

Ans. The gas evolved is carbon dioxide (CO_2). When the gas is bubbled through lime water, it becomes milky.