CBSE Test Paper 01

Chapter 02 Acid Base and Salt

1. Electrolysis of brine solution produces chlorine gas and hydrogen at **(1)**
   a. Anode and cathode, respectively.
   b. Both at cathode
   c. Cathode and anode respectively
   d. Both at Anode
2. Name the substance which on treatment with chlorine yields bleaching powder. **(1)**
   a. CaO
   b. $Ca(OH)_2$
   c. CuO
   d. $CaCo_3$
3. Which one of the following is not required to find the pH of a solution? **(1)**
   a. Litmus paper
   b. Standard pH value chart
   c. pH paper
   d. Universal indicator
4. A blue litmus paper was first dipped in dil. HCl and then in dil. NaOH solution. It was observed that the colour of the litmus paper **(1)**
   a. changed first to red and then to blue
   b. changed to red
   c. remained blue in both the solutions
   d. changed first to red and then to blue
5. Under what soil condition do you think a farmer would spread or treat the soil of his fields with quick lime (CaO) or slaked time $(CaCO_3)$? **(1)**
   a. When the pH of the soil increases
   b. When the nutrients of the soil is lost
   c. When the pH of the soil decreases
   d. All of these
6. An aqueous solution turns red litmus solution blue. Excess addition of which solution

would reverse the change? **(1)**

7. Give one example of natural indicator. **(1)**
8. Although acetic acid is highly soluble in water but still it is a weak acid. Explain why? **(1)**
9. Why is sodium hydrogen carbonate an essential ingredient in most antacids? **(1)**
10. Why acids are not stored in metal containers? **(3)**
11. 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? **(3)**
12. Write some uses of caustic soda? **(3)**
13. i. A chemical compound X is used in glass and soap industry. Identify the compound and give its chemical formula.
    ii. How many molecules of water of crystallisation are present in compound X?
    iii. How will you prepare the above compound starting from sodium chloride? Write all relevant equations involved in the process. **(3)**
14. Give important properties of bases (alkalies). **(5)**
15. Write the formulae of the salts given below**:**
    Potassium sulphate, sodium sulphate, calcium sulphate, magnesium sulphate, copper sulphate, sodium chloride, sodium nitrate, sodium carbonate and ammonium chloride.
    Identify the acids and bases from which the above salts may be obtained. How many families can you identify among these salts? **(5)**

CBSE Test Paper 01

Chapter 02 Acid Base and Salt

Answers

1. a. Anode and cathode, respectively.

   Explanation: On electrolysis, brine (sodium chloride solution) produces hydrogen gas at the cathode and chlorine gas at the anode.

   The half-equations for the reactions are:

   At the cathode: $2\ H^+(aq) + 2\ e^- \rightarrow H_2(g)$

   At the anode: $2\ Cl^-(aq); \rightarrow Cl_2(g) + 2\ e^-$

   Overall process: $2\ NaCl\ (or\ KCl) + 2\ H_2O \rightarrow Cl_2 + H_2 + 2\ NaOH\ (or\ KOH)$

   The solution left provides sodium hydroxide (a strong alkali).

2. b. $Ca(OH)_2$

   Explanation: Bleaching powder is prepared by passing chlorine gas over dry slaked lime.

   $$\underset{\text{slaked lime}}{Ca(OH)_2} + Cl_2 \rightarrow \underset{\text{bleaching powder}}{CaOCl_2} + H_2O$$

3. a. Litmus paper

   Explanation: Litmus paper cannot be used to find the pH of a solution.

4. d. changed first to red and then to blue

   Explanation: Blue paper turn in red indicate the sample is acidic. Blue paper that does not change color indicates the sample is a base. HCl is acidic and NaOH is base, So, dil. HCl turns blue litmus red which becomes blue again in NaOH.

5. c. When the pH of the soil decreases

   Explanation: When the pH of the soil becomes acidic, slaked lime or quick lime is added to neutralise the soil.

6. Changing of red litmus to blue indicates that the solution is basic. So to neutralise the basic solution an acid should be added. To revert the colour change that is to change blue litmus red, excess of acid needs to be added so that the solution becomes acidic.

7. Indicators obtained from natural sources are called natural indicators. Litmus, turmeric, red cabbage, China rose, etc. are some common natural indicators used widely to show the acidic or basic character of substances.

8. The strength of an acid depends upon the extent of ionization. Acetic acid is highly soluble in water but it dissociates partially in the aqueous solution to produce a small amount of H+ ions and, therefore, considered as a weak acid.

9. Sodium hydrogen carbonate is slightly alkaline in nature that's why it is an essential ingredient in most antacids.

10. Acids cannot be stored in metal containers as they will react with the metal, forming metal salt and liberating Hydrogen gas. Containers made of glass are ideal for storage of acid due to its chemical inertness.

11. In solution A, $[H^+(aq)] = 10^{-6}$ M

    In solution B, $[H^+(aq)] = 10^{-8}$ M

    The pH value of a solution varies from 0 to 14. The pH value is 0 for a very strong acid and the pH value is 14 for a very strong base. The pH value is 7 for a neutral solution. Hence A is acidic and B is basic in nature. The concentration of hydrogen ion decreases from pH value of 0 to 14 therefore A has more hydrogen ion concentration.

12. Three uses of caustic soda:

    a. It is used in paper industry.
    b. It is used in manufacture of soap and detergents.
    c. It is used in the manufacture of artificial fibres.
    d. It is used as a cleansing agent and in the manufacturing of washing soda.
    e. Sometimes, sodium hydroxide is also used as a reagent in the laboratories.
    f. It is used in the preparation of soda lime.
    g. It is used in the extraction of aluminium by purifying bauxite.

13. i. The compound (X) is washing soda. Its chemical formula is $Na_2CO_3 .10H_2O$

    ii. Ten molecules of water of crystallisation are present in this compound.

    iii. Ammonia and carbon dioxide gas in passed through brine (or concentrated sodium chloride solution) then a mixture of $NaHCO_3$ and NH_4Cl is formed.

$NaCl\ (s) + NH_3\ (g) + CO_2(g) + H_2O(l) \rightarrow NaHCO_3\ (s) + NH_4CI(g)$

On Heating $NaHCO_3$, sodium carbonate is formed releasing water and carbon dioxide

$2NaHCO_3\ (s) \xrightarrow{\triangle} Na_2CO_3\ (s) + H_2O(l) + CO_2(g)$

Anhydrous sodium carbonate (also known as soda ash) is dissolved in water. The solution is recrystallized and upon cooling, it gives hydrated sodium carbonate (called washing soda).

$$Na_2CO_3\ (s)\ +\ 10H_2O(l)\ \rightarrow \underset{Washing\ soda}{Na_2CO_3\ .10H_2O(s)}$$

14. i. Bases are soapy to touch and have bitter taste.

ii. They change the colour of indicators.

Indicator	Colour change
Litmus	From red to blue
Phenolphthalein	From colourless to pink
Methyl orange	From orange to yellow

iii. They act as electrolytes.

iv. They have a corrosive action on the skin.

v. Action with ammonium salts : When they are warmed with an ammonium salt, ammonia gas is produced.

e.g. $NH_4Cl + NaOH \rightarrow NaCl + H_2O + NH_3\uparrow$

vi. They absorb carbon dioxide from the air to form carbonates.

$2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$

$2KOH + CO_2 \rightarrow K_2CO_3 + H_2O$

vii. They neutralise acids to from salt and water

$Ca(OH)_2 + 2HCl \rightarrow CaCl_2 + 2H_2O$

$Fe(OH)_2 + 2HCl \rightarrow FeCl_2 + 2H_2O$

viii. Action of heat : All bases except NaOH decompose on heating to give oxides.

$Ca(OH)_2 \xrightarrow{Heat} CaO + H_2O$

$2Al(OH)_3 \xrightarrow{Heat} Al_2O_3 + 3H_2O$

ix. Precipitation reactions : When added to the solutions of the salts of the heavy

metals viz. copper, iron, zinc, etc. the bases produce insoluble metal hydroxides as precipitates.

$CuSO_{4(aq)} + 2NH_4OH \rightarrow (NH_4)_2SO_4 + Cu(OH)_2 \downarrow$ (pale blue)

$ZnSO_{4(aq)} + 2NaOH_{(aq)} \rightarrow Na_2SO_{4(aq)} + Zn(OH)_2 \downarrow$ (white)

x. Amphoteric nature : The hydroxides of zinc, aluminium and lead are amphoteric i.e. they can act as weak bases as well as weak acids.

a. As weak bases :

$Zn(OH)_2 + 2HCl\ (dil) \rightarrow ZnCl_2(aq) + 2H_2O$

$Al(OH_3)(s) + 3HCl(dil) \rightarrow AlCl_3(aq) + 3H_2O$

b. As weak acids

$Al(OH_3)(s) + 2NaOH(aq) \rightarrow \underset{Sodium\ meta\ aluminate}{NaAlO_2(aq)} + 2H_2O$

$Zn(OH)_2(s) + 2NaOH\ (aq) \rightarrow \underset{Sodium\ zincate}{Na_2ZnO_2(aq)} + 2H_2O$

15. The following table gives the formulae of the given salts, and the acids and bases from which these salts may be obtained**:**

S.No.	Salts	Formula	Family	Acid and Base
1.	Potassium sulphate	K_2SO_4	Potassium salts	H_2SO_4 and KOH
2.	Sodium sulphate	Na_2SO_4	Sodium salts	H_2SO_4 and NaOH
3.	Calcium sulphate	$CaSO_4$	Calcium salts	H_2SO_4 and $Ca(OH)_2$
4.	Magnesium sulphate	$MgSO_4$	Magnesium salts	H_2SO_4 and $Mg(OH)_2$
5.	Copper sulphate	$CuSO_4$	Copper salts	H_2SO_4 and $Cu(OH)_2$
6.	Sodium chloride	NaCl	Chloride salts	HCl and NaOH
7.	Sodium nitrate	$NaNO_3$	Nitrate salts	HNO_3 and NaOH
8.	Sodium carbonate	Na_2CO_3	Carbonate salts	H_2CO_3 and NaOH
9.	Ammonium chloride	NH_4Cl	Chloride salts	HCl and NH_4OH

CBSE Test Paper-02

Chapter 02 Acid Base and Salt

1. Tooth pastes are generally **(1)**

   a. natural
   b. acidic
   c. basic
   d. neutral

2. Lemon contains **(1)**

   a. Formic acid
   b. Citric acid
   c. Tartaric acid
   d. Lactic acid

3. 10 mL of a solution of NaOH is found to be completely neutralized by 8 mL of a given solution of HCl. If we take 20 mL of same solution of NaOH, the amount of HCl solution required to neutralize it will be **(1)**

   a. 12 mL
   b. 16 mL
   c. 8 mL
   d. 4 mL

4. On passing CO_2 through lime water for a longer time, why does the milkiness disappear? **(1)**

   a. Due to formation of $\mathrm{Ca(OH)_2}$
   b. Due to formation of water soluble $\mathrm{Ca(HCO_3)_2}$
   c. Due to formation of $\mathrm{CaCO_3}$
   d. Due to formation of CaO.

5. Which of the following gives CO_2 on heating? **(1)**

a. Quick lime
b. Limestone
c. Slaked lime
d. Soda ash

6. What will happen if water is added to an acid or a base? **(1)**

7. Write the chemical name and formula of baking soda. **(1)**

8. How can $CuSO_4$ be used for detecting the presence of water ? **(1)**

9. What is pH paper ? **(1)**

10. Plaster of Paris should be stored in a moisture-proof container. Explain why? **(3)**

11. A group of students, while on excursion trip is campaigning on the hills. One morning, they find themselves engulfed in a thick blanket of snow. One of the senior member of the group suggests to sprinkle common salt on the ice slit covering the pavement. Now answer the following questions: **(3)**

    i. What is the purpose of sprinkling common salt on ice slit?
    ii. Can we use any other substance in place of common salt?
    iii. What values are associated with the students?

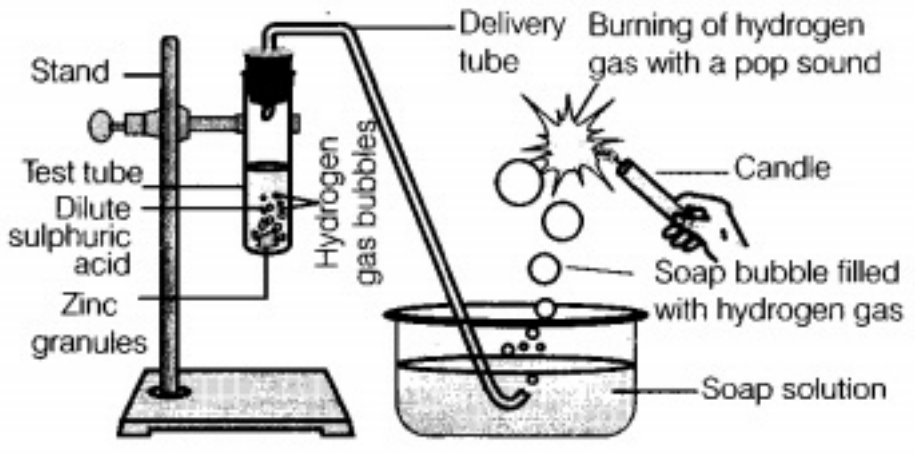
12. Two solutions P and Q have pH 2 and 12. Which solution has more concentration of H^+ (aq) ions ? **(3)**

13. A road tanker carrying an acid was involved in an accident and its contents spilled on the road. At the side of the road iron drain cover began melting and fizzing as the acid ran over them. A specialist was called to see if the acid actually leaked into the nearby river. **(3)**

    (a) Explain why specialist could carry out sample test to see of the river water contains some acid or not
    (b) Suggest a better report name for the word 'melting'
    (c) Explain why the drain covers began fizzing as the acid ran over them.

14. How is plaster of Paris prepared ? Why is temperature control necessary during its preparation ? How does it react with water ? **(5)**

15. 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?



i. In place of zinc granules, same amount of zinc dust in taken in the test tube.
ii. Instead of dilute sulphuric acid, dilute hydrochloric acid is taken.
iii. In place of zinc, copper turnings are taken.
iv. Sodium hydroxide is taken in place of dilute sulphuric acid and the test tube is heated. **(5)**

CBSE Test Paper-02

Chapter 02 Acid Base and Salt

Answers

1. c. basic

   Explanation: Toothpastes are generally basic because their function is to react with the excess acid in our mouth and thus prevent tooth decay.

2. b. Citric acid

   Explanation: Lemon constitutes citric acid and is therefore referred under the category of citrus fruits.

3. b. 16 mL

   Explanation: 10 mL of NaOH neutralises 8mL of HCl

   i.e. 1 mL of NaOH neutralises $\frac{8}{10}$ mL of HCl

   so, 20 mL of NaOH will neutralise $\frac{8}{10} \times 20$= **16mL of HCl**

4. b. Due to formation of water soluble $\mathrm{Ca(HCO_3)_2}$

   Explanation: When carbon dioxide gas is passed through lime water, it turns milky due to the formation of calcium carbonate which is insoluble in water.

   $Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$

   However, when excess of carbon dioxide is passed through this solution, the milkyness disappears. This is due the formation of calcium bicarbonate, which is soluble in water. Thus, a clear solution is obtained.

   $CaCO_3 + H_2O + CO_2 \rightarrow Ca(HCO_3)_2$

5. b. Limestone

   Explanation: Limestone ($CaCO_3$) decomposes on heating to produce quicklime (CaO) and CO_2 gas.

6. If water is added to an acid or base a large amount of heat energy is evolved which may cause the reaction mixture to splash out and cause injury to the person.

7. The chemical name of baking soda is sodium hydrogen carbonate.
   The formula of baking soda is $NaHCO_3$.

8. Anhydrous copper sulphate($CuSO_4$) is white in colour but turns blue when comes in contact with water to form $CuSO_4$. $5H_2O$. Thus, it can be used to detect the presence of moisture.

9. A filter paper soaked in universal indicator and then dried is called pH paper.

10. Plaster of Paris should be stored in a moisture-proof container, because in presence of moisture, plaster of paris sets to give a hard mass.

$$CaSO_4.\frac{1}{2}H_2O + \frac{3}{2}H_2O \rightarrow CaSO_4.2H_2O$$

$$Plaster of Paris \qquad (Hard mass)$$

It can be no longer used for making moulds and statues. To avoid above reaction to occur Plaster of Paris be stored in moisture- proof containers.

11. i. Sprinkling common salt on icy roads, ice/snow lowers the freezing point of ice due to which the ice or snow melts down. The softened ice/snow can be easily cleared from the roads.
    ii. Calcium chloride can be used in place of common salt. It can lower the freezing point up to -55°C.
    iii. The students are caring, helping, have supporting nature and have scientific knowledge.

12. The pH value of a solution varies from 0 to 14. The pH value is 0 for a very strong acid and the pH value is 14 for a very strong base. The pH value is 7 for a neutral solution. Hence P is acidic and Q is basic in nature. The concentration of hydrogen ion decreases from pH value of 0 to 14 therefore P has more hydrogen ion concentration.

13. 1. It can be done by adding a strip of blue litmus paper into a tube containing a small amount of sample water if the colour changes into red, this means that some acid has gone into the river.
    2. The acid has reacted chemically with the drain cover which is usually made of iron. The correct word is corrosion.
    3. Iron reacts with an acid $(H_2SO_4 \text{or} HCl)$ to evolve H_2 gas. Since the gas is released immediately accompanied by large number of bubbles Fizzing of detain covers is expected.

14. Plaster of paris is prepared from gypsum.
    Gypsum is calcium sulphate dihydrate. The chemical formula of gypsum is $CaSO_4 \cdot 2H_2O$

    Plaster of paris is prepared by heating gypsum to a temperature of 373K.When gypsum is heated to a temperature of 373k ,It loses three-Fourths of its water of crystallisation and forms plaster of paris.

    $CaSO_4.2H_2O \xrightarrow[273\ K]{Heat} CaSO_4.\frac{1}{2}H_2O + \frac{3}{2}\ H_2O$

    Or

    $2CaSO_4.2H_2O \xrightarrow[273\ K]{Heat} (CaSO_4)_2.H_2O + 3H_2O$

    It may be noted the temperature should be controlled carefully. It should not be allowed to rise above 425 K, because the whole of water is lost and anhydrous calcium sulphate ($CaSO_4$) is produced. It is called dead burnt plaster. It has not such property as that of plaster of paris.

    When mixed with water, it forms a paste which sets into a hard mass. This is called setting of Plaster of Paris. The setting of Plaster of Paris is due to its hydration into gypsum.

    $(CaSO_4)_2.H_2O + 3H_2O \rightarrow CaSO_4.2H_2O$

    Plaster of paris Gypsum

15. i. Since the zinc dust has a larger surface area than zinc granules. If the 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.
    ii. With dilute hydrochloric acid, almost the same amount of gas is evolved.
    iii. With copper turnings, hydrogen gas will not evolve because copper is less reactive and it will not displace hydrogen from the acid. Hence, no reaction will take place.
    iv. Zinc also reacts with NaOH. So, if sodium hydroxide is taken, then hydrogen gas will be evolved.

    $\underset{Zinc}{Zn(s)} + \underset{Sodium\ \text{hydroxide}}{2NaOH(aq)} \longrightarrow \underset{Sodium\ \text{Zincate}}{Na_2ZnO_2(aq)} + \underset{Hydrogen\ \text{gas}}{H_2(g)} \uparrow$

CBSE Test Paper-03

Chapter 02 Acid Base and Salt

1. 10 mL of a solution of NaOH is found to be completely neutralized 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 required to neutralize it will be **(1)**

   a. 8ml
   b. 12ml
   c. 4ml
   d. 16ml

2. The colour of the pH paper strip turned red when it was dipped into a sample. The sample could be **(1)**

   a. dilute Hydrochloric acid
   b. tap water
   c. dilute Sodium bicarbonate solution
   d. dilute Sodium hydroxide solution

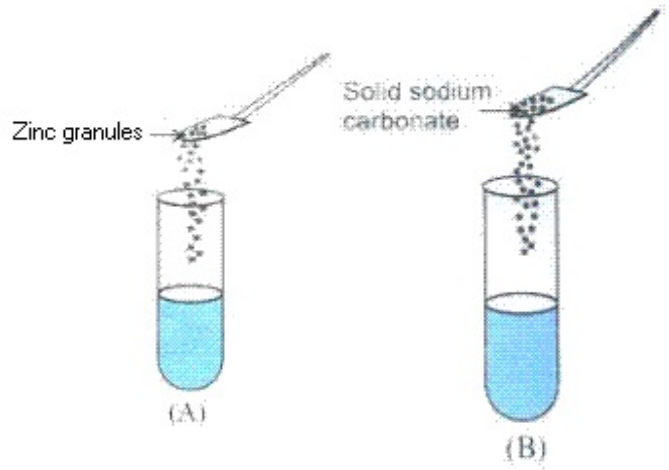
3. A student takes some zinc granules in a test tube and adds dilute hydrochloric acid to it. He would observe that the colour of the zinc granules changes to **(1)**

   a. brown
   b. black
   c. yellow
   d. white

4. Higher the hydronium ion concentration, **(1)**

   a. higher is the pH value
   b. lower is the pH value
   c. moderate is the pH value
   d. pH value is the zero

5. A student took two test tubes containing 2 ml of dilute hydrochloric acid and added zinc granules to test tube (A) and solid sodium carbonate to test tube (B) as shown below:



The correct observation would be **(1)**

   a. Rapid reaction in both the test tubes
   b. No reaction in any of the test tubes.
   c. Slow reaction in (A) and rapid reaction in (B)
   d. Rapid reaction in (A) but a slow reaction in (B)

6. Name two salts that are used in black and white photography. **(1)**

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

8. 'A' is a soluble acidic oxide and 'B' is a soluble base. Compared to the pH of pure water, what will be the pH of **: (1)**
   (a) Solution of 'A'
   (b) Solution of 'B'

9. What is pH of tomato juice ? **(1)**

10. 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. **(3)**

11. State reason for the following:

    i. Dry HCl gas does not change the colour of the dry blue litmus paper.
    ii. Alcohol and glucose also contain hydrogen, but do not conduct electricity.
    iii. Concentration of H_3O^+ ions is affected when a solution of an acid is diluted. **(3)**

12. How is chloride of lime chemically different from calcium chloride ? Why does chloride of lime gradually lose its chlorine when kept exposed to air ? **(3)**

13. Experiment to show that blue vitriol crystals contain water of crystallization : **(3)**

14. When CO_2 gas pass through saturated solution of ammonical brine, two compound 'X' and 'Y' are formed. 'Y' is used as antacid and decomposes to form another solid 'Z'. Identify 'X', 'Y', 'Z' and write the chemical equations. **(5)**

15. i. The PH of rain water collected from two cities A and B was found to be 6 and 5 respectively. Water of which city is more acidic? Find out the ratio of hydrogen ion concentration in the two samples of rain water?
    ii. Arrange the following in order (ascending) of their PH values.$NaOH$ solution, Blood, lemon Juice. **(5)**

CBSE Test Paper-03

Chapter 02 Acid Base and Salt

Answers

1. d. 16ml

   Explanation: 10 mL of NaOH solution is neutralized by 8 mL of HCl.

   1 mL of NaOH soultion is neutralized by $\frac{8}{10}$ mL of HCl.

   20 mL of NaOH solution will neutralize $\frac{8}{10}$ * 20 mL of HCl = 16 mL

2. a. dilute Hydrochloric acid

   Explanation: Dilute Hydrochloric acid turns pH paper red. It is acetic in nature.

3. b. black

   Explanation: Zinc granules changes to black in colour.

4. b. lower is the pH value

   Explanation: The hydrogen ion concentration is represented by the symbol $[H^+]$. The pH is defined as pH = -log $[H^+]$ ie, it's the negative logarithm of the H^+ concentration.

   In water H^+ is really H_3O^+ (the hydronium ion) . The greater the concentration of the hydronium ion, the lower the value of pH. It is simply logarithms. It has nothing to do with the chemistry behind it.

5. a. Rapid reaction in both the test tubes

   Explanation: Reaction will be rapid in both test tubes

   $Zn + 2HCl \rightarrow ZnCl_2 + H_2$

   $Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$

6. Two salts that are used in black and white photography are silver chloride ($AgCl$) and silver bromide ($AgBr$).

   Silver chloride decomposes to form silver metal and chlorine gas when exposed to light. The white colour of silver chloride changes to greyish white due to the formation of silver metal.

$2AgCl\ (s) \rightarrow 2Ag\ (s) + Cl_2\ (g)$

Silver bromide also behaves in a similar fashion. The pale yellow colour of silver bromide changes to greyish white due to the formation of silver metal.

$2AgBr\ (s) \rightarrow 2Ag\ (s) + Br_2\ (g)$

7. HCl, HNO_3, etc., ionise in the aqueous solution to produce H^+ ions. Hence, they show acidic character. Compounds like C_2H_5OH and glucose do not ionise in the aqueous solution to give H^+ ions, i.e., hydrogen present in them is non-ionisable. Hence, they do not show acidic character.

8. The pH of a solution is inversely proportional to its hydrogen ion concentration. This means that an aqueous solution having a higher concentration of hydrogen ion will have lower pH and vice-versa.
   Solution 'A' which is a soluble acidic oxide will supply a large number of hydrogen (H^+) ions and thus, its pH will be less than 7.
   Solution 'B' which is a soluble base will supply a lesser number of hydrogen (H^+) ions and thus, its pH will be more than 7.

9. Tomato is Acidic. Tomatoes are generally considered a high acid food item with a pH 4.1.

10. i. It is alkaline and neutralizes excess acid in the stomach. Therefore, it is used as an antacid. It is a mild non-corrosive base, so it is an ingridient of antacids.
    ii. Baking powder contains baking soda and tartaric acid. When baking powder is heated, sodium hydrogen carbonate decomposes to give CO_2 and sodium carbonate CO_2 causes bread and cakes to rise.

11. i. Dry HCl gas does not produce free H^+ ions, hence, it does not change the color of the dry blue litmus paper.
    ii. Alcohol and glucose contain hydrogen but they do not ionize in the solution to produce H^+ ions and can not conduct electricity.
    iii. The volume of the solution increases when a solution is diluted, but the number of ions remains the same, so the concentration of H_3O^+ per unit volume decreases.

12. Chloride of lime is calcium hypochlorite [$Ca(OCl)_2$] which is alkaline. Calcium chloride

is $CaCl_2$ which is neutral.

On the other hand, calcium chloride is $CaCl_2$. When exposed to air, it loses its chlorine because it reacts with carbon dioxide present in air to give calcium carbonate and chlorine gas.

$CaOCl_2$	+	CO_2	→	$CaCO_3$	+	Cl_2
Caclcium oxycholoride				calcium carbonate		chlorine gas

13. Take some powdered copper sulphate crystals in a clean and dry test tube and heat the crystals with slightly tilting it downwards. Drops of colourless liquid will condense on the cooler parts and collect it in a dish.
Anhydrous white copper sulphate is left behind in the test tube. This liquid turns anhydrous copper sulphate blue indicating that this liquid is water.

$CuSO_4.5H_2O$	$\xrightarrow{Heat}$	$CuSO_4$	+	5 H_2O
Hydrated Copper sulphate		Anhydous copper sulphate		

14. When CO_2 gas is passed through a saturated solution of ammoniacal brine, ammonium chloride and sodium bicarbonate are formed.
Compound 'Y' is used as antacid, hence compound 'Y' is sodium bicarbonate.
Compound 'X' is ammonium chloride.
Compound 'Y' decomposes to form another solid 'Z'. Compound 'Z' is sodium carbonate.
The chemical equations for the reactions are as follows**:**

$$NaCl + H_2O + CO_2 + NH_3 \rightarrow \underset{(Ammonium Chloride)}{NH_4Cl} + \underset{Sodium hycarbonate}{NaHCO_3}$$

$$\underset{Sodium hycarbonate}{2NaHCO_3} \xrightarrow{Heat} \underset{Sodium carbonate}{Na_2CO_3(s)} + H_2O + CO_2$$

15. **(a)** The pH of a rain water solution will be inversely proportional to the hydrogen ion concentration.
This means that rain water having a higher concentration of hydrogen ion will have a

lower pH and vice-versa.

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

Hydrogen ion concentration in the rain water for city **A** is calculated is as follows**:-**

$$\log\left[\frac{1}{H^+}\right] = 6 \implies \left[\frac{1}{H^+}\right] = anti\log 6 \implies \left[\frac{1}{H^+}\right] = 10^6 \implies [H^+] = 10^{-6} \text{ .....(i)}$$

Hydrogen ion concentration in the rain water for city **B** is calculated is as follows**:-**

$$\log\left[\frac{1}{H^+}\right] = 5 \implies \left[\frac{1}{H^+}\right] = anti\log 5 \implies \left[\frac{1}{H^+}\right] = 10^5 \implies [H^+] = 10^{-5} \text{ .....(ii)}$$

From (i) and (ii), we get the ratio of hydrogen ion concentration in the two samples of rain water**:**

$$\text{Ratio}\frac{(\text{City A})}{(\text{City B})} = \frac{10^{-6}}{10^{-5}} = \frac{1}{10}$$

Thus, rain water of **city B (pH = 5)** is **more acidic.**

(b) Ascending order of pH values are as follows**:-**

pH of Lemon juice < pH of Blood < pH of NaOH solution