

NCERT QUESTIONS WITH SOLUTIONS

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 tube?

Ans. (i) Put the red litmus paper in all the test tubes, turn by turn. The solution which turns red litmus to blue will be a basic solution. The blue litmus paper formed here can now be used to test the acidic solution.

(ii) Put the blue litmus paper obtained above in the remaining two test tubes, turn by turn. The solution which turns the blue litmus paper to red will be the acidic solution.

(iii) The solution which has no effect on any litmus paper will be neutral and hence it will be distilled water.

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

Ans. Curd and other sour substances contain acids. Therefore, when they are kept in brass and copper vessels, the metal reacts with the acid to liberate hydrogen gas and harmful products, thereby spoiling the food.

3. 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 usually liberated when an acid reacts with a metal.

For example,

Step 1 - Take few pieces of zinc granules and add 5 mL of dilute H_2SO_4 .

Step 2 - Shake it and pass the gas produced into a soap solution. The bubbles are formed in the soap solution. These soap bubbles contain hydrogen gas.

Test for hydrogen gas: The evolved hydrogen gas can be tested by bringing a burning candle near the soap bubbles. Hydrogen gas burns with a pop sound. (Refer Active Chemistry 3).

4. 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. $\text{CaCO}_3(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CaCl}_2(\text{s}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\ell)$

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

Ans. HCl and HNO_3 dissociate in the presence of water to form hydrogen or hydronium ions.

Although aqueous solutions of glucose and alcohol contain hydrogen, these cannot dissociate in water to form hydrogen or hydronium ions. Hence, they do not show acidic character.

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

Ans. Acids dissociate in aqueous solutions to form ions. These ions are responsible for conduction of electricity.

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

Ans. Acids do not ionize in the absence of water to liberate H_3O^+ which shows acidic nature of a solution. Therefore, dry HCl gas does not change the colour of the dry litmus paper because it does not contain H^+ ions.

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

Ans. It is recommended that the acid should be added to water and not water to the acid because the process of dissolving an acid in water is exothermic. If water is added to acid, since large amount of acid is present, a large amount of heat is generated. Therefore, the mixture splashes out and causes burns.

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

Ans. When an acid is diluted, the concentration of hydronium ions (H_3O^+) per unit volume decreases. This means that the strength of the acid decreases.

10. 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^-) would increase when excess base is dissolved in a solution of sodium hydroxide.

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?

Ans. A pH value of less than 7 indicates an acidic solution, while greater than 7 indicates a basic solution. Therefore, the solution with $\text{pH} = 6$ is acidic and has more hydrogen ion concentration than the solution of $\text{pH} = 8$ which is basic.

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

Ans. If the concentration of H^+ ions is increased, the solution becomes more acidic. If the concentration of H^+ ions is decreased, the solution becomes less acidic or more basic.

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

Ans. Yes, a basic solution also has $\text{H}^+(\text{aq})$ ions. However, their concentration is less as compared to the concentration of $\text{OH}^-(\text{aq})$ ions which makes the solution basic.

14. 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 is acidic and improper for cultivation, then to neutralise the acidity of the soil, the farmer would treat the soil with quick lime or slaked lime or chalk.

15. What is the common name of the compound CaOCl_2 ?

Ans. The common name of the compound CaOCl_2 is bleaching powder.

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

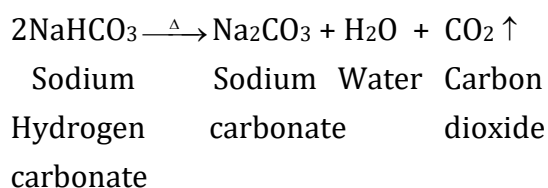
Ans. Calcium hydroxide $[\text{Ca}(\text{OH})_2]$, on treatment with chlorine, yields bleaching powder.

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

Ans. Washing soda ($\text{Na}_2\text{CO}_3 \cdot 10 \text{H}_2\text{O}$) is used for softening hard water.

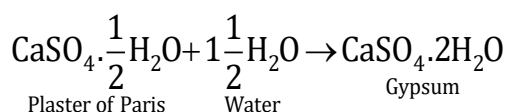
18. What will happen if a solution of sodium hydrogen carbonate is heated? Give the equation of the reaction involved.

Ans. When a solution of sodium hydrogen carbonate is heated, sodium carbonate and water are formed with the evolution of carbon dioxide gas.



19. Write an equation to show the reaction between Plaster of Paris and water.

Ans. The chemical equation for the reaction of Plaster of Paris and water can be represented as-



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

- (1) 1 (2) 4 (3) 5 (4) 10

Ans. (4) 10

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

- (1) NaCl (2) HCl (3) LiCl (4) KCl

Ans. (2) HCl

22. 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

- (1) 4mL (2) 8mL
(3) 12mL (4) 16 mL

Ans. (4) 16 mL

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

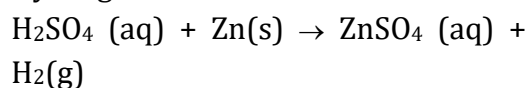
- (1) Antibiotic (2) Analgesic
(3) Antacid (4) Antiseptic

Ans. (3) Antacid

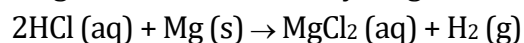
24. Write word equations and then balanced equations for the reaction taking place when -

- (1) Dilute sulphuric acid reacts with zinc granules.
(2) Dilute hydrochloric acid reacts with magnesium ribbon.
(3) Dilute sulphuric acid reacts with aluminium powder.
(4) Dilute hydrochloric acid reacts with iron filings.

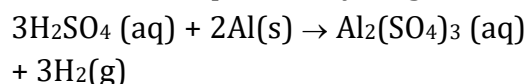
Ans. (1) Sulphuric acid + Zinc $\rightarrow$ Zinc sulphate + Hydrogen



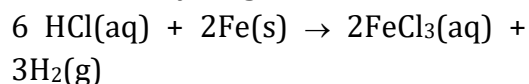
(2) Hydrochloric acid + Magnesium $\rightarrow$ Magnesium chloride + Hydrogen



(3) Sulphuric acid + Aluminium $\rightarrow$ Aluminium sulphate + Hydrogen



(4) Hydrochloric acid + Iron $\rightarrow$ Ferric chloride + Hydrogen



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

Ans. Activity

Method

Step 1- Two nails are fitted on a cork and are kept in a 100 mL beaker.

Step 2- The nails are then connected to the two terminals of a 6-volt battery through a bulb and a switch.

Step 3- Some dilute HCl is poured in the beaker and the current is switched on.

Step 4- The same experiment is then performed with glucose solution and alcohol solution.

Observations : It is observed that the bulb glows in the HCl solution but does not glow in the glucose solution and alcohol solution.

Result : HCl dissociates into H^+ (aq) and $Cl^-(aq)$ ions. These ions conduct electricity in the solution which results in the glowing of the bulb. On the other hand, the glucose solution and alcohol solution do not dissociate into ions. Therefore, it does not conduct electricity. (Refer to Active Chemistry 8 for figure).

Conclusion : From this activity, it can be concluded that all acids contain hydrogen but not all compounds containing hydrogen are acids.

Though alcohols and glucose contain hydrogen, they are not categorised as acids.

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

Ans. Distilled water is a pure form of water and is devoid of any ionic species. Therefore, it does not conduct electricity. Rain water, being an impure form of water, contains many ionic species such as acids and therefore, it conducts electricity.

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

Ans. Acids do not show acidic behaviour in the absence of water because there are no hydrogen ions available for conduction of electricity. Acids dissociate in the presence of water to give free hydrogen ions. It is the hydrogen ions that are responsible for the acidic behaviour.

28. Five solutions A, B, C, D and E 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?

Arrange the pH in increasing order of hydrogen-ion concentration.

Ans. (a) Neutral – Solution D with pH 7
 (b) Strongly alkaline – Solution C with pH 11
 (c) Strongly acidic – Solution B with pH 1
 (d) Weakly acidic – Solution A with pH 4
 (e) Weakly alkaline – Solution E with pH 9
 The pH can be arranged in the increasing order of the concentration of hydrogen ions as $11 < 9 < 7 < 4 < 1$.

29. 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 (CH₃COOH) is added to test tube B. In which test tube will the fizzing occur more vigorously and why?

Ans. The fizzing will occur strongly in test tube A, in which hydrochloric acid (HCl) is added. This is because HCl is a stronger acid than CH₃COOH and therefore, produces hydrogen gas at a faster speed due to which fizzing occurs.

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

Ans. The pH of milk is 6. As it changes to curd, the pH will reduce because curd is acidic in nature. The acids present in it decrease the pH.

31. 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 shifts the pH of the fresh milk from 6 to slightly alkaline because in alkaline condition, milk does not set as curd easily.

(b) Since this milk is slightly basic than usual milk, acids produced to set the curd are neutralised by the base. Therefore, it takes a longer time for the curd to set.

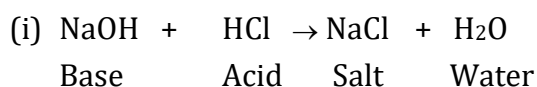
32. Plaster of Paris should be stored in a moisture-proof container. Explain why?

Ans. Plaster of Paris should be stored in a moisture-proof container because Plaster of Paris, a powdery mass, absorbs water (moisture) to form a hard solid known as gypsum.

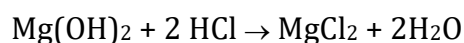
33. What is a neutralisation reaction? Give two examples.

Ans. A reaction in which an acid and base react with each other to give a salt and water is termed as neutralisation reaction. In this reaction, energy is evolved in the form of heat.

For example,



(ii) During indigestion (caused due to the production of excess of hydrochloric acid in the stomach), we use an antacid (generally, milk of magnesia, Mg(OH)₂ which is basic in nature). The antacid neutralises the excess of acids and thus, gives relief from indigestion.



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

Ans. Two important uses of washing soda and baking soda are as follows

(1) Washing soda

(a) It is used in glass, soap, and paper industries.

(b) It is used to remove permanent hardness of water.

(2) Baking soda

(a) It is used as baking powder. Baking powder is a mixture of baking soda and a mild acid known as tartaric acid. When it is heated or mixed in water, it releases CO₂ gas that makes bread or cake fluffy.

(b) It is used in soda-acid fire extinguishers.

EXERCISE-01

Neutralisation equation

ACID + BASE → SALT + WATER

Complete the following equations in both words and formulae.

- Hydrochloric acid + Sodium hydroxide
→ Sodium chloride + Water
 $\text{HCl} + \text{NaOH}$
→ _____ + _____
- Nitric acid + Sodium hydroxide
→ Sodium nitrate + Water
 $\text{HNO}_3 + \text{NaOH}$
→ _____ + _____
- Nitric acid + Zinc hydroxide
→ _____ + _____
 $\text{HNO}_3 + \text{Zn(OH)}_2$
→ _____ + _____
- Sulphuric acid + Calcium hydroxide
→ _____ + _____
 $\text{H}_2\text{SO}_4 + \text{Ca(OH)}_2$
→ _____ + _____
- Hydrochloric acid + Calcium hydroxide
→ _____ + _____
 $\text{HCl} + \text{Ca(OH)}_2$
→ _____ + _____
- Sulphuric acid + Ammonium hydroxide
→ _____ + _____
 $\text{H}_2\text{SO}_4 + \text{NH}_4\text{OH}$
→ _____ + _____

Multiple choice questions

- Which of the following are present in a dilute aqueous solution of hydrochloric acid?
(1) $\text{H}_3\text{O}^+ + \text{Cl}^-$ (2) $\text{H}_3\text{O}^+ + \text{OH}^-$
(3) $\text{Cl}^- + \text{OH}^-$ (4) unionised HCl
- Which of the following is acidic in nature?
(1) Lime juice (2) Human blood
(3) Lime water (4) Antacid
- Which one of the following is acidic?
(1) Lemon juice (2) Tomatoes
(3) Curd (4) All of these
- Some fruits like mango, lemon, raw grapes, orange, etc., have a sour taste due to the presence of
(1) Acetic acid (2) Citric acid
(3) Lactic acid (4) Oxalic acid
- Which among the following is not a base?
(1) NaOH (2) KOH
(3) NH_4OH (4) $\text{C}_2\text{H}_5\text{OH}$
- Which one of the following will turn red litmus blue?
(1) Vinegar (2) Soap
(3) Lemon juice (4) Soft drinks
- Which one of the following will turn blue litmus red?
(1) Vinegar
(2) Lime water
(3) Ammonium hydroxide solution
(4) Soap solution
- Phenolphthalein is
(1) Pink in acidic medium, yellow in basic medium
(2) Yellow in acidic medium, pink in basic medium
(3) Colourless in acidic medium, pink in basic medium
(4) Pink in acidic medium, colourless in basic medium.

9. Which of the following statements is true for acids?
 (1) Bitter and change red litmus to blue
 (2) Sour and change red litmus to blue
 (3) Sour and change blue litmus to red
 (4) Bitter and change blue litmus to red
10. Which of the following indicators turn red in an acidic solution?
 i. Phenolphthalein ii. Litmus
 iii. Turmeric iv. Methyl orange
 Choose the correct option:
 (1) (i) and (ii) (2) (ii) and (iii)
 (3) Only (ii) (4) (ii) and (iv)
11. Which one of the following is an olfactory indicator?
 (1) Litmus (2) Turmeric
 (3) Vanilla essence (4) All of these
12. Zinc granules on treating with an acid X, form the zinc sulphate (ZnSO_4) salt along with the evolution of a gas Y which burns with a pop sound when brought near to a burning candle. Identify the acid X and gas evolved Y.
 (1) X- Sulphuric acid and Y- Oxygen gas
 (2) X- Hydrochloric acid and Y- Oxygen gas
 (3) X- Sulphuric acid and Y- Hydrogen gas
 (4) X- Hydrochloric acid and Y- Hydrogen gas
13. Which of the following substance will not give carbon dioxide on treatment with dilute acid?
 (1) Marble (2) Limestone
 (3) Baking soda (4) Lime
14. Identify the products of the following reaction
 $\text{CaCO}_3 + \text{HCl} \longrightarrow ?$
 (1) Calcium hydrogen carbonate and chlorine gas
 (2) Calcium chloride and water
 (3) Calcium oxide, carbon dioxide and water
 (4) Calcium chloride, carbon dioxide and water
15. The pH of the gastric juices released during digestion is
 (1) less than 7 (2) more than 7
 (3) equal to 7 (4) equal to 0
16. If a few drops of a concentrated acid accidentally spills over the hand of a student, what should be done?
 (1) Wash the hand with saline solution.
 (2) Wash the hand immediately with plenty of water and apply a paste of sodium hydrogen carbonate.
 (3) After washing with plenty of water apply solution of sodium hydroxide on the hand.
 (4) Neutralise the acid with a strong alkali.
17. To prevent tooth decay we are advised to brush our teeth regularly. The nature of the tooth paste commonly used is
 (1) acidic (2) neutral
 (3) basic (4) corrosive
18. An ant's sting can be treated with _____ which will neutralise the effect of the chemical injected by the ant's sting into our skin.
 Choose the correct option from the following to be filled in the blank space:
 (1) methanoic acid (2) formic acid
 (3) baking soda (4) caustic soda
19. Which of the following is a basic salt?
 (1) SnCl_2 (2) NaCl
 (3) NH_4Cl (4) CH_3COONa
20. Sodium carbonate is a basic salt because it is a salt of
 (1) strong acid and strong base
 (2) weak acid and weak base
 (3) strong acid and weak base
 (4) weak acid and strong base

21. 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
(1) (i) and (ii) (2) (i), (ii) and (iv)
(3) (i) and (iii) (4) (i), (iii) and (iv)
22. Identify the correct representation of reaction occurring during chloralkali process.
(1) $2\text{NaCl(l)} + 2\text{H}_2\text{O(l)} \rightarrow 2\text{NaOH(l)} + \text{Cl}_2\text{(g)} + \text{H}_2\text{(g)}$
(2) $2\text{NaCl(aq)} + 2\text{H}_2\text{O(aq)} \rightarrow 2\text{NaOH(aq)} + \text{Cl}_2\text{(g)} + \text{H}_2\text{(g)}$
(3) $2\text{NaCl(aq)} + 2\text{H}_2\text{O(l)} \rightarrow 2\text{NaOH(aq)} + \text{Cl}_2\text{(aq)} + \text{H}_2\text{(aq)}$
(4) $2\text{NaCl(aq)} + 2\text{H}_2\text{O(l)} \rightarrow 2\text{NaOH(aq)} + \text{Cl}_2\text{(g)} + \text{H}_2\text{(g)}$
23. Which of the following is represented by the formula NaHCO_3 ?
(1) Sodium carbonate
(2) Baking soda
(3) Sodium acetate
(4) Washing soda
24. One of the constituents of baking powder is sodium hydrogen carbonate, the other constituent is
(1) hydrochloric acid
(2) tartaric acid
(3) acetic acid
(4) sulphuric acid
25. Lime water is
(1) CaO (2) Ca(OH)_2
(3) CaCO_3 (4) CaCl_2
26. Bleaching powder is used as a disinfectant for water to
(1) make water tastier
(2) remove all the dirt from water
(3) make water germ-free
(4) make water clear
27. $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ is
(1) Washing soda (2) Baking soda
(3) Bleaching powder (4) Tartaric acid
28. At what temperature is gypsum heated to form Plaster of Paris?
(1) 90°C (2) 100°C
(3) 110° (4) 120°C
29. How many water molecules does Plaster of Paris contain?
(1) $1\frac{1}{2}$ (2) $\frac{1}{2}$ (3) 3 (4) 4
30. Copper sulphate crystals when heated strongly, lose their water of crystallization to give anhydrous copper sulphate accompanied by a change in color from:
(1) Blue to green (2) Blue to white
(3) Blue to sky blue (4) Blue to grey
- Fill in the blanks**
- Sting of honey bee contain_____.
 - A water-soluble base produce _____ ions in solutions.
 - An indicator changes its _____ with change of the nature of the solution.
 - Phenolphthalein gives a _____ colour when added to sodium hydroxide solution.
 - Blue litmus turns red when added to _____ solution.
 - A farmer treats the soil of his field with lime when the soil has _____ nature.
 - Milk of magnesia is used as _____.
 - The pH of an acidic solution is _____ than 7.
 - Electrolysis of an aqueous solution of _____ produces hydrogen at cathode, chlorine at anode and sodium hydroxide in the solution.
 - Hydrated copper sulphate contains five molecules of _____ of crystallization.

Fill in the missing data in the following table

Name of the salt	Salt obtained from		
	Formula	Base	Acid
(i) Ammonium chloride	NH_4Cl	NH_4OH	–
(ii) Copper sulphate	–	–	H_2SO_4
(iii) Sodium chloride	NaCl	NaOH	–
(iv) Magnesium nitrate	$\text{Mg}(\text{NO}_3)_2$	–	–
(v) Potassium sulphate	K_2SO_4	–	–
(vi) Calcium nitrate	$\text{Ca}(\text{NO}_3)_2$	$\text{Ca}(\text{OH})_2$	–

True or False

- Oxalic acid is present in bee sting.
- Litmus (indicator) is obtained from nettle plant.
- An indicator is a substance by which one can identify an acidic and basic solution.
- Lime water turns red litmus blue.
- Phenolphthalein is a natural indicator.
- The right temperature for heating gypsum during the manufacture of Plaster of Paris is 273 K.
- Plaster of Paris can be stored in any type of containers (open or closed or air tight).
- The aqueous solution of sodium chloride is acidic.
- Baking soda can be used to treat ant's sting.
- Common salt dissolved in water turns blue litmus red.

Match the column

- Match the chemical substances given in Column (I) with their appropriate application given in Column (II).

Column-I		Column-II	
(1)	Bleaching powder	(i)	Preparation of glass
(2)	Baking soda	(ii)	Production of H_2 and Cl_2
(3)	Washing soda	(iii)	Decolourisation
(4)	Sodium chloride	(iv)	Antacid

- Match the acids given in Column (I) with their correct source given in Column (II)

Column-I		Column-II	
(1)	Lactic acid	(i)	Tomato
(2)	Acetic acid	(ii)	Lemon
(3)	Citric acid	(iii)	Vinegar
(4)	Oxalic acid	(iv)	Curd

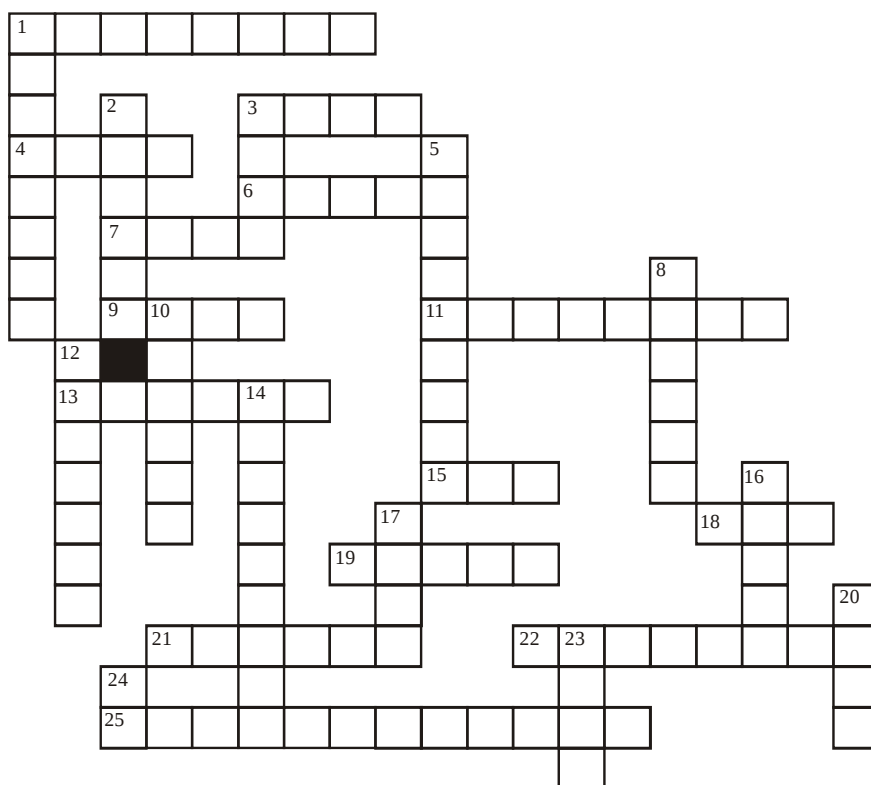
- Match the important chemicals given in Column (I) with the chemical formulae given in Column (II) :

Column-I		Column-II	
(1)	Plaster of Paris	(i)	$\text{Ca}(\text{OH})_2$
(2)	Gypsum	(ii)	$\text{CaSO}_4 \cdot 1/2\text{H}_2\text{O}$
(3)	Bleaching Powder	(iii)	$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
(4)	Slaked Lime	(iv)	CaOCl_2

- Match the following columns :

Column-I		Column-II	
(1)	Bleaching powder	(i)	Sodium bicarbonate
(2)	Baking soda	(ii)	Sodium carbonate
(3)	Washing soda	(iii)	Calciumoxychloride
(4)	Plaster of Paris	(iv)	Calcium sulphate hemihydrate

Crossword puzzle



Across

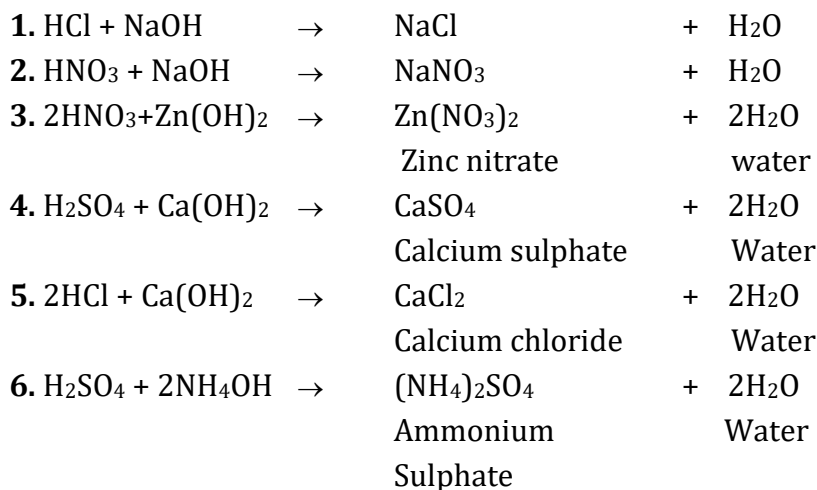
1. Name of acid in softdrink.[8]
3. Chemical containing hydroxide ions.[4]
4. Chemical that is corrosive, has a sour taste and a pH less than 7.[4]
6. Neutral substances have this pH.[5]
7. Alkalis have a pH ____ than 7.[4]
9. Acid and base neutralise to form ____ and water.[4]
11. Household bases are suitable for ____.[8]
13. Chemical with a soapy feel and pH more than 7. [6]
15. Acids change blue litmus paper ____.[3]
18. Sulphuric acid turns litmus paper ____.[3]
19. Salt has this pH.[5]
21. Alkalis turn ____ paper blue.[6]
22. Carbon dioxide and water form ____ acid.[8]
25. Stomach acid.[12]

Down

1. Many household ____ products are bases.[8]
2. Indicator made from lichens.[6]
3. Chemical that neutralises an acid.[4]
5. Chemical that changes colour in acids and bases.[9]
8. Common indicator used in liquid or paper form.[6]
10. Soluble base.[6]
12. Common name for sodium hydroxide is ____ soda.[7]
14. Common name for calcium hydroxide.[9]
16. Distilled water has this pH.[5]
17. Acids have a pH that is ____ than 7.[4]
20. ____ rain is an environmental problem in industrial areas.[4]
23. Reacts with a metal to form hydrogen gas and a salt.[4]
24. Measure of amount of hydrogen ions released in solution.[2]

ANSWER KEY

Neutralisation equation



Multiple choice questions

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	1	1	4	2	4	2	1	3	3	4	3	3	4	4	1
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	2	3	3	4	4	3	4	2	2	2	3	1	2	2	2

Fill in the blanks

- | | | | |
|--------------------|---------------------------------|------------|---------|
| 1. Formic acid | 2. hydroxide (OH ⁻) | 3. colour | 4. pink |
| 5. a acidic | 6. acidic | 7. antacid | 8. less |
| 9. sodium chloride | 10. water | | |

Fill in the missing data in the following table

Name of the salt	Salt obtained from		
	Formula	Base	Acid
(i) Ammonium chloride	NH ₄ Cl	NH ₄ OH	HCl
(ii) Copper sulphate	CuSO ₄	Cu(OH) ₂	H ₂ SO ₄
(iii) Sodium chloride	NaCl	NaOH	HCl
(iv) Magnesium nitrate	Mg(NO ₃) ₂	Mg(OH) ₂	HNO ₃
(v) Potassium sulphate	K ₂ SO ₄	KOH	H ₂ SO ₄
(vi) Calcium nitrate	Ca(NO ₃) ₂	Ca(OH) ₂	HNO ₃

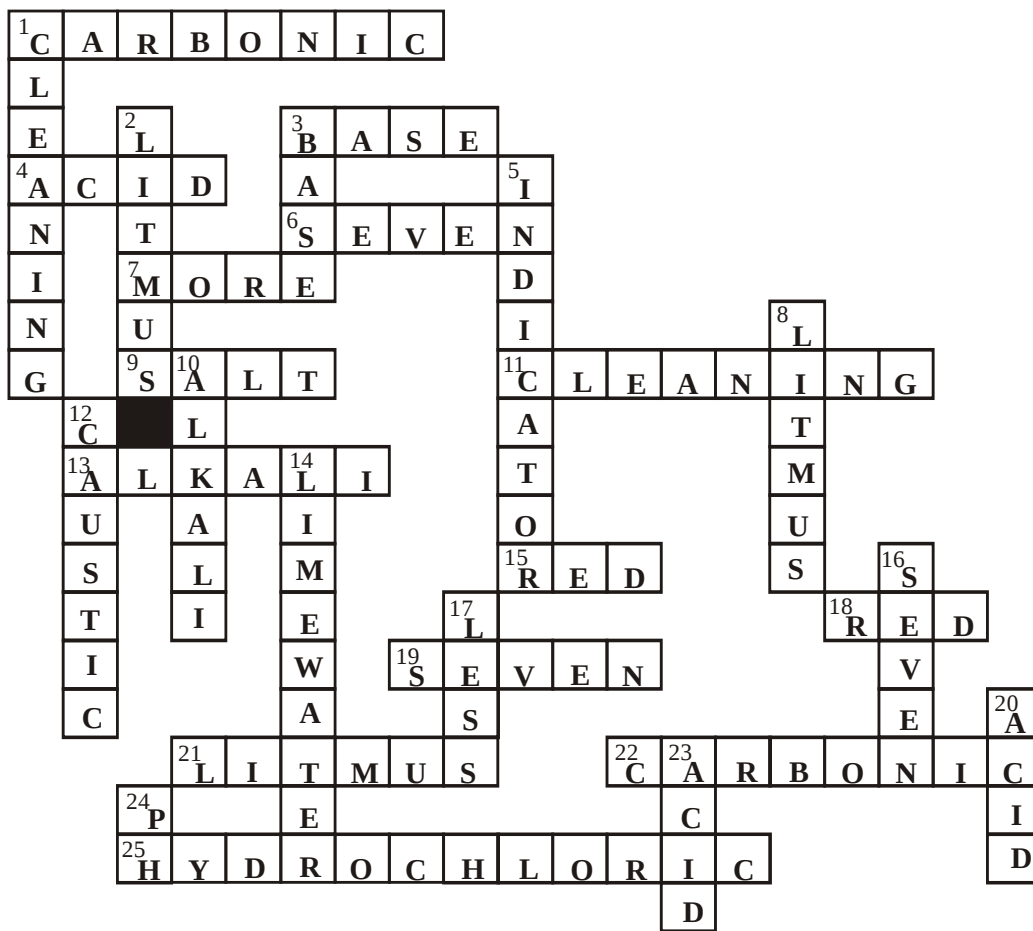
True or False

- | | | | | |
|----------|----------|----------|---------|-----------|
| 1. False | 2. False | 3. True | 4. True | 5. False |
| 6. False | 7. False | 8. False | 9. True | 10. False |

Match the column

- (1) → (iii) ; (2) → (iv) ; (3) → (i) ; (4) → (ii)
- (1) → (iv) ; (2) → (iii) ; (3) → (ii) ; (4) → (i)
- (1) → (ii) ; (2) → (iii) ; (3) → (iv) ; (4) → (i)
- (1) → (iii) ; (2) → (i) ; (3) → (ii) ; (4) → (iv)

Crossword puzzle



EXERCISE-02

Very short answer type questions

1. Name the acids present in (i) vinegar (ii) lemon (iii) orange.
2. How alkalis differ from bases? Explain.
3. Name any two natural indicators.
4. What colour change takes place when turmeric comes in contact with soap?
5. What are the colours shown by phenolphthalein in acidic medium and basic medium?
6. Usually which gas is liberated when acid reacts with metals?
7. Which gas is liberated when metal carbonates react with acids?
8. Will solution of glucose conduct electricity?
9. On what factor strength of acid and base depends?
10. What will happen to the concentration of $[H^+]$ ions in a solution if NaOH is added to water?
11. Which type of acid & base forms only the normal salts?
12. From the following, pick the acidic, basic and neutral salt.
(a) Sodium chloride
(b) Ammonium chloride
(c) Sodium acetate
(d) Calcium carbonate
13. Write one use of each of washing soda and baking soda.
14. Define water of crystallization.
15. What is the temperature required to convert gypsum into POP?

Short answer type questions

1. Write down the molecular formula for : Sulphuric acid, Nitric acid, Phosphoric acid, Carbonic acid.
2. Select the formulae of acids, bases and salts from the following list :
NaCl, NaOH, H_3PO_4 , Na_2CO_3 , $Ca(OH)_2$, $CuSO_4 \cdot 5H_2O$, H_2SO_4 , H_2CO_3 , HCl, $NaHCO_3$, $Na_2CO_3 \cdot 10H_2O$, $Al(OH)_3$, KCl.
3. For diluting an acid the acid should be poured carefully in water and not the reverse. Why?
4. 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.
5. Why HCl gas is unable to change the colour of dry blue litmus paper? What happens if the litmus paper is moistened?
6. When zinc metal is treated with a dilute solution of a strong acid, a gas is evolved, which is utilised 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.
7. Name the gas evolved when dilute sulphuric acid react with sodium carbonate. Write the chemical equation for the reaction involved.
8. What happens when nitric acid is added to egg shell?
9. What does pH stand for? What does a pH scale indicate?
10. Name the acid 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.

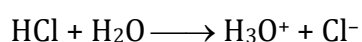
11. A student prepared solutions of (i) an acid and (ii) a base in two separate beakers. She forgot to label the solutions and litmus paper is not available in the laboratory. Since both the solutions are colourless, how will she distinguish between the two?
12. What happens when electric current is passed through brine? Give reaction.
13. How would you distinguish between baking powder and washing soda by heating?
14. How is Plaster of Paris obtained? What reaction is involved in the setting of a paste of Plaster of Paris?
15. A blue salt becomes white on heating. With the help of a reaction explain the change in colour.
- Long answer type questions**
1. Dry HCl gas does not affect a dry blue litmus paper, whereas it changes a moist blue litmus paper to red. Explain.
2. (a) What will you observe when dil. HCl is added to a small amount of copper oxide in a beaker?
(b) Aqueous solution of HCl shows acidic character. But the aqueous solution of glucose fails to do so. Why?
(c) Why curd and sour substances should not be kept in brass and copper vessels?
3. 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 is passed on dry Y, it gives a compound Z, used for disinfecting drinking water. Identify X, Y, G and Z.
4. Identify the compound X on the basis of the reactions given below. Also, write the name and chemical formulae of A, B and C.
- | | | |
|---------------|-----------------------|--------------------------|
| Compound
X | +Zn | → A + H ₂ (g) |
| | +HCl | → B + H ₂ O |
| | +CH ₃ COOH | → C + H ₂ O |
5. Discuss chlor-alkali process for manufacturing sodium hydroxide.
6. A sanitary worker uses a white chemical having strong smell of chlorine gas to disinfect the water tank.
(i) Identify the compound.
(ii) Write the chemical equation for its preparation.
(iii) Write its uses.
7. 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?
8. A compound of sodium is used in kitchen to make pakoras crispy. It is also used to remove acidity in stomach.
(i) Identify the compound.
(ii) State how it is manufactured.
(iii) Write an equation to show the effect of heat on this compound.
(iv) Write its uses.
9. What is plaster of Paris? How is it prepared? Give the chemical equation.
10. Comment on the statement : Are the crystals of salts really dry?

Exercise-01 Solutions

Multiple choice questions

1. Option (1)

According to Arrhenius theory, "An acid is a substance which when dissolved in water, ionizes and releases hydrogen ions $[H^+(aq)]$ in solution". It further combines with water to form hydronium ion $[H_3O^+(aq)]$.



2. Option (1)

Lime juice contains citric acid.

3. Option (4)

Lemon juice, tomatoes, curd all are acidic in nature.

4. Option (2)

Citrus fruits contain citric acid.

5. Option (4)

Ethanol (C_2H_5OH) doesn't give OH^- (hydroxide ions) in aqueous medium.

6. Option (2)

Soap is basic in nature, will turn red litmus blue.

7. Option (1)

Vinegar is acidic in nature, will turn blue litmus red.

8. Option (3)

Phenolphthalein is colourless in acidic medium, pink in basic medium.

9. Option (3)

Acid has a sour taste, it turns blue litmus to red.

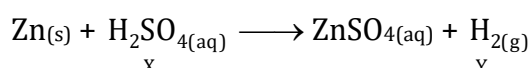
10. Option (4)

Methyl orange and blue litmus both turn red in acidic solution.

11. Option (3)

An Olfactory indicator is a substance whose smell varies depending on whether it is mixed with an acidic or basic solution. Olfactory indicators can be used in the laboratory to test whether a solution is a base or an acid, a process called olfactory titration. Onion, clove oil and vanilla extract are examples. An olfactory indicator works on the principle that when an acid or base is added to it, then different odour can be detected in bases and in acids.

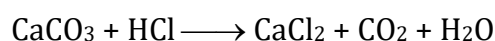
12. Option (3)



13. Option (4)

Except lime all have carbonate anion so after treatment with acid all produces CO_2 gas.

14. Option (4)



15. Option (1)

The pH of gastric juices is less than 7 in the human stomach.

16. Option (2)

Sodium hydrogen carbonate is a weak base so it is used to neutralize the acid.

17. Option (3)

Nature of tooth paste should be basic to neutralize the acidic nature of mouth.

18. Option (3)

Sodium hydrogen carbonate is a weak base so it is used to neutralize the acid.

19. Option (4) CH_3COONa it is made by weak acid CH_3COOH and strong base NaOH. 20. Option (4) Strong base is NaOH Weak acid is H_2CO_3 21. Option (3) Washing soda is prepared from NaCl by Solvay process. NaHCO_3 may be obtained by the reaction of carbon dioxide and ammonia with aqueous solution of sodium chloride. 22. Option (4) The chloralkali process - production of sodium hydroxide, chlorine and hydrogen from sodium chloride is known as chloralkali process. $2\text{NaCl(aq)} + 2\text{H}_2\text{O(l)} \longrightarrow 2\text{NaOH(aq)} + \text{Cl}_2\text{(g)} + \text{H}_2\text{(g)}$ 23. Option (2) Baking soda is sodium hydrogen carbonate or sodium bicarbonate. 24. Option (2) Baking powder is a mixture of baking soda (sodium hydrogen carbonate) and a mild edible acid like tartaric acid. 25. Option (2) $\text{CaO} + \text{H}_2\text{O} \longrightarrow \text{Ca(OH)}_2$ 26. Option (3) Bleaching powder is used as disinfectant for water to make it germ-free. 27. Option (1) $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ – Washing soda. 28. Option (2) On heating at 100°C, gypsum gives plaster of Paris. 29. Option (2) $\text{CaSO}_4 \cdot \frac{1}{2} \text{H}_2\text{O}$ (plaster of Paris).	30. Option (2) $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ – Blue Anhydrous Copper sulphate (CuSO_4) – White True or False 1. False Bee sting contains formic acid. 2. False A water-soluble purple powder derived from certain lichens that changes to red with increasing acidity and to deeper blue with increasing basicity. 3. True Indicates the nature of particular solution whether acidic, basic or neutral. 4. True Lime water is basic in nature. 5. False It is a synthetic indicator. 6. False The right temperature for heating gypsum during the manufacture of plaster of Paris is 373 K. 7. False Plaster of Paris is water and heat sensitive, so it should be stored in closed or air tight container. 8. False An aqueous solution of NaCl is neutral ($\text{pH}=7$). 9. True It is used to treat ant's sting. 10. False Common salt in water forms neutral solution, which doesn't have any effect on litmus.
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Exercise-02 Solutions

Very short answer type questions

- (i) Vinegar- acetic acid
(ii) Lemon- citric acid
(iii) Orange- citric acid
- Bases are substances that react with acids and neutralise them. They are usually metal oxides, metal hydroxides, metal carbonates or metal hydrogen carbonates. Many bases are insoluble - they do not dissolve in water. If a base does dissolve in water, we call it an alkali.
- Litmus, China rose, turmeric etc.
- It changes from yellow to reddish brown.
- Phenolphthalein remains colourless in acidic medium while turns pink in basic medium.
- Hydrogen gas.
- CO_2 gas. Acid + Metal carbonate $\rightarrow$ Salt + H_2O + CO_2
- No, glucose solution cannot conduct electricity due to absence of ions.
- On the basis of degree of dissociation.
- Concentration decreases, therefore pH for acids increase and for alkalis pH decreases
- Strong acid and strong base or weak acid and weak base.
- (a) NaCl – Neutral salt
(b) NH_4Cl – Acidic salt
(c) CH_3COONa – Basic salt
(d) CaCO_3 – Basic salt
- Use of washing soda**
Washing soda (or sodium carbonate) is used for washing clothes (laundry purposes).

Use of sodium hydrogen carbonate (NaHCO_3)

As an ingredient in antacids. Being alkaline, it neutralises excess acid in the stomach and provides relief.

- The water associated with the crystal (or molecule) of any salt is called water of crystallisation.

The salt containing water of crystallisation are called hydrated salts.

- 100°C or 373K .

Short answer type questions

- Sulphuric acid- H_2SO_4
Nitric acid- HNO_3
Phosphoric acid- H_3PO_4
Carbonic acid- H_2CO_3
- Acids : H_3PO_4 , HCl , H_2SO_4 , H_2CO_3
Bases : NaOH , $\text{Ca}(\text{OH})_2$, $\text{Al}(\text{OH})_3$
Salts : NaCl , Na_2CO_3 , $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, NaHCO_3 , $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$, KCl
- It is recommended that the acid should be added to water and not water to the acid because the process of dissolving an acid in water is exothermic. If water is added to acid, since large amount of acid is present, a large amount of heat is generated. Therefore, the mixture splashes out and causes burns.
- (i) Dry HCl gas-no effect.
(ii) Moistened NH_3 gas-red to blue.
(iii) Lemon juice-blue to red.
(vi) Carbonated soft drink-blue to red.
(v) Curd-blue to red.
(vi) Soap solution-red to blue.

5. Acid do not ionize in the absence of water to liberate H_3O^+ which shows acidic nature of a solution. Therefore, dry HCl gas does not change the colour of the dry litmus paper because it does not contain H^+ ions. In presence of moisture HCl dissociates into H^+ ions and will turn blue litmus red.
6. Zinc metal gives hydrogen gas when it is treated with dilute sulphuric acid. Hydrogen gas is utilized in hydrogenation of oil.

$$\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$$

Test for hydrogen gas: When a burning candle is brought near the hydrogen gas, it burns with pop sound which confirms the presence of hydrogen gas.
7. $\text{Na}_2\text{CO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O} + \text{CO}_2$
 CO_2 gas is evolved.
8. Egg shell is made of calcium carbonate. We know that when calcium carbonate reacts with nitric acid, it gives carbon dioxide, calcium nitrate and water. Same reaction happens when nitric acid is poured over egg shell.

$$\text{CaCO}_3 + 2\text{HNO}_3 \rightarrow \text{Ca}(\text{NO}_3)_2 + \text{CO}_2 + \text{H}_2\text{O}$$
9. "Potential of Hydrogen". This is what pH stands for pH is a measure of the acidity or basicity of an aqueous solution. Solutions with a pH less than 7 are said to be acidic and solutions with a pH greater than 7 are basic or alkaline. Pure water has a pH very close to 7.
10. Name of acid present in ant sting: Methanoic acid

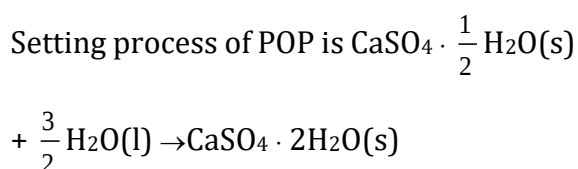
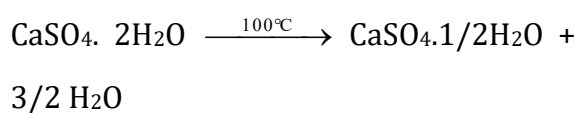
Chemical Formula of methanoic acid: HCOOH . Method to get relief from the discomfort caused by the ant sting: Rubbing baking soda over the location of ant sting. Explanation: Since baking soda is a base thus by rubbing over the ant sting it neutralizes the methanoic acid present in ant sting and gives relief from pain.
11. We can use phenolphthalein to check which of the beakers contains acid and which one contains a base. Apart from that, we can also use other natural indicators; like China rose or turmeric.
12. When electricity is passed through an aqueous solution of brine (NaCl), sodium hydroxide is formed along with the liberation of hydrogen gas at cathode and chlorine gas at the anode
13. The production of carbon dioxide is main characteristic of baking powder that makes it suitable for baking. Baking powder gives carbon dioxide and water vapour on heating at even low temperature such as 100°C . The gas so formed turns lime water milky, which confirms the presence of carbon dioxide gas.

$$2\text{NaHCO}_3 + \text{Heat} \rightarrow \text{Na}_2\text{CO}_3 + \text{CO}_2 + \text{H}_2\text{O}$$

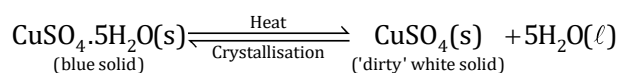
When Washing soda is heated it does not produce carbon dioxide even at high temperature, such as 200°C or 300°C . However washing soda gives sodium carbonate and become hemihydrate.

The gas produced by heating of the samples can be checked by passing through lime water. If the lime water turns milky then the evolved gas is carbon dioxide and the heated substance is baking powder.

14. The gypsum is heated to about 100° C to remove its H₂O (water) content. It becomes a dry powder, with the chemical name calcium sulphate hemihydrate.



15. Actually blue salt of copper sulphate is chemically copper sulphate penta hydrate (CuSO₄·5H₂O) blue colour is due to these 5 moles of water. By heating this water evaporates and leaving CuSO₄ which is colourless

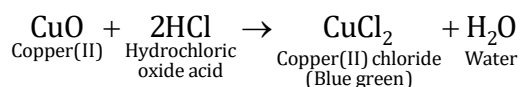


Long answer type questions

1. Acid do not ionize in the absence of water to liberate H₃O⁺ which shows acidic nature of a solution. Therefore, dry HCl gas does not change the colour of the dry litmus paper because it does not contain H⁺ ions. In presence of moisture HCl dissociates into H⁺ ions and will turn blue litmus red.

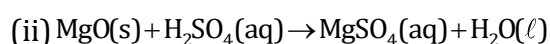
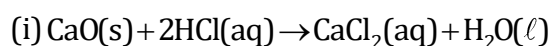
2. (a) Metal oxides react with the acids to form salt and water.

Metal oxide + Acid → Salt + Water



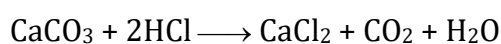
This shows that metal oxides are basic in nature.

Some more examples

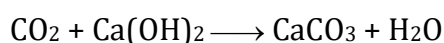


- (b) As electric current is carried through the solution by ions, this shows that acids dissociate in the solution to produce H⁺ (aq) ions but substances like glucose and alcohol do not dissociate to give H⁺ ions and hence are not acidic. Thus, H⁺ ions are responsible for the acidic properties.
- (c) Curd and other sour substances contain acids. Therefore, when they are kept in brass and copper vessels, the metal reacts with the acid to liberate hydrogen gas and harmful products, thereby spoiling the food.

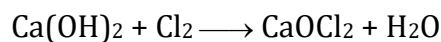
3. Calcium carbonate gives carbon dioxide gas when reacts with hydrochloric acid.



Carbon dioxide turns lime water milky when passed through it because of formation of calcium carbonate. When carbon dioxide; so formed; is passed through lime water, lime water turns milky because of the formation of calcium carbonate.



On the electrolysis of brine, chlorine gas is deposited over anode which gives calcium oxy chloride (Bleaching powder) on passing over slaked lime. The bleaching powder is used in disinfecting the drinking water.



Therefore; Metal carbonate 'X' is calcium carbonate.

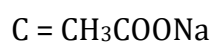
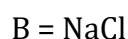
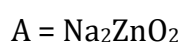
Solution 'Y' is lime water (Calcium hydroxide).

Gas 'G' is chlorine gas.

Dry 'Y' is dry calcium hydroxide (dry slaked lime).

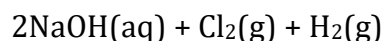
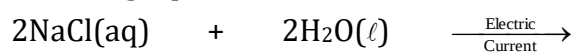
Compound 'Z' is bleaching powder (Calcium oxy chloride).

4. X = NaOH



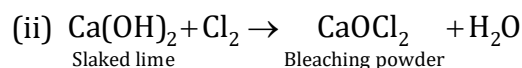
5. Chlor-alkali process for obtaining sodium hydroxide

When we pass electricity through a solution of sodium chloride, commonly called **brine**, it decomposes to form sodium hydroxide according to the following equation:



On electrolysis, chlorine gas is formed at anode and hydrogen at cathode, sodium hydroxide solution is formed near the cathode. All these products are commercially important.

6. (i) Compound is bleaching powder.



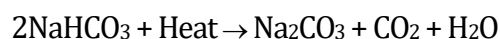
(iii) Uses of bleaching powder

(a) For bleaching cotton and linen in the textile industry, for bleaching wood pulp in paper factories and for bleaching washed clothes in laundry.

(b) As an oxidising agent in many chemical industries.

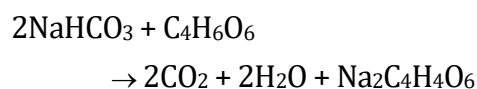
(c) For disinfecting drinking water to make it free of germs.

7. (a) The chemical name of baking soda is sodium bicarbonate which gives sodium carbonate, carbon dioxide and water on heating. If baking soda is used instead of baking powder, in making of cake the formation of sodium carbonate would make the taste of cake bitter.



(b) By mixing of edible acid, usually tartaric acid, baking soda is converted into baking powder. Other mild edible acid can also be used instead of tartaric acid.

(c) Tartaric acid gives hydrogen ion when water is added to it. Hydrogen ion produced by tartaric acid reacts with sodium bicarbonate and gives carbon dioxide which makes the dough soft and spongy. If sodium carbonate is formed because of heating, tartaric acid neutralizes it and forms sodium tartrate which has pleasant smell and good taste.

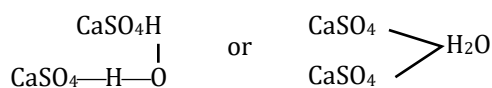


8. (i) Baking soda
 (ii) By solvay process it is an intermediate product
 (iii) $2\text{NaHCO}_3 \xrightarrow{\Delta} \text{Na}_2\text{CO}_3 + \text{CO}_2 + \text{H}_2\text{O}$
 (iv) Uses of sodium hydrogen carbonate (NaHCO_3)
- (a) For making **baking powder** which is a mixture of baking soda (sodium hydrogen carbonate) and a mild edible acid like tartaric acid. When baking powder is mixed with water, the following reaction takes place.
- $$\text{NaHCO}_3 + \text{H}^+ \rightarrow \text{CO}_2 + \text{H}_2\text{O}$$
- Sodium salt of the acid from acid
 Carbon dioxide so produced during the reaction is responsible for making the bread and cake to rise making them soft and spongy.
- (b) As an ingredient in antacids. Being alkaline, it neutralises excess acid in the stomach and provides relief.
- (c) It is used in soda-acid fire extinguisher.

9. Plaster of Paris ($\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$)

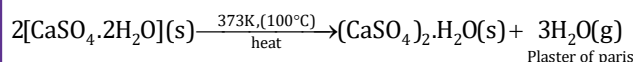
Plaster of Paris is hemihydrate (hemi means half and hydrate means water) of calcium sulphate. Its molecular formula is $\text{CaSO}_4 \cdot \frac{1}{2} \text{H}_2\text{O}$ or $(\text{CaSO}_4)_2 \cdot \text{H}_2\text{O}$.

In Plaster of Paris one molecule of water is shared by two formula units of CaSO_4 as,

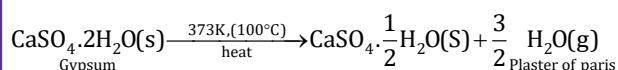


Preparation of plaster of Paris

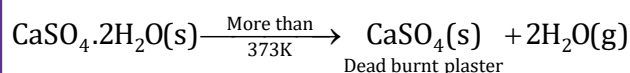
Plaster of Paris is obtained by heating gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) in a kiln at 373K (or 100°C).



OR



During the preparation of Plaster of Paris, temperature should be controlled carefully. Otherwise, anhydrous calcium sulphate (CaSO_4) will be formed. Anhydrous calcium sulphate does not set into hard mass when mixed with water. So, if temperature is not controlled carefully, the Plaster of Paris obtained will have poor setting property.



10. Crystals of some salts contain certain amount of associated water.

The water associated with the crystal (or molecule) of any salt is called water of crystallisation.

The salt containing water of crystallisation are called **hydrated salts**.

Aim

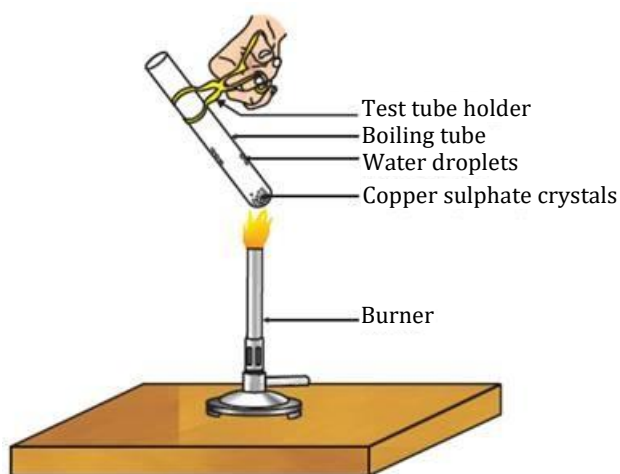
To test the presence of water of crystallisation in copper sulphate crystals.

Materials required

Boiling tube, copper sulphate crystals, burner, water, test tube holder.

Method

- (i) Heat a few crystals of copper sulphate in a dry boiling tube.
- (ii) Note the colour of copper sulphate after heating.
- (iii) Observe the water droplets in the boiling tube.
- (iv) Add 2-3 drops of water on the sample of copper sulphate obtained after heating.



Removing water of crystallisation.

Now answer

- (i) What do you observe on heating blue copper sulphate crystals?

- (ii) Is the blue colour of copper sulphate restored on adding water?

Observation and discussion

Blue coloured copper sulphate crystals on heating leave behind white anhydrous copper sulphate and water droplets are seen in the upper cooler parts of the boiling tube. On adding 2-3 drops of water to the white residue, blue colour reappears.

Conclusion

Copper sulphate crystals on heating lose water to form white anhydrous copper sulphate which can combine again with water to form blue coloured copper sulphate crystals.

Some compounds with water of crystallisation

It is the fixed number of water molecules present in one formula unit of a crystalline salt. For example,

Blue vitriol	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
Green vitriol	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$
Glauber's salt	$\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$
White vitriol	$\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$
Gypsum	$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
Epsom salt	MgSO_4