Acid Bases and Salts

NCERT Exercises (Questions-Solutions)

Intext Questions

Page No. 18

1. You have been provided with three test tubes. One of them contains, distilled water and the other two contain an acidic solution and a basic solution, respectively. If you are given only red litmus paper, how will you identify the contents of each test tubes?

Ans.: Take three small pieces of red litmus paper. Put one drop each of the given solutions on these litmus papers.
The liquid which turns red litmus into blue is a basic solution.
Divide the blue litmus paper so formed into two parts. Put one drop each of the other two liquids separately on these two pieces of litmus paper;
The solution which turns blue litmus paper red is acidic solution.
The solution which does not affect the colour of litmus paper is water.

Page No. 22

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

Ans.: The curd and sour substances are acidic. They will react with brass (alloy of copper and zinc metals) and copper vessels and will spoil the vessels.

2. Which gas is usually liberated when an acid reacts with a metal? Illustrate with an example. How will you test for the presence of this gas?

Ans.: Hydrogen gas is liberated when an acid reacts with a metal. For example, when zinc metal reacts with dil. HCl, hydrogen is evolved and salt zinc chloride is formed as:

$$Zn_{(s)} + 2HCl_{(aq)} \rightarrow ZnCl_{2(aq)} + H_{2(g)}$$

It can be tested by bringing a burning candle near the gas. The candle continues burning with a pop sound.

3. A metal compound A reacts with dilute hydrochloric acid to produce effervescence. The gas evolved extinguishes a burning candle. Write a balanced chemical equation for the reaction if one of the compounds formed is calcium chloride.

Ans.: The compound A must be calcium carbonate because carbonates react with the acids to produce carbon dioxide gas which extinguishes fire, and also the compound formed will be calcium chloride as follows:

$$\underset{\text{Calcium carbonate}}{CaCO_{3(s)}} + \underset{\text{hydrochloric acid}}{2HCl_{(aq)}} \rightarrow \underset{\text{calcium chloride}}{CaCl_{2(aq)}} + \underset{\text{water}}{H_2O_{(l)}} + \underset{\text{Carbon dioxide}}{CO_{2(g)}}$$

Page No. 25

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

Ans.: HCl and HNO_3, produce $H^+_{(aq)}$ ions in aqueous solution, which is responsible for their acidic character.

$HCl_{(aq)} \rightarrow H^+_{(aq)} + Cl^-$

$HNO_{3(aq)} \rightarrow H^+_{(aq)} + NO^-_{3\,(aq)}$

Alcohol (C_2H_5OH) and glucose $(C_6H_{12}O_6)$ are covalent compounds and they do not undergo dissociation in aqueous solution. This is evident from the fact that their aqueous solutions do not conduct electricity. Hence, the aqueous solutions of alcohol and glucose do not show acidic character even though they contain hydrogen atoms.

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

Ans.: Dry. aqueous solution of an acid produces ions and therefore, it conducts electricity. The electric current is carried through the solution by ions.

3. Why does dry HCl gas not change the colour of the dry litmus paper?

Ans.: Dry HCl gas does not show acidic character due to absence of H^+ ions and therefore, does not change the colour of the dry litmus paper.

4. While diluting an acid, why is it recommended that the acid should be added to water and not water to the acid?

Ans.: Dilution of a concentrated acid, particularly concentrated sulphuric acid, is a highly exothermic reaction. When water is added to a concentrated acid, the heat liberated is so large that the solution starts almost boiling. This may cause spurting of the hot acid solution and harm the person. Excessive local heating may even break the glass container. That is way concentrated acids are diluted by slowly adding concentrated acid into water with constant stirring and not by adding water to the add.

5. How is the concentration of hydronium ions (H_3O^+) affected when a solution of an acid a diluted?

Ans.: When the solution of acid is diluted the H^+ ions are released from the add to combine with H_2O and H_3O^+ ions is increased,

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

Ans.: The OH^- concentration increases with the concentration of $NaOH$ and reaches a limiting value.

Page No. 28

1. You have two solutions, A and *B*. The pH of solution A is 6 and pH of solution B is 8. Which solution has more hydrogen ion concentration? Which of this is acidic and which one is basic?

Ans.: pH of solution A = 6. $\therefore H^+$ ion concentration $= 10^{-6} M.$

pH of solution B = 8. $\therefore H^+$ ion concentration $= 10^{-8} M.$

As $10^{-6} > 10^{-8}$, hence solution A has more H¹" ion concentration.

A solution with pH < 7 is acidic. Hence, solution A is acidic.

A solution with pH > 7 is basic. Hence, solution *B* is basic.

2. What effect does the concentration of $H^+_{(aq)}$ ions have on the nature of the solution?

Ans.: If a solution has higher concentration of H^+ ions it is more acidic in nature,

3. Do basic solutions also have $H^+_{(aq)}$ ions ? If yes, then why are these basic ?

Ans.: Yes, basic solutions also have $H^+_{(aq)}$ ions. This is because in all aqueous solutions, $H^+_{(aq)}$ and $OH^-_{(aq)}$ exist in equilibrium with each other. The equilibrium constant for this equilibrium is given by $K_w = [H^+][OH^-]$ In a basic solution, $H^+_{(aq)}$ concentration is much lower than the $OH^-_{(aq)}$ concentration.

4. Under what soil condition do you think a farmer would treat the soil of his fields with quick lime (calcium oxide) or slaked lime (calcium hydroxide) or chalk (calcium carbonate)?

Ans.: If the soil condition is more acidic than optimum conditions.

Page No. 33

1. What is the common name of the compound $CaOCl_2$?

Ans.: Bleaching powder.

2. Name the substance which on treatment with chlorine yields bleaching powder.

Ans.: Dry slaked lime, $Ca(OH)_2$.

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

Ans.: Sodium carbonate (washing powder).

4. What will happen if a solution of sodium hydrogen carbonate is heated ? Give the equation of the reaction involved.

Ans.: When a solution of sodium hydrogen carbonate is heated it gives sodium carbonate, Bite **carbon dioxide and** water.

$$\underset{\text{Sodium hydrogen carbonate}}{2NaHCO_3} \xrightarrow{Heat} \underset{\text{Sodium carbonate}}{Na_2CO_3} + H_2O + CO_2$$

5. Write an equation to show the reaction between plaster of Paris and water.

Ans.: It forms gypsum giving a hard solid mass.

$$\underset{\substack{\text{Plaster of Paris}\\(\text{White powder})}}{CaSO_4.\frac{1}{2}H_2O} + \frac{3}{2}H_2O \longrightarrow \underset{\substack{\text{Gypsum}\\(\text{solid mass})}}{CaSO_4} + 2H_2O$$

Page No. 34

1. A solution turns red litmus blue, its pH is likely to be

(a) 1 (b) 4 (c) 5 (d) 10

Ans.: **(d):** Because pH should be greater than 7.

2. A solution reacts with crushed egg-shells to give a gas that turns lime-water milky. The solution contains

(a) $NaCl$ (b) HCl (c) $LiCl$ (d) KCl

Ans.: **(b)** Egg-shells contain calcium carbonate. Calcium carbonate reacts with HCl to give out CO_2 gas, which turns lime water milky.

3. 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 neutralize it will be

(a) 4 mL (b) 8mL (c) 12 mL (d) 16 mL

Ans.: (d): $20\,mL$ of $NaOH = 2\times 8\,mL$ of $HCl = 16\,mL$ of HCl.

4. Which one of the following types of medicines is used for treating indigestion?

(a) Antibiotic (b) Analgesic (c) Antacid (d) Antiseptic

Ans.: **(c):** The indigestion is due to excess of acid produced in the stomach. The medicine used to neutralise it is called antacid,

5. Write word equations and then balanced equations for the reaction taking place when:

(a) Dilute sulphuric add reacts with zinc granules

(b) Dilute hydrochloric add reacts with magnesium ribbon

(c) Dilute sulphuric acid reacts with aluminium powder

(d) Dilute hydrochloric acid reacts with iron fillings.

Ans.: (a) Zinc + Sulphuric acids (dil). $\rightarrow$ Zinc sulphate + Hydrogen

$$Zn_{(s)} + H_2SO_{4(aq)} \rightarrow ZnSO_{4(aq)} + H_{2(g)}$$

(b) Magnesium ribbon + Hydrochloric add (dil.) $\rightarrow$ Magnesium chloride + Hydrogen

$$Mg_{(s)} + 2HCl_{(aq)} \rightarrow MgCl_{2(aq)} + H_{2(g)}$$

(c) Aluminium powder + Sulphuric acid (dil.) $\rightarrow$ Aluminium sulphate + Hydrogen

$$2Al + 3H_2SO_4(dil) \rightarrow Al_2(SO_4)_{3(aq)} + 3H_{2(g)}$$

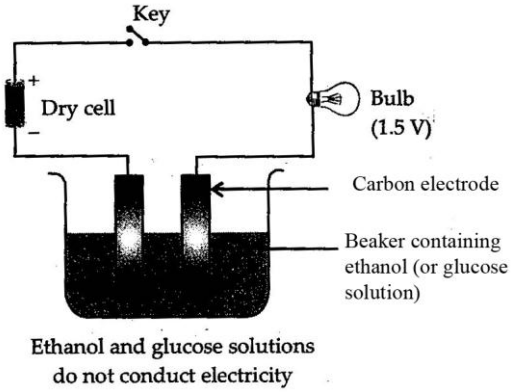
(d) Iron filings + Hydrochloric acid (dil.) $\rightarrow$ Iron(II) chloride + Hydrogen

$$Fe_{(s)} + 2HCl \rightarrow FeCl_{2(aq)} + H_{2(g)}$$

6. Compounds such as alcohol and glucose also contain hydrogen but are not categorized as acids. Describe an activity to prove it.

Ans. **Activity:** To show that alcohols and glucose are not acids.

Materials required: Dilute solution of ethanol and glucose solution **Apparatus required :** Beaker (1), carbon electrodes (2), dry cells (2), bulb 1.5 V (1),



Ethanol and glucose solutions
do not conduct electricity

Procedure: Take a beaker and place two carbon electrodes into it. Connect the electrodes to a battery bulb through a key and a dry cell. Pour ethanol into the beaker and press the key. See, if the bulb glows. Bulb does not glow. Repeat similar experiment with glucose solution. Record your observations.
Observation : It is observed that the bulb does not glow With both the solutions.
Conclusion : The solutions of glucose and ethanol are non-conductors of electricity.
Explanation: Ethanol and the solution of glucose containing hydrogen in their molecules do not conduct electricity. Therefore/ these compounds do not produce H^+ ions in solutions.
Hence these are not categorised as acids.

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

Ans.: Distilled water is pure and it does not form ions. Where as rain water contains impurities in it like acid which contains ions and release them when dissolved in water. Hence no ioig distilled water, so electricity is not conducted but ions are there in rain water so electric conducted.

8. Why do acids not show acidic behaviour in the absence of water ?

Ans.: Acids ionise only in the presence of water to give ions. $HCl + H_2O \rightarrow H_3O^+ + Cl^-$

However, in the absence of water, acids do not ionise to give H30$^+$ ions and therefore, do not behave as acids.

Page No. 35

9. Five solutions A, B, C, *D* and £ when tested with universal indicator showed pH as 4, 1, 11, 7 and 9 respectively. Which solution is :

(a) neutral ? (b) strongly alkaline? (c) strongly acidic? (d) weakly acidic?
(e) weakly alkaline?
(f) Arrange the pH in increasing order of hydrogen-ion concentration.

Ans.: (a) Solution *D is* neutral (pH =7)
(b) Solution C is strongly alkaline (pH =11)
(c) Solution B is weakly acidic (pH =1)
(d) Solution A is strongly acidic (pH = 4)
Solution E is weakly alkaline (pH = 9)
pH in the increasing order of hydrogen ion concentration:
$pH = 11 < pH = 9 < pH = 7 < pH = 4 < pH = 1$

10. Equal lengths of magnesium ribbons are taken in test tubes A and *B.* Hydrochloric acid (HCl) is added to test tube A, while acetic acid (CH_3COOH) is added to test tube B. In which test tube will the fizzing occur more vigorously and why?

Ans.: In test tube A hydrochloric acid is present which is a strong acid as compared to acetic acid present in test tube B.

The fizzing occurs more vigorously in test tube A as HCl is strong and dissociates completely into Cl^- and CF ions for the reaction.

11. Fresh milk has a pH of 6. How do you think the pH will change as it turns into curd? Explain your answer.

Ans.: Curd is sour in taste and becomes acidic. Therefore, its pH will decrease from pH of 6 to a lower value.

12. A milkman adds a very small amount of baking soda to fresh milk.

(a) Why does he shift the pH of the fresh milk from 6 to slightly alkaline ?

(b) Why does this milk take a long time to set as curd?

Ans.: **(a)** The milkman adds baking soda to milk so that the milk becomes slightly alkaline. Thus, milk will not be converted to acidic curd readily

(b) This will take a longer time to set to curd because it is alkaline and takes longer time for It bacteria to make it acidic.

13. Plaster of Paris should be stored in a moisture proof container. Explain Why?

Ans.: Plaster of Paris in contact with moisture (water) changes to solid hard mass, gypsum. Therefore, it gets wasted. Hence it should be stored in a moisture proof containers.

$$\underset{Plaster\ of\ Paris}{CaSO_4.\frac{1}{2}H_2O} + H_2O \longrightarrow \underset{Gypsum}{CaSO_4.2H_2O}$$

14. What is neutralization reaction? Give two examples.

Ans.: The reaction of an acid and a base to form salt and water is a neutralization reaction. For example,

(i) $HCl + NaOH \rightarrow NaCl + H_2O$ (ii) $H_2SO_4 + 2KOH \rightarrow K_2SO_4 + 2H_2O$

15. Give two important uses of washing soda and baking soda.

Ans.: **Washing Soda**

(1) It is used for softening of hard water.

(2) It is used for the manufacture of soap, glass, paper, borax, caustic soda, etc.

Baking soda

(1) Baking soda is mainly used in the preparation of baking powder. Baking powder contains sodium hydrogen carbonate and an acid like tartaric acid or citric acid.

(2) Baking soda is used in medicines as an antacid. It is used in medicines to remove acidity of the stomach. Therefore, it is an important constituent of an antacid.

NCERT Exemplar (Problems-Solutions)

Multiple Choice Questions (MCQs)

1. What happens when a solution of an acid is mixed with a solution of a base in a test tube?

(i) The temperature of the solution increases.
(ii) The temperature of the solution decreases.
(iii) The temperature of the solution remains the same.
(iv) Salt formation takes place.

(a) Only (i) (b) (i) and (iii) (c) (ii) and (iii) (d) (i) and (iv)

Concept Involved

(i) Neutralisation is defined as the process in which an acid reacts with a base to form salt and water.
(ii) In exothermic process, heat is evolved.

Ans. **(d)** When an acid reacts with a base, neutralization reaction takes place to form salt and water and it is an exothermic reaction. So, the temperature of the solution increases.

2. An aqueous solution turns red litmus solution blue. Excess addition of which of the following solution would reverse the change?

(a) Baking powder (b) Lime
(c) Ammonium hydroxide solution (d) Hydrochloric acid

Ans. **(d)** Since, the aqueous solution turns red litmus solution blue. So, it is a basic compound.
An acid solution (HCl) would reverse the change. That is HCl would turn blue litmus solution to red.
Other options baking powder, lime and ammonium hydroxide solution are basic compounds. So, the blue litmus solution would not change the colour by adding these compounds.

3. During the preparation of hydrogen chloride gas on a humid day, the gas is usually passed through the guard tube containing calcium chloride. The role of calcium chloride taken in the guard tube is to

(a) absorb the evolved gas (b) moisten the gas
(c) absorb moisture from the gas (d) absorb Cl^- ions from the evolved gas

Ans. **(c)** The role of calcium chloride $CaCl_2$ is to absorb moisture from the gas, because calcium chloride is a good dehydrating agent.

4. Which of the following salts does not contain water of crystallization?

(a) Blue vitriol (b) Baking soda (c) Washing soda (d) Gypsum

Concept Involved

The water molecules which form part of the structure of a crystal (of a salt) are called water of crystallization. The salts which contain water of crystallisation are called hydrated salts.

Ans. **(b)** Chemical formula of baking soda is NaHC03 (sodium hydrogen carbonate). Chemical formulae of blue vitriol is $CuSO_4\,5H_2O$, washing soda is $Na_2CO_3 \cdot 10H_2O$ and gypsum is $CaSO_4 \cdot 2H_2O$

So, baking powder does not contain water of crystallization.

5. **Sodium carbonate is a basic salt because it is a salt of**

(a) strong acid and strong base (b) weak acid and weak base

(c) strong acid and weak base (d) weak acid and strong base

The salts of weak acids and strong bases give basic solutions (or alkaline solutions) having pH more than 7.

Ans. **(d)** Sodium carbonate (Na_2CO_3) is the salt of weak acid carbonic acid (H_2CO_3) and a strong base sodium hydroxide (NaOH).

$$\underset{\text{Sodium hydroxide}}{2NaOH} + \underset{\text{Carbonic acid}}{H_2CO_3} \longrightarrow \underset{\text{Sodium carbonate (salt)}}{Na_2CO_3} + \underset{\text{Water}}{2H_2O}$$

6. **Calcium phosphate is present in tooth enamel. Its nature is**

(a) basic (b) acidic (c) neutral (d) amphoteric

$$\underset{\text{Sodium hydroxide}}{3Ca(OH)_2} + 2\underset{\text{Phosphoric acid}}{H_3PO_4} \longrightarrow \underset{\text{Calcium phosphate}}{Ca_3(PO_4)} + 6H_2O$$

Ans. (a) Calcium phosphate $Ca_3(PO_4)$ is basic salt, as it is a salt of weak acid (phosphoric acid) and slightly stronger base (calcium hydroxide) (though both are weak). Also when pH of our mouth falls below 5.5 due to eating of sweets etc., i.e., mouth is acidic, the dissolution of enamel (calcium phosphate) starts which shows that calcium phosphate is basic in nature.

7. **A sample of soil is mixed with water and allowed to settle. The clear supernatant solution turns the pH paper yellowish-orange. Which of the following would change the colour of this pH paper to greenish-blue?**

(a) Lemon juice (b) Vinegar (c) Common salt (d) An antacid

Ans. (d) As pH paper turns greenish blue for weakly basic compound and antacids contain weak base like $Mg(OH)_2$. So, an antacid would change the colour of this pH paper to greenish-blue. Other options (a) and (b) contain acids and option (c) is a neutral salt.

8. **Which of the following gives the correct increasing order of acid strength?**

(a) Water < acetic acid < hydrochloric acid (b) Water < hydrochloric acid < acetic acid

(c) Acetic acid < water < hydrochloric acid (d) Hydrochloric acid < water < acetic acid

Ans. **(a)** Hydrochloric acid is a mineral acid and ionises completely in water, that's why it is a strong acid. Acetic acid is an organic acid and ionises only partially in water, hence, it is a weak acid. Water has some what neutral nature. Thus, the order of acidity is water < acetic acid < hydrochloric acid.

9. If a few drops of a concentrated acid accidentally spills over the hand of a student, what should be done?

(a) Wash the hand with saline solution

(b) Wash the hand immediately with plenty of water and apply a paste of sodium hydrogen carbonate

(c) After washing with plenty of water apply solution of sodium hydroxide on the hand

(d) Neutralise the acid with a strong alkali

Ans. **(b)** Wash the hand immediately with plenty of water to wash away most of the acid and then apply a paste of baking soda $\left(NaHCO_3\right)$ to neutralize the little acid left. Here a strong base cannot be used to neutralise the acid due to its corrosive nature.

10. Sodium hydrogen carbonate when added to acetic acid evolves a gas. Which of the following statements are true about the gas evolved?

(i) It turns lime water milky.

(ii) It extinguishes a burning splinter.

(iii)It dissolves in a solution of sodium hydroxide.

(iv) It has a pungent odour.

(a) (i) and (ii) (b) (i), (ii) and (iii) (c) (ii), (iii) and (iv) (d) (i) and (iv)

Ans. **(b)** When sodium hydrogen carbonate is added to acetic acid then carbon dioxide (CO_2) gas is evolved.

$$\underset{\text{Sodium hydrogen carbonate}}{NaHCO_3} + \underset{\text{Acetic acid}}{CH_3COOH} \longrightarrow \underset{\text{Sodium acetate}}{CH_3COONa} + CO_2 + H_2O$$

CO_2 turns lime water milky, it is a non-supporter of combustion and is absorbed by strong alkalies like NaOH.

11. Common salt besides being used in kitchen can also be used as the raw material for making

(i) washing soda (ii) bleaching powder

(iii) baking soda (iv) slaked lime

(a) (i) and (ii) (b) (i), (ii) and (iv) (c) (i), (ii) and (iii) (d) (i), (iii) and (iv)

Ans. **(c)** Common salt (sodium chloride) is used as a raw material for making a large number of chemicals in industry such as sodium hydroxide, washing soda, baking soda, hydrochloric acid, hydrogen, chlorine and sodium metal. Chlorine gas obtained is used for making bleaching powder.

12. One of the constituents of baking powder is sodium hydrogen carbonate, the other constituent is

(a) hydrochloric acid (b) tartaric acid (c) acetic acid (d) sulphuric acid

Ans. **(b)** Baking powder is a mixture of baking soda $NaHCO_3$, (sodium hydrogen carbonate) and a mild edible acid such as tartaric acid. When baking powder mixes with water (for making cake or bread), sodium hydrogen carbonate reacts with tartaric acid to evolve carbon dioxide gas.

13. To protect tooth decay we are advised to brush our teeth regularly. The nature of the tooth paste commonly used is

(a) acidic (b) neutral (c) basic (d) corrosive

When pH of our mouth fails below 5.5 due to eating of sweets etc., (i.e., our mouth is moderately acidic) then the-acid becomes strong enough to attack the enamel which is made up of calcium phosphate of our teeth and corrodes it. This sets in tooth decay.

Ans. **(c)** The tooth paste commonly used is basic so that the extra acid formed during tooth decay is neutralised and prevent tooth decay.

14. Which of the following statements is correct about an aqueous solution of an acid and a base?

(i) Higher the pH, stronger the acid (ii) Higher the pH, weaker the acid
(iii) Lower the pH, stronger the base (iv) Lower the pH, weaker the base
(a) (i) and (iii) (b) (ii) and (iii) (c) (i) and (iv) (d) (ii) and (iv)

The common pH scale having pH value from 0 to 14. At pH 7, a solution is neutral. As the pH of solution decreases from 7 to 0, the hydrogen ion concentration in the solution goes on increasing and hence the strength of acid goes on increasing. As the pH of solution increases from 7 to 14, the hydroxide ion concentration in the solution goes on increasing due to which the strength of base also goes on increasing.

Ans. **(d)** It depends on the solution i.e., higher the pH, weaker the acid and lower the pH weaker the base.

15. The pH of the gastric juices released during digestion is

(a) less than 7 (b) more than 7 (c) equal to 7 (d) equal to 0

Ans. **(c)** Our stomach produces hydrochloric acid (of pH about 1.4). This dilute hydrochloric acid helps in digesting our food.

16. Which of the following phenomena occur, when a small amount of acid is added to water?

(i) Ionisation (ii) Neutralisation
(iii) Dilution (iv) Formation
(a) (i)and(ii) (b) (i) and (iii) (c) (ii) and (iii) (d) (ii) and (iv)

And. **(B)** (i) When water is added to an acid, their molecules dissociate to form ions.

$$HCl + H_2O \longrightarrow H^+ + Cl^- + H_2O$$

$$H_2O + H^+ \longrightarrow H_3O^+ \text{ (Hydronium ion)}$$

(iii) Mixing of an acid with water is called dilution, it results in the decrease in the concentration of ions, (H_3O^+) per unit volume.

17. Which one of the following can be used as an acid-base indicator by a visually impared student?

(a) Litmus (b) Turmeric (c) Vanilla essence (d) Petunia leaves

Ans. **(c)** Vanilla essence is an olfactory indicator. So, its smell is different in acid and basic media which can be detected easily by a visually impared student. Vanilla extract has a characteristic pleasant smell.
If a basic solution like sodium hydroxide solution is added to vanilla extract then we cannot detect the characteristic smell of vanilla extract. An acidic solution like hydrochloric acid, however, does not destroy the smell of vanilla extract.

18. Which of the following substances will not give carbon dioxide on treatment with dilute acid?

(a) Marble (b) Limestone (c) Baking soda (d) Lime

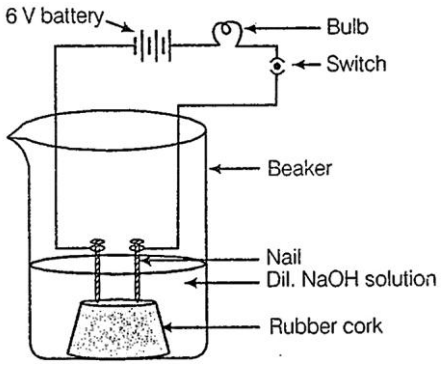
Ans. **(d)** Lime, CaO (calcium oxide) does not evolve CO_2 when reacted with dilute acid. Other given compounds are carbonates and hydrogen carbonates, so evolve CO_2 with dilute acid.

19. Which of the following is acidic in nature?

(a) Lime juice (b) Human blood (c) Lime water (d) Antacid

Ans. **(a)** Lime juice is acidic in nature because it contains citric acid. Human blood is slightly basic (i.e., having pH 7.8). Lime water and antacid are basic in nature as they contain hydroxide (OH^-) ion.

20. **In an attempt to demonstrate electrical conductivity through an electrolyte, the following apparatus (figure) was set up.**



Which among the following statement(s) is/are correct?
(i) Bulb will not glow because electrolyte is not acidic.
(ii) Bulb will glow because $NaOH$ is a strong base and furnishes ions for conduction.
(iii) Bulb will not glow because circuit is incomplete.
(iv) Bulb will not glow because it depends upon the type of electrolytic solution.
(a) (i) and (iii) (b) (ii) and (iv) (c) Only (ii) (d) Only (iv)

Ans. **(c)** Bulb will glow because $NaOH$ being a strong base furnishes OH^- and Na^+ ions (which are responsible for electrical conductivity).

21. **Which of the following is used for dissolution of gold?**
(a) Hydrochloric acid (b) Sulphuric acid (c) Nitric acid (d) Aqua-regia

Ans. **(d)** Aqua-regia is used for the dissolution of gold. Gold dissolves only in aqua-regia.
Aqua-regia is a mixture of cone, HN03 and cone. HCI in the ratio 1 : 3.

Aqua-regia = [$Conc.HNO_3 + conc\ HCl$]
$_{1:3}$

22. **Which of the following is not a mineral acid?**
(a) Hydrochloric acid (b) Citric acid (c) Sulphuric acid (d) Nitric acid

Mineral acids or inorganic acids are generally repared from the minerals present in the earth's crust, e.g., HCI (hydrochloric acid), H_2SO_4 (sulphuric acid) and HNO_2 (nitric acid) are mineral acids.
Edible acids or organic acids are produced by plants or animals. e.g., acetic acid, citric acid, lactic acid etc., are edible acids.

Ans. **(b)** Citric acid is an example of organic acid or edible acid.

23. **Which among the following is not a base?**
(a) $NaOH$ (b) KOH (c) NH_4OH (d) C_2H_5OH

Ans. **(c)** C_2H_5OH is not a base. It is an example of an organic compound known as alcohol (ethyl alcohol) which has somewhat acidic nature. And also C_2H_5OH does not give OH^- ions in the solution, so it is not a base.

24. Which of the following statements is not correct?

(a) All metal carbonates react with acid to give a salt, water and carbo.n dioxide

(b) All metal oxides react with water to give salt and acid

(c) Some metals react with acids to give salt and hydrogen

(d) Some non-metal oxides react with water to form an acid

Ans. **(b)** Most metal oxides are insoluble in water but some of these (e.g., Na_2O, CaO) dissolve in water to form alkalies not salt and acid e.g.,

$$Na_2O(s) + H_2O(l) \longrightarrow_2 NaOH(aq)$$

25. Match the chemical substances given in Column I with their appropriate application given in Column II.

Column I	Column II
A. Bleaching powder	1. Preparation of glass
B. Baking soda	2. Production of H_2 and Cl_2
C. Washing soda	3. Decolourisation
D. Sodium chloride	4. Antacid

Codes

	A	B	C	D
(a)	2	1	4	3
(b)	3	2	4	1
(c)	3	4	1	2
(d)	2	4	1	3

Ans. **(c)** Bleaching powder bleaches the clothes and other coloured substances, baking soda is a constituent of antacid, washing soda is used in the preparation of glass and sodium chloride when subjected to electrolyses gives N_2 and Cl_2 gases.

26. Equal volumes of hydrochloric acid and sodium hydroxide solutions of same concentration are mixed and the pH of the resulting solution is checked with a pH paper. What would be the colour obtained? (You may use colour guide given in figure of NCERT Book (Science Class X) on page 26).

(a) Red (b) Yellow (c) Yellowish green (d) Blue

Ans. **(c)** Because the resulting solution is obtained as a result of neutralization reaction.

$$\underset{\text{Strong acid}}{HCl} + \underset{\text{Strong base}}{NaOH} \longrightarrow \underset{\text{Sodium chloride neutral}}{NaCl} + H_2O$$

The colour of the neutral solution (with pH=7) obtained is yellowish green.

27. Which of the following is/are true when HCl (g) is passed through water

(i) It does not ionise in the solution as it is a covalent compound.

(ii) It ionises in the solution.

(iii) It gives both hydrogen and hydroxyl ion in the solution.

(iv) It forms hydronium ion in the solution due to the combination of hydrogen ion with water molecule.

(a) Only (i) (b) Only (iii) (c) (ii) and (iv) (d) (iii) and (iv)

Ans. **(c)** When HCl is passed through water then HCl being a polar covalent compound, ionises in water as

$$HCl(aq) \longrightarrow H^+ + Cl^-$$

$$H^+ + H_2O \longrightarrow \underset{\text{Hydronium ion}}{H_3O^+}$$

28. Which of the following statement is true for acids?

(a) Bitter and change red litmus to blue (b) Sour and change red litmus to blue

(c) Sour and change blue litmus to red (d) Bitter and change blue litmus to red

Ans. **(c)** Acids are those chemical substances which have a sour taste and turn blue titmus solution to red. On the other hand, bases are bitter in taste and soapy to touch and turn red litmus solution to blue.

29. Which of the following are present in a dilute aqueous solution of hydrochloric acid?

(a) $H_3O^+ + Cl^-$ (b) $H_3O^+ + OH^-$ (c) $Cl^- + OH^-$ (d) Unionized HCl

Ans. **(a)** When acid is mixed with water, their molecules dissociate to form ions.

The H^+ ions combine with H_2O to form H_3O^+ ions.

$$HCl + H_2O \longrightarrow H^+ + Cl^- + H_2O$$

$$H_2O + H^+ \longrightarrow H_3O^+ \text{ (Hydronium ion)}$$

30. Identify the correct representation of reaction occurring during chloralkali process.

(a) $2NaCl(l) + 2H_2O(l) \longrightarrow 2NaOH(l) + Cl_2(g) + H_2(g)$

(b) $2NaCl(aq) + 2H_2O(aq) \longrightarrow 2NaOH(aq) + Cl_2(l) + H_2(aq)$

(c) $2NaCl(aq) + 2H_2O(l) \longrightarrow 2NaOH(aq) + Cl_2(aq) + H_2(aq)$

(d) $2NaCl(aq) + 2H_2O(l) \longrightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$

Ans. **(d)** $2NaCl(aq) + 2H_2O(l) \longrightarrow$

$2NaOH(aq) + Cl_2(g) + H_2(g)$

(because state of Cl_2 and H, is gaseous, H_2O is liquid and that of NaCl and NaOH is aqueous).

31. Match the adds given in Column I with their correct source given in Column II

Column I	Column II
A. Lactic acid	1. Tomato
B. Acetic acid	2. Lemon
c. Citric acid	3. Vinegar
D. Oxalic acid	4. Curd

Ans.

Column I	Column II
a. Lactic acid	Curd
B. Acetic actd	Vinegar
C. Citric acid	Lemon
D. Oxalic acid	Tomato

32. Match the important chemicals given in Column I with the chemical formulae given in Column II.

Column I	Column II
A. Plaster of Paris	1. $Ca(OH)_2$
B. Gypsum	2. $CaSO_4 \cdot \frac{1}{2} H_2O$
C. Bleaching powder	3. $CaSO_4 \cdot 2H_2O$

D. Slaked lime	4. $CaOCl_2$

Ans.

Column I	Column II
A. Plaster of Paris	$CaSO_4 \cdot \frac{1}{2} H_2O$
B. Gypsum	$CaSO_4 \cdot 2H_2O$
C. Bleaching powder	$CaOCl_2$
D. Slaked lime	$Ca(OH)_2$

33. What will be the action of the following substances on litmus paper? Dry HCl gas, moistened NH_3 gas, lemon juice, carbonated soft drink, curd, soap solution.

Ans. (i) Dry HCl gas No change on litmus paper

(ii) Moistened NH_3 gas (basic) Red litmus will turn blue.

(iii) Lemon Juice (contains citric acid) Blue litmus will turn red.

(iv) Carbonated soft drinks (contains carbonic acid) Blue litmus will turn red.

(v) Curd (contains lactic acid) Blue litmus will turn red.

(vi) Soap solution (basic) Red litmus will turn blue.

34. Name the add present in ant sting and give its chemical formula. Also give the common method to get relief from the discomfort caused by the ant sting.

Ans. Formic acid (or methanoic acid) is present in the ant sting. The chemical formula is HCOOH. By applying some wet baking soda on the affected area, it gives relief.

35. What happens when nitric acid is added to egg shell?

Ans. Egg shells contain calcium carbonate $(CaCO_3)$. When nitric acid is added to it, brisk effervescence due to the formation of CO_2 gas is observed. The reaction is

$$\underset{\text{calcium carbonate}}{CaCO_3(s)} + 2\underset{\text{Nitric acid}}{HNO_3(aq)} \longrightarrow \underset{\text{Calcium nitrate}}{Ca(NO_3)_2(aq)} + \underset{\text{Carbon dioxide}}{CO_2(g)} + \underset{\text{Water}}{H_2O(l)}$$

36. A student prepared solutions of (i) an acid and (ii) a base in two separate beakers. She forgot to label the solutions and litmus paper is not available in the laboratory. Since, both the solutions are colourless, how will she distinguish between the two?

Ans. In the absence of litmus, any other indicator like methyl orange, phenolphthalein, etc., can be used. Otherwise a natural indicator like turmeric can also be used.

Some common indicators with characteristic colours are tabulated below

S. No.	Indicator	Colour in acidic solution	Colour in neutral solution	Colour in basic solution
1.	Litmus	Red	Purple	Blue
2.	Phenolphthalein	Colourless	Colourless	Pink

3.	Methyl orange	Red/pink	Orange	Yellow
4.	Turmeric juice	Yellow	Yellow	Reddish Brown

37. How would you distinguish between baking powder and washing soda by heating?

Ans. On heating $NaHCO_3$ (baking soda), CO_2 (carbon dioxide) gas is given out that turns lime water milky

$$\underset{\text{Baking soda}}{2NaHCO_3} \xrightarrow{\text{Heat}} \underset{\text{Sodium carbonate}}{Na2Co_3} + H_2O + Co_2 \uparrow$$

While on heating $NaHCO_3 \cdot 10H_2O$ (washing soda) water of crystallization is given out and the salt becomes anhydrous. The presence of water of crystallization given as product can be tested by treating it with anhydrous $CuSO_4$ (white) which becomes blue in colour in its contact.

$$Na_2CO_3 \cdot 10H_2O \xrightarrow{\text{Heat}} Na_2CO_3 + 10H_2O$$

38. Salt A commonly used in bakery products on heating gets converted into another salt B which itself is used for removal of hardness of water and a gas C is evolved. The gas C when passed through lime water, turns it milky. Identify A, B and C.

Ans. Salt A is sodium bicarbonate $NaHCO_2$ (as it is used in bakery products and gives Na_2CO_3 on heating). Salt B is sodium carbonate Na_2CO_3 (it is used for removal of hardness of water) Gas C is carbon dioxide COg (as it turns lime water milky).

This can be shown as floows

$$\underset{\substack{\text{Sodium}\\\text{bicarbonate}}}{2NaHCO_3} \xrightarrow{\text{Heat}} \underset{\substack{\text{Sodium}\\\text{carbonate}}}{Na_2CO_3} + H_2O + CO_2 \uparrow$$

39. In one of the industrial processes for manufacture of sodium hydroxide, a gas X is formed as by-product. The gas X reacts with lime water to give a compound Y which is used as a bleaching agent in chemical industry. Identify X and Y giving the chemical equation of the reactions involved.

Ans. In the manufacture of sodium hydroxide, hydrogen gas and chlorine gas (X) are formed as by-product. Chlorine gas reacts with lime water to give bleaching powder, a bleaching agent. Thus, X is chlorine gas (Cl_2 gas).

Y is calcium oxychloride or bleaching powder ($CaOCl_2$).

The equation for the preparation of sodium hydroxide is

$$2NaCl(aq) + 2H_2O(l) \longrightarrow 2NaOH(aq) + \underset{(X)}{Cl_2}(g) + H_2(g) \quad Cl_2 + Ca(OH)_2 \longrightarrow CaOCl_2 + H_2O$$

40. Fill in the missing data in the given table.

Name of the salt	Formula	Salt obtained from	
		Base	Acid
(i) Ammonium chloride	NH_4Cl	NH_4OH	–
(ii) Copper Sulphate Sodium	–	–	H_2SO_4
(iii) Sodium chloride	$NaCl$	$NaOH$	–
(iv) Magnesium nitrate	$Mg(NO_3)_2$	–	HNO_3
(v) Potassium sulphate	K_2SO_4	–	–

(v) Calcium sulphate	$Ca(NO_3)_2$	$Ca(OH)_2$	–

Ans. (i) Acid: HCl [$\because$ $NH_4OH + HCl \longrightarrow NH4Cl + H_2O$]

(ii) Formula: $CuSO_4$

Base: $Cu(OH)_2$ [$\because$ $Cu(OH)_2 + H_2SO_4 \longrightarrow CuSO_4 + 2H_2O$]

(iii) Acid: HCl [$\because$ $NaOH + HCl \longrightarrow NaCl + H_2O$]

(iv) Base: $Mg(OH)_2$

[$\because$ $Mg(OH)_2 + 2HNO_3 \longrightarrow Mg(NO_3)_2 + 2H_2O$]

(v) base: KOH

Acid: H_2SO_4 [$\because$ $2KOH + H_2SO_4 \longrightarrow K_2SO_4 + 2H_2O$]

(vi) Acid: HNO_3 [$\because$ $Ca(OH)_2 + 2HNO_3 \longrightarrow Ca(NO_3)_2 + 2H_2O$]

41. What are strong and weak acids? In the following list of acids, separate strong acids from weak acids. Hydrochloric acid, citric acid, acetic acid, nitric acid, formic acid, sulphuric acid.

Ans. Strong acid The acid that ionises completely in aqueous solution, thus producing a high concentration of H_3O^+ ions, is called a strong acid, e.g., HCl, H_2SO_4 HNO_3 etc.

Weak acid Weak acid ionises only partially in aqueous solution and thus it produces ions as well as molecules, e.g., acetic acid, carbonic acid.

Strong Acid	Weak Acid
Hydrochloric acid	Citric acid
Nitric acid	Acetic acid
Sulphuri acid	Formic acid

42. When zinc metal is treated .with a dilute solution of a strong acid, a gas is evolved, which is utilized in the hydrogenation of oil. Name the gas evolved. Write the chemical equation of the reaction involved and also write a test to detect the gas formed.

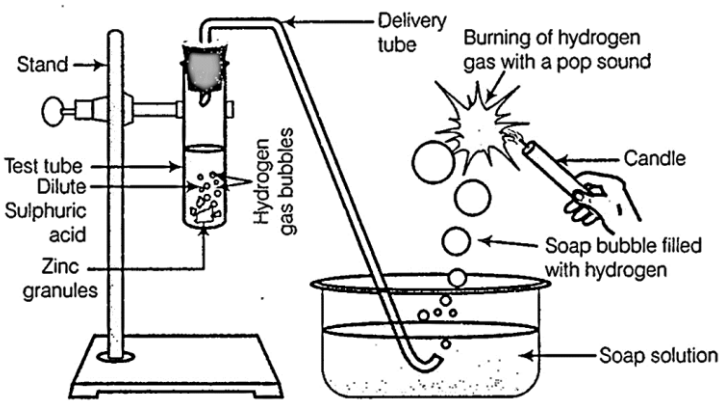
Ans. When zinc reacts with dilute solution of strong acid (like hydrochloric acid HCl), it forms salt and hydrogen gas is evolved which is used in hydrogenation of oil.

$$Zn + \underset{\text{Dil hydrochloric acid}}{2HCl} \longrightarrow \underset{\text{Zinc chloride}}{ZnCl_2} + H_2 \uparrow$$

To test the presence of Hg gas when a burning splinter is brought near the mouth of the test tube, the gas burns with a pop sound.

Long Answer Type Questions

43. In the following schematic diagram for the preparation of hydrogen gas as shown in the figure, what would happen if the following changes are made?



(a) In place of zinc granules, same amount of zinc dust is taken in the test tube.
(b) Instead of dilute sulphuric acid, dilute hydrochloric acid is taken.
(c) In place of zinc, copper turnings are taken.
(d) Sodium hydroxide is taken in place of dilute sulphuric acid and the tube is heated.

Ans. **(a)** It same amount of zinc dust is taken in the test tube then the reaction will be comparatively faster and hydrogen gas will evolve with greater speed. It is because dust has larger surface area than zinc granules.

(b) With dilute hydrochloric acid, almost same amount of gas is evolved.

(c) With copper turnings, hydrogen gas will not evolve because copper is less reactive, it does no react with dil. H_2SO_4 or dil. HCI. Hence, no reaction will take place.

(d) Zinc also react with NaOH, So, if sodium hydroxide is taken, then hydrogen gas will evolved.

$$\underset{\text{Zinc}}{Zn} + 2\underset{\text{Sodium hydroxide}}{NaOH} \longrightarrow \underset{\text{Sodium zincate}}{Na_2ZnO_2} + \underset{\text{Hydrogen gas}}{H_2}\uparrow$$

44. For making cake, baking powder is taken. If at home your mother uses baking soda instead of baking powder in cake.

(a) How will it affect the taste of the cake and why?
(b) How can baking soda be converted into baking powder?
(c) What is the role of tartaric acid added to baking soda?

Ans. (a) The advantage of using baking powder is that tartaric acid present in baking powder reacts with sodium carbonate (Na_2CO_3) produced during decomposition of $NaHCO_3$ and neutralizes it. If only sodium hydrogen carbonate (baking soda) is used in making cake, then sodium carbonate formed from it by the action of heat (during baking) give a bitter taste to cake.

(b) By adding tartaric acid to baking soda we can form baking powder.

(c) Tartaric acid neutralises the sodium carbonate formed during decomposition $NaHCO_3$ hence, making the cake tasty and not bitter in taste.

45. A metal carbonate X on reacting with an acid gives a gas which when passed through a solution Y gives the carbonate back. On the other hand, a gas G that is obtained at anode during electrolysis of brine passed on dry Y, it gives a compound Z, used for disinfecting drinking water. Identify X, Y, G and Z.

Ans. X is calcium carbonate and the gas evolved is carbon dioxide, when calcium carbon reacts with acid.

$$CaCO_3 + \text{Dil.}2HCl \longrightarrow CaCl_2 + H_2O + CO_2\uparrow$$

Solution Y is lime water $Ca(OH)_2$ because, when CO_2 is passed through it, it gives the carbonate back as shown by the given equation.

$$\underset{Y}{Ca(OH)_2} + CO_2 \longrightarrow \underset{X}{CaCO_3}\downarrow + H_2O$$

The gas evolved at anode during electrolysis of brine is chlorine (G).

$$\underset{\text{Sodium chloride (brine)}}{2NaCl} + 2H_2O \xrightarrow{\text{Electrolysis}} 2NaOH + \underset{\text{Chlorine gas (G)}}{Cl_2(g)} + H_2(g)$$

When chlorine gas is passed through dry $Ca(OH)_2$ (Y), it produces bleaching powder (Z), used for disinfecting drinking water.

$$Ca(OH)_2 + Cl_2 \longrightarrow \underset{\text{Bleaching powder (Z)}}{CaOCl_2} + H_2O$$

Hence, Z is calcium oxy-chloride ($CaOCl_2$) or bleaching powder.

46. A dry pellet of a common base B, when kept in open absorbs moisture and turns sticky. The compound is also a by-product of chlor-alkali process. Identify B, what type of reaction occurs when B is treated with an acidic oxide? Write a balanced chemical equation for one such solution.

Ans. Sodium hydroxide ($NaOH$) is commonly used base and is hygroscopic, that is, it absorbs moisture from the atmosphere and becomes sticky.

Thus, base B is $NaOH$ (sodium hydroxide).It is also a by-product of chlor-alkali process. The acidic oxide reacts with base to give salt and water.

If CO_2 is the acidic oxide taken, then the following reaction takes place with 'B'.

$$\underset{\text{Sodium hydroxide (B)}}{2NaOH} + CO_2 \longrightarrow \underset{\text{Sodium carbonate}}{Na_2CO_3} + H_2O$$

Such reaction is called neutralization reaction.

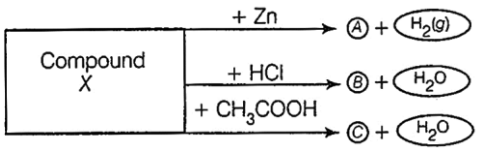
47. A sulphate salt of group 2 element of the periodic table is a white, soft substance, which can be moulded into different shapes by making its dough. When this compound is left in open for some time, it becomes a solid mass and cannot be used for moulding purposes. Identify the sulphate salt and why does it show such a behaviour? Give the reaction involved.

Ans. The sulphate salt which is used for making different shapes is plaster of Paris. Its chemical name is calcium sulphate hemihydrate $CaSO_4 \cdot \frac{1}{2}H_2O$. The two formula units of $CaSO_4$ share one molecule of water. As a result, it is soft. When it is left open for some time, it absorbs moisture from the atmosphere and forms gypsum which is a hard solid mass.

So, gypsum sets as a hard solid mass and cannot be used for moulding purposes.

$$\underset{\substack{\text{(Plaster of paris)}\\ \text{Sulphate salt(soft)}}}{CaSO_4 \cdot \frac{1}{2}H_2O} + 1\frac{1}{2}\underset{\text{Water}}{H_2O} \longrightarrow \underset{\substack{\text{Gypsum (hard mass sets as)}}}{CaSO_4 \cdot 2H_2O}.$$

48. Identify the compound X on the basis of the reactions given below. Also, write the name and chemical formulae of A, B and C.



Ans. Compound X is $NaOH$ (sodium hydroxide).

$$2NaOH + Zn \longrightarrow \underset{\substack{\text{Sodium}\\ \text{zincate}\\ \text{(A)}}}{Na_2ZnO_2} + H_2(g)$$

$$NaOH + HCl \longrightarrow \underset{\substack{\text{Sodium}\\ \textit{chloride}\\ (B)}}{NaCl} + H_2O$$

$$NaOH + CH_3COOH \longrightarrow \underset{\substack{\text{Sodium}\\ \text{acetate}\\ \text{(C)}}}{CH_3COONa} + H_2O$$