Acid Bases and Salts

Previous Years' CBSE Board Questions

2.1 Understanding the Chemical Properties of Acids and Bases

MCQ

1. When sodium bicarbonate reacts with dilute hydrochloric acid, the gas evolved is
(a) Hydrogen; it gives pop sound with burning matchstick.
(b) Hydrogen; it turns lime water milky.
(c) Carbon dioxide; it turns lime water milky.
(d) Carbon dioxide; it blows off a burning match stick with a pop sound.
(2023) U

2. Acid present in tomato is:
(a) Methanoic acid
(b) Acetic acid
(c) Lactic acid
(d) Oxalic acid (2023)

3. Select a pair of olfactory indicators from the following:
(a) Clove oil and vanilla essence
(b) Onion and turmeric
(c) Clove oil and litmus paper
(d) Vanilla and methyl orange (2023)

4. Which of the options in the given table are correct?

Option	Natural Source	Acid Present
(i)	Orange	Oxalic acid
(ii)	Sour milk	Lactic acid
(iii)	Ant sting	Methanoic acid
(iv)	Tamarind	Acetic acid

(a) (i) and (ii)
(c) (ii) and (iii)
(b) (i) and (iv)
(d) (iii) and (iv) (Term I, 2021-22)

5. Three test tubes A, B and C contain distilled water, an acidic solution and a basic solution respectively. When red litmus solution is used for testing these solutions, the observed colour changes respectively will be
(a) A no change; B - becomes dark red ; C- becomes blue
(b) A becomes light red; B - becomes blue; C - becomes red
(c) A- becomes red; B - no change; C - becomes blue
(d) A becomes light red; B - becomes dark red; - C - becomes blue (Term I, 2021-22)

6. A visually challenged student, has to perform a lab test to detect the presence of acid in a given
solution. The acid-base indicator preferred by him will be:
(a) Blue litmus
(b) Clove oil
(c) Red cabbage extract
(d) Hibiscus extract (2020)

7. Which one of the following natural sources contains Oxalic acid?
(a) Tomato
(c) Ant sting
(b) Tamarind
(d) Nettle sting (2020C)

VSA (1 mark)

8. State the purpose for which litmus is used in laboratories. (2021C)

SAI (2 marks)

9. A student took a small amount of copper oxide in a conical flask and added dilute hydrochloric acid to it with constant stirring. He observed a change in colour of the solution.
(i) Write the name of the compound formed and its colour. reaction involved.
(ii) Write a balanced chemical equation for the (2023)

10. Blue litmus solution is added to two test tubes A and B containing dilute HCI and NaOH solution respectively. In which test tube a colour change will be observed? State the colour change and give its reason. (2019)

11. With the help of an example, explain what happens when a base reacts with a non-metallic oxide. What do you infer about the nature of non-metal oxide? (Board Term 1, 2017)

12. What is observed when carbon dioxide gas is passed through lime water
(i) for a short duration?
(ii) for a long duration? Also write the chemical equations for the reactions involved. (Board Term 1, 2016)

SA II (3 marks)

13. (a) Write a balanced equation to show the reaction that occurs when a piece of aluminium is dipped in a dilute solution of (i) sulphuric acid and
(ii) sodium hydroxide
(b) Write the colour of the solution formed when copper oxide is treated with hydrochloric acid. Give reason for this observation. (2023)

14. 2 mL of sodium hydroxide solution is added to a few pieces of granulated zinc metal taken in a test tube. When the content are warmed, a gas evolves which is bubbled through a soap solution before testing. Write the equation of the chemical reaction involved and the test to detect the gas. Name the gas which will be evolved when the same metal reacts with dilute solution of a strong acid. (2018)

OR

Write the names of the product formed when zinc reacts with NaOH. Also write the balanced chemical equation for the reaction involved. Write a test to confirm the presence of the gas evolved during this reaction.
(Board Term 1, 2015)

LA (5 marks)

15. A cloth strip dipped in onion juice is used for testing a liquid 'X'. The liquid 'X' changes its odour. Which type of an indicator is onion juice? The liquid 'X' turns blue litmus red. List the observations the liquid 'X' will show on reacting with the following:

(a) Zinc granules
(b) Solid sodium carbonate
Write the chemical equations for the reactions involved. (2020)

2.2 What Do All Acids and All Bases have in Common? MCQ

16. Sodium hydroxide is termed as alkali while ferric hydroxide is not because:
(a) Sodium hydroxide is a strong base, while ferric hydroxide is a weak base.
(b) Sodium hydroxide is a base which is soluble in water while ferric hydroxide is also a base but it is not soluble in water.
(c) Sodium hydroxide is a strong base while ferric hydroxide is a strong acid.
(d) Sodium hydroxide and ferric hydroxide both are strong base but the solubility of sodium hydroxide in water is comparatively higher than that of ferric hydroxide. (2023)

17. Hydronium ions are formed by the reaction between
(a) sodium hydroxide and water
(b) calcium chloride and water
(c) hydrogen chloride gas and water
(d) ethanol and water. (2023)

18. Concentrated H_2SO_4 is diluted by adding drop by drop
(a) water to acid with constant stirring
(b) acid to water with constant stirring
(c) water to acid followed by a base
(d) base to acid followed by cold water.
(Term 1, 2021-22)

19. Consider the following compounds

I. HCI
II. C_2H_5OH
III. $C_6H_{12}O_6$
IV. H_2SO_4
Which of these compounds do not conduct electricity in solution?

(A) I and II
(B) II and III
(C) III and IV
(D) I and IV (2020C)

SAI (2 marks)

20. On diluting an acid, it is advised to add acid to water and not water to acid. Explain why it is so advised? (Board Term 1, 2014)

SA II (3 marks)

21. (i) Suggest a safe procedure of diluting a strong concentrated acid.
(ii) Name the salt formed when sulphuric acid is added to sodium hydroxide and write its pH.
(iii) Dry HCl gas does not change the colour of dry blue litmus paper. Why? (2023)

22. (i) Draw a labelled diagram to show the preparation of hydrogen chloride gas in laboratory.
(ii) Test the gas evolved first with dry and then with wet litmus paper. In which of the two cases, does the litmus paper show change in colour?
(iii) State the reason of exhibiting acidic character by dry HCI gas/HCI solution. (2020)

23. Complete and balance the following chemical equations:
(i) $NaOH_{(aq)} + Zn_{(s)} \rightarrow$
(ii) $CaCO_{3(s)} + H_2O_{(l)} + CO_{2(g)}$
(iii) $HCl_{(aq)} + H_2O_{(l)} \rightarrow$ (2020)

24. How the following substances will dissociate to produce ions in their solutions? (Board Term 1, 2017)
(i) Hydrochloric acid
(ii) Nitric acid
(iii) Sulphuric acid
(iv) Sodium hydroxide
(v) Potassium hydroxide
(vi) Magnesium hydroxide

LA (5 marks)

25. (a) Illustrate an activity to investigate whether all compounds containing hydrogen are acidic.
(b) What happens when hydrochloric acid and sodium hydroxide are dissolved in water? Explain by giving equation of each. (Board Term I, 2016)

2.3 How Strong are Acid or Base Solutions?

MCQ

26. Fresh milk has a pH of 6. To delay its curdling, a chemical substance is added to it, which is
(a) sodium carbonate
(b) baking powder
(c) sodium hydroxide (caustic soda)
(d) baking soda (sodium hydrogen carbonate). (2023)

27. Select from the following the statement which is true for bases.
(a) Bases are bitter and turn blue litmus red.
(b) Bases have a pH less than 7.
(c) Bases are sour and change red litmus to blue.
(d) Bases turn pink when a drop of phenolph-
thalein is added to them. (Term 1, 2021-22)

28. Consider the pH value of the following acidic samples.

S.No.	Sample	pH Value
1.	Lemon Juice	2.2
2.	Gastric Juice	1.2
3.	Vinegar	3.76
4.	Dil. Acetic acid	3.0

(a) 34>12
(b) 2>1>3>4
(c) 2>1>4>3
(d) 3>4>2>1 (Term I, 2021-22)

29. A solution gives yellowish orange colour when a few drops of universal indicator are added to it. This solution is of
(a) lemon juice
(b) sodium chloride
(c) sodium hydroxide
(d) milk of magnesia. (Term I, 2021-22)

30. An aqueous solution 'A' turns phenolphthalein solution pink. On addition of an aqueous solution 'B' to 'A' the pink colour disappears. The following statement is true for solution 'A' and 'B':
(a) A is strongly basic and B is a weak base.
(b) A is strongly acidic and B is a weak acid.
(c) A has pH greater than 7 and B has pH less than 7.
(d) A has pH less than 7 and B has pH greater than 7. (2020)

31. The acid produced in our stomach during digestion of food is
(a) Hydrochloric acid
(b) Oxalic acid
(c) Lactic acid
(d) Acetic acid (2020C)

SAI (2 marks)

32. Two solutions M and N give red and blue colour respectively with a universal indicator.
(i) In which solution will the hydrogen ion concentration be more? Justify your answer.
(ii) If both M and N solutions are mixed and the resultant mixture is tested with a universal indicator, it turns green. What is the nature of the salt formed? Justify your answer. (2023)

33. Out of the two hydrochloric acid and acetic acid, which one is considered as strong acid and why? Write the name/molecular formula of one more strong acid. (2021C)

34. Out of HCI and CH_3COOH, which one is a weak acid and why? Explain with the help of an example. (AI 2019)

35. Explain how an antacid works. (Board Term I, 2017)

SA II (3 marks)

36. (a) You are provided with concentrated sulphuric acid. Describe the process of preparing a dilute solution of sulphuric acid.
(b) What is the effect of dilution on (H_3O^*/OH") ratio?
(c) If the H_3O+ ion concentration is increased in a solution, will the pH increase or decrease? What are the probable colours of pH paper if the pH range is 0.5 to 2.0? (2020C)

37. (a) What does pH scale measure?
(b) Write its range.
(c) State the significance of highest and lowest values of pH scale. (2019C)

38. (a) Three acidic solutions A, B and C have pH = 0, 3 and 5 respectively.
(i) Which solution has highest concentration of H+ ions?
(ii) Which solution has the lowest concentration of H+ ions?
(b) How concentrated sulphuric acid can be diluted? Describe the process.
(Board Term I, 2014) An

39. A compound P forms the enamel of teeth. It is the hardest substance of the body. It doesn't dissolve in water but gets corroded when the pH is lowered below 5.5.
(a) Identify the compound P.
(b) How does it undergo damage due to eating chocolate and sweets? What should we do to prevent tooth decay? (Board Term I, 2014)

2.4 More About Salts

MCQ

40. The name of the salt used to remove permanent hardness of water is
(a) Sodium hydrogen carbonate ($NaHCO_3$)
(b) Sodium chloride (NaCl)
(c) Sodium carbonate decahydrate ($Na_2CO_3.10H_2O$)

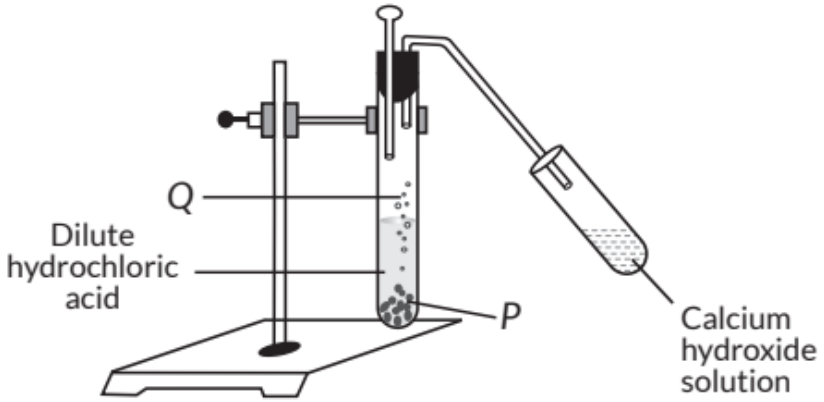
(d) Calcium sulphate hemihydrate ($CaSO_4.\frac{1}{2}H_2O$)
(2023) R

41. Study the following table and choose the correct option.

	Salt	Parent Acid	Parent Base	Nature of Salt
(a)	Sodium chloride	HCl	NaOH	Basic
(b)	Sodium carbonate	H_2CO_3	NaOH	Neutral
(c)	Sodium sulphate	H_2SO_4	NaOH	Acidic
(d)	Sodium acetate	CH_3COOH	NaOH	Basic

(Term I, 2021-22) An

42. Study the experimental set up shown in given figure and choose the correct option from the following.



	P	Q	Change observed in calcium hydroxide solution
(a)	K_2CO_3	Cl_2 gas	No change
(b)	$KHCO_3$	CO_2 gas	No change
(c)	$KHCO_3$	H_2 gas	Turns milky
(d)	K_2CO_3	CO_2 gas	Turns milky

(Term I, 2021-22) Ev

43. Which of the following salts do not have the water of crystallisation?
(i) Bleaching Powder

(ii) Plaster of Paris
(ii) Washing soda
(iv) Baking soda
(a) (ii) and (iv)
(b) (i) and (iii)
(c) (ii) and (iii)
(d) (i) and (iv) (Term I, 2021-22)

44. Assertion (A): Sodium hydrogen carbonate is used as an ingredient in antacids.
Reason (R): $NaHCO_3$ is a mild non-corrosive basic salt.
(a) Both (A) and (R) are true and (R) is the correct explanation of (A).
(b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(c) (A) is true, but (R) is false.
(d) (A) is false, but (R) is true. (Term 1, 2021-22)

45. Absence of tartaric acid in baking powder makes the taste of the cake bitter due to the presence of
(a) sodium hydrogen carbonate
(b) sodium carbonate
(c) sodium metabisulphite
(d) sodium sulphate. (Term I, 2021-22)

46. Salt 'A' commonly used in food products, is a reactant to produce salt 'B', used in the kitchen for making tasty, crispy pakoras. Salt 'B' on heating converts into another salt 'C', which is used in the manufacturing of glass. Salts 'A', 'B' and 'C' respectively are
(a) $NaHCO_3$, NaCl, Na_2CO_3
(b) Na_2CO_3, $NaHCO_3$, NaCI
(c) Na_2CO_3, NaCl, $NaHCO_3$
(d) NaCl, $NaHCO_3$, Na_2CO_3 (Term I, 2021-22)

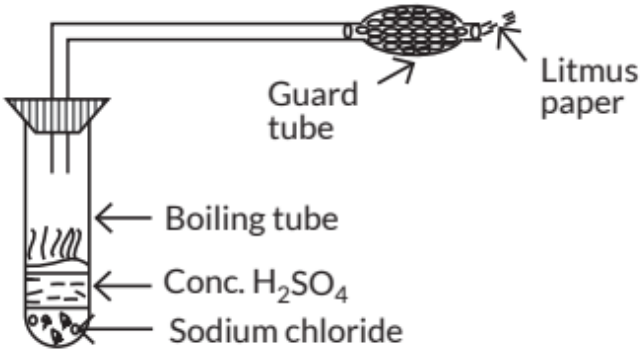
47. An aqueous solution of a salt shows an orange red colour when a drop of universal indicator is added to it. This salt is made up of
(a) a strong acid and a strong base
(b) a weak acid and a weak base
(c) a strong acid and a weak base
(d) a weak acid and a strong base. (Term I, 2021-22)

48. Given below is a reaction showing Chlor-alkali process

$$2NaCl_{(aq)} + 2H_2O_{(l)} \rightarrow \underset{(A)}{2NaOH_{(aq)}} + \underset{(B)}{Cl_{2(g)}} + \underset{(C)}{H_{2(g)}}$$

The products A, B and C are produced respectively
(a) at the anode, at the cathode, near the cathode
(b) near the cathode, at the anode, at the cathode
(c) at the cathode, near the cathode, at the anode
(d) at the anode, near the cathode, at the cathode. (Term I, 2021-22)

49.



In the activity shown in the diagram, if the climate is humid, the role of the calcium chloride taken in the guard tube is to
(a) absorb the evolved gas
(b) warm up the gas
(c) dry the gas
(d) absorb chloride ions from the evolved gas. (Term I, 2021-22)

Read the passage given below and answer the questions 50-53:
One day Kamal saw that her mother was roasting penanuts in a pan (kadahi) in the kitchen and she had taken ordinary salt to roast the peanuts. She was surprised to observe that in spite of very high temperature, the salt does not melt and the peanuts also get roasted.

50. The chemical name of common salt is
(a) potassium chloride
(b) sodium carbonate
(c) sodium hydrogen carbonate
(d) sodium chloride.

51. Common salt is
(a) a covalent compound
(b) an ionic compound formed by sharing electrons
(c) an ionic compound formed by the transfer of electrons
(d) soluble in organic solvents.

52. Common salt is not a raw material for
(a) bleaching powder
(b) plaster of paris
(c) baking soda
(d) caustic soda.

53. Common salt is used as a raw material in the preparation of washing soda in which the number of molecules of water of crystallisation is
(a) 10
(b) 7
(c) 5
(d) 2. R (Term I, 2021-22)

54. Baking soda is a mixture of
(a) sodium carbonate and acetic acid
(b) sodium carbonate and tartaric acid
(c) sodium hydrogen carbonate and tartaric acid
(d) sodium hydrogen carbonate and acetic acid. (2020)

55. The chemical formula for plaster of Paris is (2020)

(a) $CaSO_4.2H_2O$ (b) $CaSO_4.H_2O$

(c) $CaSO_4.\frac{1}{2}H_2O$ (d) $2CaSO_4.H_2O$

SAI (2 marks)

56. On heating X at 373 K, it loses water molecules and becomes Y. Y is a substance which doctors use for supporting fractured bones in the right position. (2023)
(i) Identify X and Y.
(ii) How can X be reobtained from Y?

57. "Sodium hydrogen carbonate is a basic salt". Justify this statement. How is it converted into washing soda? (AI 2019)

58. A solution 'X' gives orange colour when a drop of it falls on pH paper, while another solution 'Y' gives bluish colour when a drop of it falls on pH paper. What is the nature of both the solutions ? Determine the pH of solutions 'X' and 'Y. (2019)

59. On adding a few drops of universal indicator in three colourless solutions X, Y and Z taken separately in three test tubes, a student observed the changes in colour as green in X, red in Y and blue in Z.
(a) Arrange X, Y and Z in increasing order of their pH values.
(b) Which one of the three X, Y and Z, will change the colour of phenolphthalein? Why? (2019C)

60. Why is sodium hydrogen carbonate an alkaline salt? List its two important uses. (2019C)

61. Write the chemical formula of bleaching powder. How is bleaching powder prepared? For what purpose is it used in drinking water? (Board Term 1, 2016)

SA II (3 marks)

62. Consider the following salts:
(i) YCI (ii) NH_4X (iii) ZCO_3
(a) What would be the pH of the salt solution if in YCI, Y is sodium? Give reason for your answer.
(b) If in salt NH X, X is nitrate, then its solution will give what colour with universal indicator? Why?
(c) What would be the change in colour in blue litmus solution if ZCO_3 is added to it and Z is potassium? (2023)

63. The industrial process used for the manufacture of caustic soda involves electrolysis of an aqueous solution of compound 'X'. In this process, two gases 'Y' and 'Z' are liberated. 'Y' is liberated at cathode and 'Z', which is liberated at anode, on treatment with dry slaked lime forms a compound 'B'. Name X, Y, Z and B. (2023)

64. List the important products of the Chlor-alkali process. Write one important use of each. (2020)

65. How is washing soda prepared from sodium carbonate? Give its chemical equation. State the type of this salt. Name the type of hardness of water which can be removed by it? (2020)

66. Give reasons for the following:
(i) Only one half of water molecule is shown in the formula of plaster of Paris.
(ii) Sodium hydrogen carbonate is used as an antacid.
(iii) On strong heating, blue coloured copper sulphate crystals turn white. (2020)

67. During electrolysis of brine, a gas 'G' is liberated at anode. When this gas 'G' is passed through slaked lime, a compound 'C' is formed, which is used for disinfecting drinking water.
(i) Write formula of 'G' and 'C.
(ii) State the chemical equations involved.
(iii) What is common name of compound 'C'? Give its chemical name. (2020)

68. Identify the acid and the base from which sodium chloride is obtained. Which type of salt is it? When is it called rock salt? How is rock salt formed? (Delhi 2019)

69. A white powder is added while baking cakes to make it soft and spongy. Name its main ingredients. Explain the function of each ingredient. Write the chemical reaction taking place when the powder is heated during baking. (AI 2019)

70. (a) Why is electrolysis of brine called 'Chlor-alkali process'? Write the chemical equation involved in this process.
(b) A few crystals of hydrated copper sulphate are heated in a dry test-tube. Enlist any two observations. (2019C)

71. The pH of a salt used to make tasty and crispy pakoras is 14. Identify the salt and write a chemical equation for its formation. List its two uses. (2018)

72. Write one point of difference between each of the following:
(i) A hydrated salt and an anhydrous salt.
(ii) Washing soda and soda ash.
(iii) Baking soda and baking powder. (Board Term 1, 2017)

73. Complete the following table:

Sample solution	Red litmus solution	Blue litmus solution	Phenolp-hthalein solution
Acetic acid			
Sodium hydroxide			
Baking soda			

(Board Term I, 2017) U

74. A white coloured powder is used by doctors for supporting fractured bones.
(a) Write chemical name and formula of the powder.
(b) When this white powder is mixed with water a hard solid mass is obtained. Write balanced chemical equation for this change. (Board Term 1, 2016)

75. (a) Define an acid-base indicator. Mention one synthetic acid-base indicator.
(b) If someone in the family is suffering from a problem of acidity after overeating, which of the following substances would you suggest as a remedy? Lemon juice, vinegar or baking soda solution. Mention the property on the basis of which you will choose the remedy. (Board Term I, 2014) An

LA (5 marks)

76. A chemical compound 'X' is used in the soap and glass industry. It is prepared from brine.
(a) Write the chemical name, common name and chemical formula of 'X'.
(b) Write the equation involved in its preparation.
(c) What happens when it is treated with water containing Ca or Mg salts ? (2020)

77. Define water of crystallisation. Give the chemical formula for two compounds as examples. How can it be proved that the water of crystallisation makes a difference in the state and colour of the compounds? (2020)

78. (a) A student dropped a few pieces of marble in dilute hydrochloric acid contained in a test tube. The evolved gas was passed through lime water. What

change would be observed in lime water? Write balanced chemical equations for both the changes observed.
(b) 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. (Board Term 1, 2017)

79. (a) What are anhydrous and hydrated salts? Explain with a suitable example of each.
(b) How is plaster of Paris prepared? What reaction takes place when it sets to a hard mass? (Board Term 1, 2017)

80. (a) Write the chemical formula of hydrated copper sulphate and anhydrous copper sulphate. Giving an activity illustrate how these two are interconvertible.
(b) Write chemical names and formulae of plaster of Paris and gypsum. (Board Term 1, 2016) Cr

81. How is sodium hydroxide produced? Write the balanced chemical equation also. Why is this process called as chlor-alkali process? In this process name the products given off at : (Board Term 1, 2015)
(a) anode
(b) cathode
Write one use of each of these products.

OR

(a) Name and describe giving chemical equation the process used for producing sodium hydroxide. Why is this process so named?
(b) Give one use of each of any two products obtained in this process. (Board Term 1, 2014)

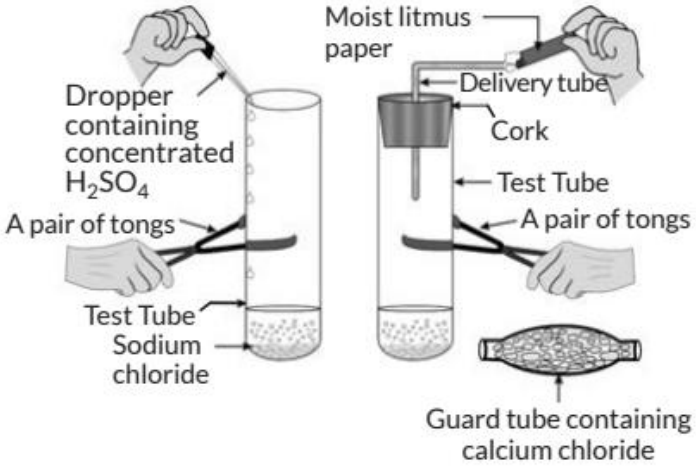
82. What is water of crystallisation? Write the common name and chemical formula of a commercially important compound which has ten water molecules as water of crystallisation. How is this compound obtained? Write the chemical equation also. List any two uses of this compound. (Board Term 1, 2015)

CBSE Sample Questions

2.1 Understanding the Chemical Properties of Acids and Bases

MCQ

1. The change in colour of the moist litmus paper in the given set up is due to



i. presence of acid
ii. presence of base
iii. presence of H*(aq) in the solution
iv. presence of Litmus which acts as an indicator
(a) i and ii (b) Only ii (c) Only iii (d) Only iv (2022-23)

2. Vinay observed that the stain of curry on a white shirt becomes reddish-brown when soap is scrubbed on it, but it turns yellow again when the shirt is washed with plenty of water. What might be the reason for his observation?
(i) Soap is acidic in nature.
(ii) Soap is basic in nature
(iii) Turmeric is a natural indicator which gives reddish tinge in bases.
(iv) Turmeric is a natural indicator which gives reddish tinge in acids.
(a) (i) and (ii)
(c) (i) and (iv)
(b) (ii) and (iii)
(d) (ii) and (iv) (Term I, 2021-22)

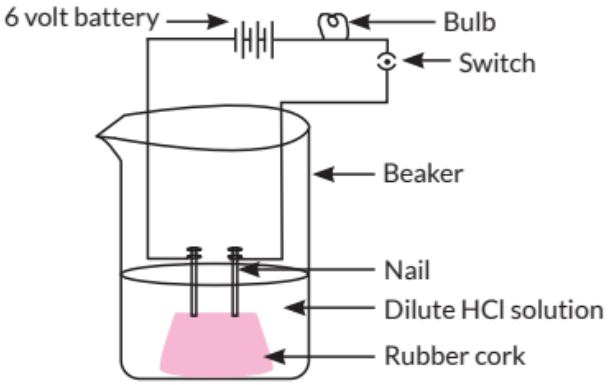
2.2 What Do All Acids and All Bases have in Common?

MCQ

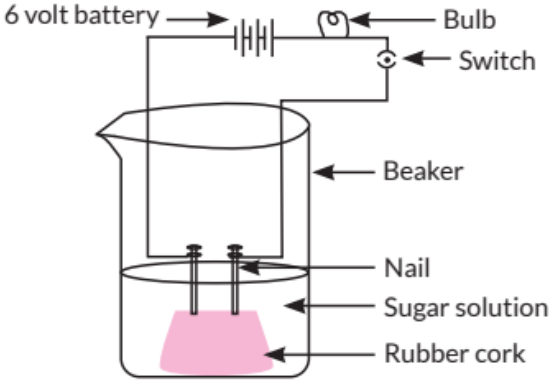
3. How will you protect yourself from the heat generated while diluting a concentrated acid?
(a) By adding acid to water with constant stirring.
(b) By adding water to acid with constant stirring.
(c) By adding water to acid followed by base.
(d) By adding base to acid with constant stirring. (Term I, 2021-22)

4. In which of the following set ups would the bulb glow?

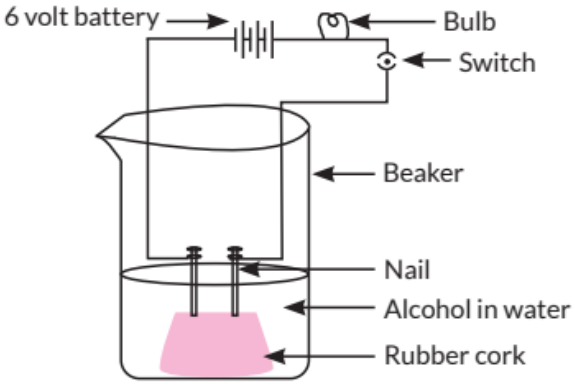
(i)



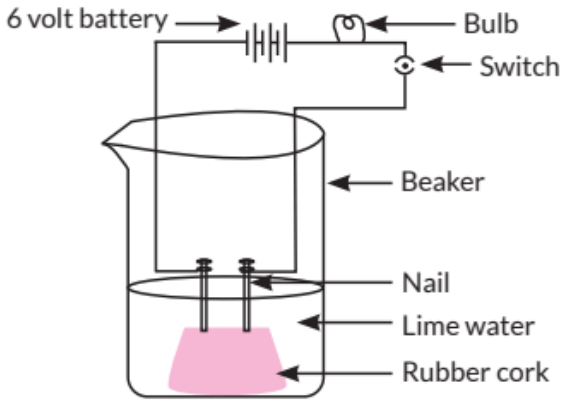
(ii)



(iii)



(iv)

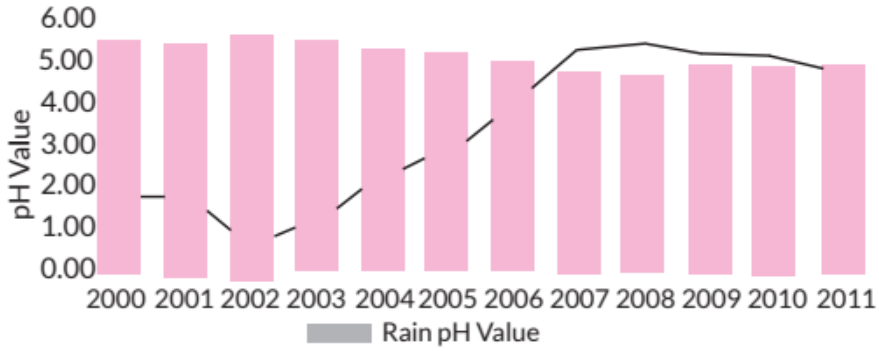


2.3 How Strong are Acid or Base Solutions?

MCQ

5. Anita added a drop each of diluted acetic acid and diluted hydrochloric acid on pH paper and compared the colours. Which of the following is the correct conclusion?
(a) pH of acetic acid is more than that of hydrochloric acid.
(b) pH of acetic acid is less than that of hydrochloric acid.
(c) Acetic acid dissociates completely in aqueous solution.
(d) Acetic acid is a strong acid. (2022-23)

6. In which year is concentration of hydrogen ion the highest?



(a) 2002
(b) 2008
(c) 2011
(d) 2005 (Term 1, 2021-22)

2.4 More About Salts

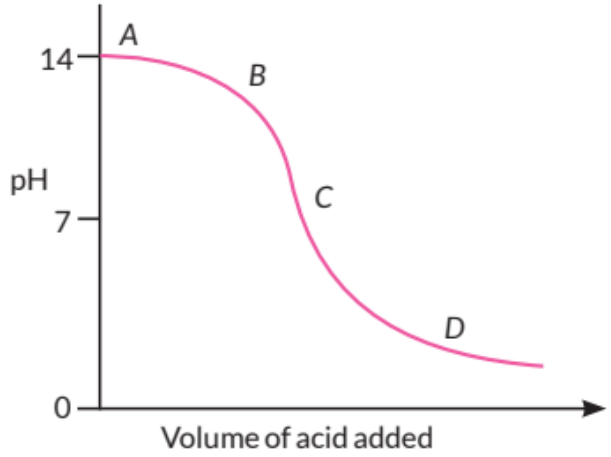
MCQ

7. With the reference to four gases CO_2,CO, Cl_2 and O_2, which one of the options in the table is correct?

Option	Acidic oxide	Used in treatment of water	Product of respiration	Product of incomplete combustion
(a)	CO	Cl_2	O_2	CO
(b)	CO_2	Cl_2	CO_2	CO
(c)	CO_2	O_2	O_2	CO_2
(d)	CO	O_2	CO_2	CO_2

(2022-23)

8. The graph given below depicts a neutralization reaction (acid + alkali → salt + water). The pH of a solution changes as we add excess of acid to an alkali.



Which letter denotes the area of the graph where both acid and salt are present? (Term I, 2021-22)

(b) B

(a) A

(c) C

(d) D

9. Which of the given options correctly represents the parent acid and base of calcium carbonate?

	Parent Acid	Parent Base
(a)	HCl	NaOH
(b)	H_2CO_3	$Ca(OH)_2$
(c)	H_3PO_3	$CaSO_4$
(d)	H_2SO_4	$CaSO_4$

(Term I, 2021-22) U

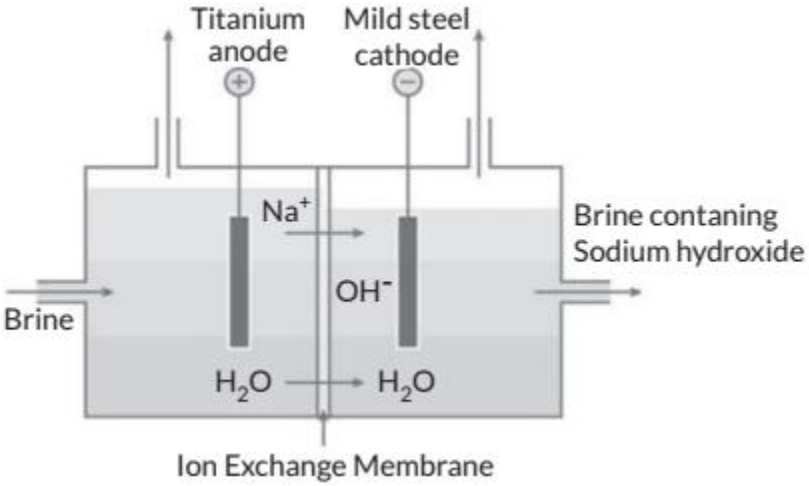
10. Assertion (A): Fresh milk in which baking soda is added, takes a longer time to set as curd.
Reason (R): Baking soda decreases the pH value of fresh milk to below 6.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true and R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true. (Term I, 2021-22)

VSA (1 mark)

11. Write the chemical name and chemical formula of the salt used to remove permanent hardness of water. (2020-21)

SA II (3 marks)

12.



(a) Identify the gases evolved at the anode and cathode in the above experimental set up.
(b) Name the process that occurs. Why is it called so?

(c) Illustrate the reaction of the process with the help of a chemical equation. (2022-23)

LA (5 marks)

13. Match the following pH values 1, 7, 10, 13 to the solutions given below:
- Milk of magnesia
- Gastric juices
- Brine
- Aqueous sodium hydroxide.

Amit and Rita decided to bake a cake and added baking soda to the cake batter. Explain with a balanced reaction, the role of the baking soda. Mention any other use of baking soda. (2020-21)

14. (i) Four samples A, B, C and D change the colour of pH paper or solution to green, reddish- pink, blue and orange. Their pH was recorded as 7, 2, 10.5 and 6 respectively. Which of the samples has the highest amount of hydrogen ion concentration? Arrange the four samples in the decreasing order of their pH.
(ii) Rahul found that the plaster of Paris, which he stored in a container, has become very hard and lost its binding nature. What is the reason for this? Also, write a chemical equation to represent the reaction taking place.
(iii) Give any one use of plaster of Paris other than for plastering or smoothening of walls. (2020-21)

SOLUTIONS

Previous Years' CBSE Board Questions

1. (c) When sodium bicarbonate reacts with dilute hydrochloric acid, carbon dioxide gas is liberated. The reaction that occurs is shown below:

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

Carbon dioxide when passed into lime water gives a milky solution. This is due to the formation of an insoluble suspension of calcium carbonate:

$$Ca(OH)_{2(aq)} + CO_{2(g)} \longrightarrow \underset{\text{(white precipitate)}}{CaCO_{3(s)}} + H_2O_{(l)}$$

2. (d): Oxalic acid is present in tomato.

3. (a) There are some substances whose odour changes in acidic or basic media. These are called olfactory indicators. Clove oil and vanilla essence are olfactory indicators.

4. (c): Orange is a natural source of citric acid while tamarind contains tartaric acid.

5. (a) Colour of red litmus remains red in neutral solutions, become dark red in acidic and blue in presence of basic solutions. So, there will be no change in colour of red litmus in distilled water (test tube A). In test tube B, it becomes dark red and in test tube C, red litmus turns blue.

6. (b): Clove oil can be used as acid-base indicator by visually challenged student. Clove oil gives different odour in acidic and basic solution.

7. (a): Tomato contains oxalic acid.

8. Litmus is most commonly used indicator in laboratories to test whether the given substance is acidic or basic.

9. (i) Copper oxide (CuO) dissolves in mineral acids such as HCI to give the corresponding copper salt and water. The salt formed by the reaction of CuO with dilute HCI is copper chloride. In aqueous solutions, copper chloride appears green in colour while in anhydrous form it appears as a yellowish-brown powder.
(ii) Balanced chemical equation for the given reaction is

$$CuO + 2HCl \longrightarrow CuCl_2 + H_2O$$

10. When blue litmus is added to test tube A, containing dil. HCI, colour of the blue litmus paper changes from blue to red. When blue litmus is added to test tube B, containing dil. NaOH, no colour change will be observed.

11. Oxides of non-metals react with bases to form salt and water. For example: Calcium hydroxide, which is a base, reacts with carbon dioxide to produce salt and water.

$$\underset{\text{Carbon dioxide}}{CO_2} + \underset{\text{Calcium hydroxide}}{Ca(OH)_2} \longrightarrow \underset{\text{Calcium carbonate}}{CaCO_3} + H_2O$$

Hence, oxides of non-metals are generally acidic in nature.

12. (i) When CO_2 is passed through lime water for short interval of time, it turns milky due to the formation of insoluble calcium carbonate.

$$\underset{\text{Calcium hydroxide (Lime water)}}{Ca(OH)_{2(aq)}} + \underset{\text{Carbon dioxide}}{CO_{2(g)}} \longrightarrow \underset{\text{Calcium carbonate (White ppt.)}}{CaCO_{3(s)}\downarrow} + \underset{\text{Water}}{H_2O_{(l)}}$$

(ii) If CO2 is passed for long duration through lime water, the white precipitate formed dissolves due to the formation of soluble calcium hydrogen carbonate and the solution becomes clear.

$$\underset{\text{Calcium carbonate (insoluble)}}{CaCO_{3(s)}} + \underset{\text{Carbon dioxide}}{CO_{2(g)}} + \underset{\text{Water}}{H_2O_{(l)}} \longrightarrow \underset{\text{Calcium hydrogen carbonate (soluble)}}{Ca(HCO_3)_{2(aq)}}$$

13.

(a) (i) $2Al + 3H_2SO_4 \longrightarrow Al_2(SO_4)_3 + 3H_2$

(ii) $2Al + 2NaOH + 2H_2O \longrightarrow 2NaAlO_2 + 3H_2$

(b) Copper oxide reacts with HCI to produce copper chloride and water. This results in loss of black colour of copper oxide during reaction and copper chloride formed dissolve in water to produce a bluish green solution.

$$\underset{\text{(Black)}}{CuO_{(s)}} + 2HCl_{(dil)} \longrightarrow \underset{\text{(Bluish green)}}{CuCl_{2(aq)}} + H_2O_{(l)}$$

14. It is observed that active metals like zinc react with strong bases like NaOH, KOH etc. to liberate hydrogen gas and corresponding salt.

$$\underset{\text{Sodium hydroxide}}{2NaOH_{(aq)}} + \underset{\text{Zinc}}{Zn_{(s)}} \longrightarrow \underset{\text{Sodium zincate (Salt)}}{Na_2ZnO_{2(aq)}} + \underset{\text{Hydrogen}}{H_{2(g)}}\uparrow$$

The evolution of gas is confirmed by the bubble formation in soap solution. Test to detect H_2 gas: When burning matchstick is kept on the mouth of this test tube, pop sound is heard which confirms the presence of H_2 gas.

OR

When Zn metal reacts with dilute solution of strong acid, H_2 gas is evolved.

$$\underset{\text{Strong acid}}{Zn + 2HCl} \longrightarrow \underset{\text{Salt}}{ZnCl_2} + \underset{\text{gas}}{H_2\uparrow}$$

15. Onion juice is an olfactory indicator. Olfactory indicators give one type of odour in acidic medium and a different odour in basic medium. As the liquid 'X' turns blue litmus red, hence it is an acidic solution.
(a) Acids react with active metals such as zinc, magnesium, etc. and evolve hydrogen gas, for example,

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

(b) Acids react with metal carbonates to give carbon dioxide with brisk effervescence.

For example, $Na_2CO_3 + H_2SO_4 \rightarrow Na_2SO_4 + CO_2 + H_2O$

16. (b) Sodium hydroxide, potassium hydroxide, calcium hydroxide, etc. are soluble in water, therefore they are termed as alkalies while bases like copper hydroxide, ferric hydroxide, aluminium hydroxide, etc. do not dissolve in water, therefore they are not termed as alkalies.

17. (c) According to Arrhenius theory, acids are substances which dissociate in aqueous solution to give hydrogen ions (or hydronium ions).

$$\underset{\text{Hydrochloric acid}}{HCl_{(aq)}} + H_2O_{(l)} \longrightarrow \underset{\text{Hydronium ion}}{H_3O^+_{(aq)}} + Cl^-_{(aq)}$$

18. (b) Reaction between a concentrated acid and water is highly exothermic. Hence, during dilution of concentrated acid, drop by drop acid should be added to water with constant stirring so that less amount of heat is released in the process that can be absorbed by water.

19. (b): HCI and H^2SO^4 are strong acid, give H^+ ions in aqueous solution and conduct electricity.

C_2H_5OH and $C_6H_{12}O_6$ do not produce ions in aqueous solution and hence do not conduct electricity.

20. Diluting concentrated acid with water is a highly exothermic process. So, when water is added to concentrated acid, large amount of heat is liberated

which changes some water to steam explosively which can splash the acid and even the glass apparatus may break due to excessive heating.

21. (i) During the dilution of a strong concentrated acid, always add acid to water and not the water to acid. The dissociation of an acid in water is a highly exothermic process as acid has strong affinity for water. Large amount of heat is produced on mixing the acid with water. Hence, the acid is always diluted by adding the acid to water slowly and with constant stirring.

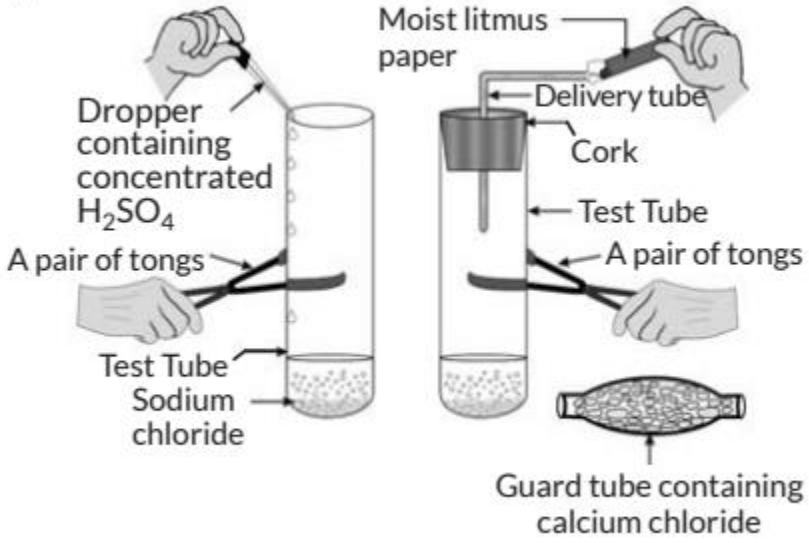
(ii) $H_2SO_4 + 2NaOH \longrightarrow Na_2SO_4 + 2H_2O$

Sodium sulphate salt is formed when sulphuric acid reacts with sodium hydroxide. Sodium sulphate is a neutral salt which forms an aqueous solution with pH of 7.

(iii) The colour of blue litmus paper changes only in the presence of hydrogen (H^+) or hydronium (H_3O^+) ions. HCI can produce these ions only in aqueous solution. Hence, dry HCI gas does not change the colour of dry blue litmus paper.

22.

(i)



Preparation of hydrogen chloride gas

(ii) There is no change in the colour of 'dry' blue litmus paper but 'moist' blue litmus paper turns red if brought near the mouth of the test tube. This shows that HCI gas does not show acidic behaviour in absence of water but it shows acidic behaviour in presence of water.

(iii) When HCI gas dissolves in water, forms hydrochloric acid solution i.e., $HCl_{(aq)}$ which then produces H^+ or H_3O^+ ions.

$$HCl + H_2O \longrightarrow H_3O^+ + Cl^-$$

Due to the presence of H^+ or H^3O, it shows acidic behaviour.

23.

(i) $2NaOH_{(aq)} + Zn_{(s)} \longrightarrow Na_2ZnO_{2(aq)} + H_{2(g)}$

(ii) $CaCO_{3(s)} + CO_{2(g)} + H_2O_{(l)} \longrightarrow Ca(HCO_3)_{2(aq)}$

(iii) $HCl_{(aq)} + H_2O_{(l)} \longrightarrow H_3O^+_{(aq)} + Cl^-_{(aq)}$

24. Dissociation of various substances to produce ions in their solutions are:

(i) Hydrochloric acid (HCl) :
$HCl_{(aq)} \rightleftharpoons H^+_{(aq)} + Cl^-_{(aq)}$

(ii) Nitric acid (HNO_3) :
$HNO_{3(aq)} \rightleftharpoons H^+_{(aq)} + NO^-_{3\,(aq)}$

(iii) Sulphuric acid (H_2SO_4) :
$H_2SO_{4(aq)} \rightleftharpoons 2H^+_{(aq)} + SO^{2-}_{4\,(aq)}$

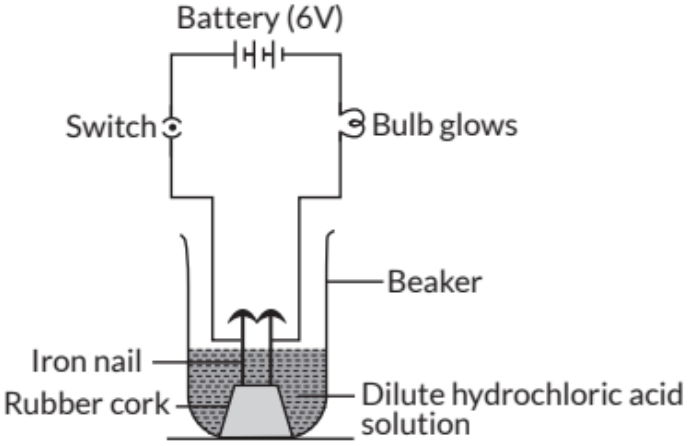
(iv) Sodium hydroxide (NaOH) :
$NaOH_{(aq)} \rightleftharpoons Na^+_{(aq)} + OH^-_{(aq)}$

(v) Potassium hydroxide (KOH) :
$KOH_{(aq)} \rightleftharpoons K^+_{(aq)} + OH^-_{(aq)}$

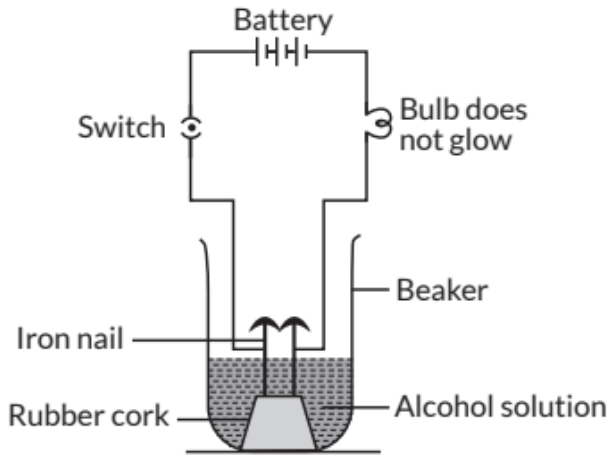
(vi) Magnesium hydroxide [$Mg(OH)_2$] :
$Mg(OH)_{2(aq)} \rightleftharpoons Mg^{2+}_{(aq)} + 2OH^-_{(aq)}$

25. (a) Take two beakers, one containing HCI acid and other containing alcohol which is not an acid but contains hydrogen. Now, fix two iron nails on a rubber cork and insert in a beaker and connect the nail to the two terminal of 6V battery through a switch and a bulb. Pour some dilute HCI solution in beaker and switch on the current. The bulb starts glowing. This shows that acids get dissociated as H^+ and CI ions and these ions are responsible for conducting electricity.

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



Let us now take alcohol solution in the beaker and switch on the current. The bulb does not glow in this case. This shows that alcohol does not conduct electricity.



So, all acids have hydrogen but all hydrogen containing compounds are not acids.

(b) HCI dissociates in aqueous solution to give hydrogen ions (or hydronium ions) and chloride ions.

$$\underset{\text{Hydrochloric acid}}{HCl_{(aq)}} + H_2O_{(l)} \longrightarrow \underset{\text{Hydronium ion}}{H_3O^+_{(aq)}} + Cl^-_{(aq)}$$

NaOH when dissolved in water produces sodium ions and hydroxide ions in the solution.

$$\underset{\text{Sodium hydroxide}}{NaOH_{(s)}} + H_2O_{(l)} \longrightarrow \underset{\text{Sodium ions}}{Na^+_{(aq)}} + \underset{\text{Hydroxide ions}}{OH^-_{(aq)}}$$

26. (d) Baking soda, or sodium hydrogen carbonate ($NaHCO_3$) is used to delay the curdling of milk.

27. (d) Bases are substances which have bitter taste, soapy touch and turn red litmus solution to blue. Bases have pH more than 7. Bases give pink colour with phenolphthalein.

28. (c) The concentration of H^+ ions increases with increase in acidic strength of any acid. Also, as pH value increases, acidity decreases.

$$pH \propto \frac{1}{\text{Acidity}} \propto \frac{1}{\text{Concentration of } H^+}$$

So, decreasing order of H^+ ion concentration is: Gastric juice > Lemon juice > Dilute acetic acid > Vinegar
2 > 1 > 4 > 3

29. (a): Few drops of universal indicators in a solution give yellowish orange colour to solution. This indicates that the solution used was acidic in nature. For example: lemon juice.

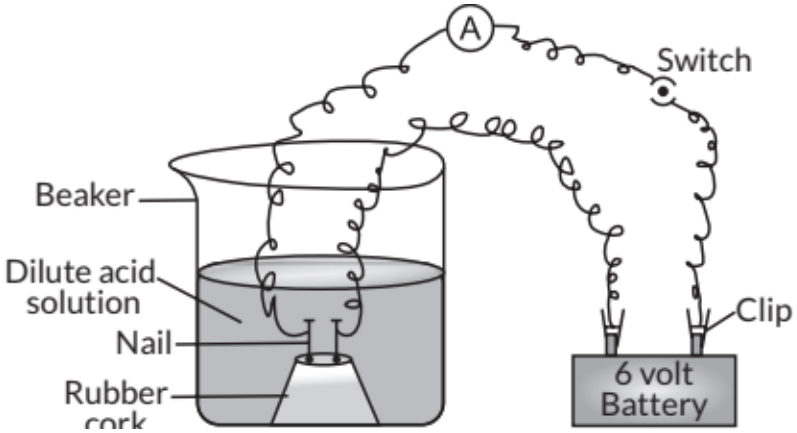
30. (c): As the aqueous solution of A turns phenol- phthalein solution pink, hence A is basic in nature. On adding an acidic solution, the pink colour will disappear. Hence, B is an acid.

31. (a): Hydrochloric acid is produced in our stomach during digestion of food.

32. (i) Solution of M gives red colour with a universal indicator which indicates that it is an acidic solution having pH = 1-2. Solution of N gives blue colour with a universal indicator which indicates that it is a basic solution having pH = 11. Higher the pH, lower is the hydrogen ion concentration, hence in solution M, hydrogen ion concentration is more.
(ii) The universal indicator turns green, which indicates that it is a neutral solution having pH = 7. The mixture of M and N forms a salt solution.

33. Hydrochloric acid is a stronger acid than acetic acid because it dissociate completely in aqueous solution to give H^+ ions. H_2SO_4 (sulphuric acid) is an example of strong acid.

34. Out of HCI and CH_3COOH, CH_3COOH is a weak acid because it dissociates partially in the solution. This can be proved with the help of following example. If 1 M HCl and 1 M CH_3COOH are taken in the beaker as shown in the figure, greater deflection is observed in case of HCI which shows that more ions are produced by HCI in solution which produce more current.



35. The acidity produced due to excess hydrochloric acid in the stomach which cause indigestion, produce pain and irritation. Milk of magnesia (chemically magnesium hydroxide) is used as an antacid. Since, it is basic in nature, reacts with the excess hydrochloric acid present in the stomach and neutralises it.

$$\underset{\substack{\text{Magnesium hydroxide}\\ \text{(Milk of magnesia)}}}{Mg(OH)_2} + \underset{\text{Hydrochloric acid}}{2HCl} \longrightarrow \underset{\text{Magnesium chloride}}{MgCl_2} + \underset{\text{Water}}{2H_2O}$$

36. (a) Dilution of a concentrated acid is highly exothermic reaction. The heat produced is so large that the solution may splash out or the glass beaker in which the dilution is carried out may berak due to excessive localized heating. Hence, to slow dow the exotehrmic reaction, dilution of a concentrated acid is always done by taking sufficient amount of water in a beaker and adding concentrated acid into it slowly with stirring. Thus, we always dilute an acid by adding acid into water and not water into acid.
(b) Mixing an acid or base with water results in decrease in the concentration of ions ($H3O^+/OH^-$) per unit volume.

(c) If conc. of H_3O^+ is increased in a solution, pH will decrease. Colour of pH paper if the pH ranges 0.5 to 2.0 is red.

37. (a) pH scale is used to measure the strength of acids and bases.
(b) The pH value ranges from 1 to 14.
(c) Lowest value of pH scale indicates the highly acidic solution. Highest value of pH scale indicates the highly basic solution.

38. (a) (i) The solution having lower pH will have more hydrogen ion concentration. Hence, solution 'A' will have highest H^+ ion concentration.
(ii) Solution 'C' i.e., pH = 5 has the lowest concentration of H^+ ions.
(b) Mixing of an acid with water is called dilution. This process is highly exothermic and therefore, acid is always added to the water not water to acid. The process for diluting concentrated sulphuric acid is:
(i) Take about 10 mL of water in a beaker.
(ii) Add concentrated sulphuric acid dropwise to water and swirl the beaker slowly.

39. (a) The compound P is calcium phosphate.
(b) Eating chocolates and sweets produce large amount of acid in the mouth which is not completely neutralised by the saliva produced in the mouth. Excess acid attacks the enamel and tooth decay starts as pH of the mouth falls below 5.5. The best way to prevent tooth decay is to clean the teeth by using toothpastes after eating food. Toothpastes which are generally basic neutralise the excess acid in the mouth.

40. (c) $Na_2CO_3 \cdot 10H_2O$ is used to remove permanent hardness of water. Washing soda (Na_2CO_3-$10H_2O$) reacts with soluble calcium and magnesium chlorides and sulphates in hard water to form insoluble carbonates, that can be removed by filtration and then water becomes soft. sodium acetate (CH_3COONa) is formed by CH_3COOH (a weak acid) and NaOH (a strong base), it is basic in nature.

42. (d): K_2CO_3 reacts with dilute hydrochloric acid to give CO_2 gas that reacts with calcium hydroxide turning the latter milky.

$$K_2CO_{3(aq)} + 2HCl_{(aq)} \longrightarrow 2KCl_{(aq)} + H_2O_{(l)} + CO_{2(g)}\uparrow$$

$$CO_{2(g)} + Ca(OH)_{2(aq)} \longrightarrow \underset{\text{(Milky solution)}}{CaCO_{3(s)}} + H_2O_{(l)}$$

43.

(d) :

Bleaching powder	:	$CaOCl_2$
Plaster of Paris	:	$CaSO_4 \cdot \frac{1}{2}H_2O$
Washing soda	:	$Na_2CO_3 \cdot 10H_2O$
Baking soda	:	$NaHCO_3$

44. (a): Sodium hydrogen carbonate is used as an antacid to neutralise the acidity in the stomach because it is mild non-corrosive basic salt.

45. (b): Baking powder is a mixture of potassium hydrogen tartarate and sodium hydrogen carbonate. On baking, sodium hydrogen carbonate decomposes to sodium carbonate which is neutralised by tartaric acid. Absence of tartaric acid means persistance of sodium carbonate which gives a bitter taste.

46. (d): Baking soda is commonly used in kitchen for making tasty crispy pakoras etc. Sometimes it is added for faster cooking.

$$\underset{(A)}{NaCl} + H_2O + CO_2 + NH_3 \longrightarrow NH_4Cl + \underset{(B)}{NaHCO_3}$$

$$\underset{(B)}{2NaHCO_3} \xrightarrow{\text{heat}} \underset{(C)}{Na_2CO_3} + CO_2 + H_2O$$

47. (c): An orange red colour of universal indicator shows that the solution tested is acidic in nature that is, salt is composed of a strong acid and a weak base.

48. (b): When electricity is passed through an aqueous solution of sodium chloride (called brine), it decomposes to form sodium hydroxide and this process is called chlor- alkali process.

$$2NaCl_{(aq)} + 2H_2O_{(l)} \longrightarrow \underset{\text{(near cathode)}}{2NaOH_{(aq)}} + \underset{\text{(at anode)}}{Cl_{2(g)}} + \underset{\text{(at cathode)}}{H_{2(g)}}$$

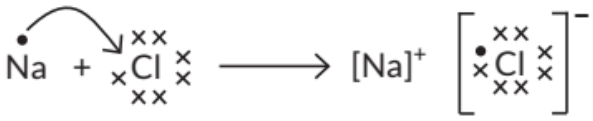
49. (c): If the climate is very humid, the gas produced (HCI) has to be passed through a guard tube containing calcium chloride to dry the gas.

50. (d): Chemical name of common salt is sodium chloride (NaCl).

51. (c): Common salt is an ionic compound formed by complete transfer of electrons.

$$\underset{2,8,1}{Na} \longrightarrow \underset{\substack{2,8 \\ \text{(Sodium ion)}}}{Na^+} + e^-$$

$$\underset{2,8,7}{Cl} + e^- \longrightarrow \underset{\substack{2,8,8 \\ \text{(Chloride ion)}}}{Cl^-}$$



52. (b): Common salt is not a raw material for production of plaster of Paris. Caustic soda (NaOH) is obtained by chlor-alkali process by using NaCl. Chlorine required for synthesis of bleaching powder, is also obtained by decomposition of common salt by electricity. Common salt is also used in the preparation of baking soda.

53. (a): Washing soda is $Na_2CO_3.10H_2O$

$$[NaCl + H_2O + CO_2 + NH_3 \longrightarrow \underset{\text{Baking soda}}{NH_4Cl + NaHCO_3}]$$

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

$$Na_2CO_3 + 10H_2O \longrightarrow \underset{\text{(Washing soda)}}{Na_2CO_3 \cdot 10H_2O}$$

54. (c): Baking soda is a mixture of sodium hydrogen carbonate and a mild edible acid like tartaric acid or citric acid.

55. (c, d): Plaster of Paris is calcium sulphate hemihydrate which can be represented as,

$$CaSO_4 \cdot \frac{1}{2} H_2O \text{ and } 2CaSO_4 \cdot H_2O.$$

56. (i) On heating gypsum at 373 K, it loses water molecules and becomes calcium sulphate hemihydrate

$(CaSO_4 \cdot \frac{1}{2} H_2O)$. This is called Plaster of Paris, the

substance that doctors use as plaster for supporting fractured bones in the right position. Hence 'X' is gypsum ($CaSO_4 2H_2O$) and 'Y' is Plaster of

Paris ($CaSO_4 \cdot \frac{1}{2} H_2O$) .

$$\underset{(X)\ \text{Gypsum}}{CaSO_4 \cdot 2H_2O} \xrightarrow{373K} \underset{(Y)\ \text{Plaster of Paris}}{CaSO_4 \cdot \frac{1}{2}H_2O} + 1\frac{1}{2}H_2O$$

57. Sodium hydrogen carbonate ($NaHCO_3$) is basic in nature as on hydrolysis it gives a mixture of strong base (NaOH) and weak acid (H_2CO_3). Sodium hydrogen carbonate is converted to washing soda in the following way:
(i) Thermal decomposition of $NaHCO_3$:

$$\underset{\text{Sodium hydrogen carbonate}}{2NaHCO_{3(s)}} \xrightarrow{\text{Heat}} \underset{\text{Anhydrous sodium carbonate}}{Na_2CO_{3(s)}} + CO_2\uparrow + H_2O\uparrow$$

(ii) Recrystallisation of sodium carbonate :

$$Na_2CO_{3(s)} + 10H_2O_{(l)} \longrightarrow \underset{\text{Washing soda}}{Na_2CO_3 \cdot 10H_2O_{(s)}}$$

58. 'X' is acidic solution having pH range 3-4. 'Y' is basic solution having pH 9.

59. Universal indicator gives green colour in X. Hence X is neutral solution.
Universal indicator gives red colour in Y. It means Y is acidic solution.
Universal indicator gives blue colour in Z. i.e., Z is basic solution.
(a) Y<X<Z
(b) Z will change the colour of phenolphthalein indicator because Z is basic solution changes colour of phenolphthalein from colourless to pink

60. $NaHCO_3$ is an alkaline salt as its pH value is greater than 7. It is a salt of strong base and weak acid. Two uses of sodium bicarbonate are as follows:
(i) It is used as an antacid in medicines.
(ii) It is used as an additive in food and drinks.

61. The chemical formula of bleaching powder is $CaOCl_2$. It is prepared by the action of chlorine gas on dry slaked lime $Ca(OH)_2$.

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

The chlorine used in the above reaction is the by- product produced during the electrolysis of brine. It is used in disinfecting drinking water as chlorine liberated by it, kills the germs.

62. (a) If in YCI, Y is sodium, then salt will be NaCl. NaCl is a salt of strong acid (HCI) and strong base (NaOH). Therefore, NaCl solution is neutral with pH value of 7.
(b) If in NH4X, X is nitrate, then it would be NH4NO3. NH4NO3 is a salt of weak base (NH_4OH) and strong acid (HNO3). It is an acidic salt and give orange yellow colour with universal indicator.
(c) If in ZCO_3, Z is potassium then it would be K_2CO_3' K_2CO_3 is salt of strong base (KOH) and weak acid (H_2CO_3). It is basic salt and colour of blue litmus solution will remain unchanged in it.

63. Sodium hydroxide (NaOH, caustic soda) is prepared by electrolysis of an aqueous solution of sodium chloride (X). This method is called 'chlor-alkali' process. The complete reaction can be represented as follows:

$$\underset{(X)}{2NaCl_{(aq)}} + 2H_2O_{(l)} \xrightarrow[\text{electricity}]{\text{on passing}} 2NaOH_{(aq)} + \underset{(Z)}{Cl_{2(g)}} + \underset{(Y)}{H_{2(g)}}$$

Yis H_2 gas while Z is chlorine gas. Water also ionizes to a small extent to produce H+ ions and OH ions.

$$H_2O \rightarrow H^+ + OH^-$$

On passing electric current through the solution of NaCI, H^+ ions are discharged more easily at the cathode than Na^+ ions.

$$\begin{aligned} &\text{At cathode : } H^+ + e^- \rightarrow H \\ &\qquad\qquad\quad H + H \rightarrow H_2 \\ &\text{At anode : } \quad Cl^- \rightarrow Cl + e^- \\ &\qquad\qquad\quad Cl + Cl \rightarrow Cl_2 \end{aligned}$$

When chlorine gas is treated with dry slaked lime [$Ca(OH)_2$], bleaching powder is formed as shown:

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

64. Sodium hydroxide is prepared by electrolysis of an aqueous solution of sodium chloride (brine). The complete reaction can be represented as :

$$2NaCl_{(aq)} + 2H_2O_{(l)} \xrightarrow[\text{electricity}]{\text{On passing}} 2NaOH_{(aq)} + Cl_{2(g)} + H_{2(g)}$$

The process of electrolysis of sodium chloride solution is called chlor-alkali process because of the products formed chlor for chlorine and alkali for sodium hydroxide. The three very useful products obtained by the electrolysis of sodium chloride solution are sodium hydroxide, chlorine and hydrogen.
At anode : Cl_2 gas is liberated.
At cathode : H_2 gas is liberated.
Uses of sodium hydroxide: In the manufacture of soaps and detergents.
Uses of chlorine: As a germicide and disinfectant for sterilisation of drinking water and for water of swimming pools.
Uses of hydrogen: In the manufacture of ammonia which is used for the preparation of various fertilizers like urea, ammonium sulphate etc.

65. Washing soda is prepared by recrystallisation of sodium carbonate:

$$\underset{\text{Anhydrous sodium carbonate}}{Na_2CO_{3(s)}} + 10H_2O_{(l)} \longrightarrow \underset{\text{Washing soda}}{Na_2CO_3.10H_2O_{(s)}}$$

It is a basic salt as on hydrolysis it gives a mixture of strong base (NaOH) and weak acid (H_2CO_3).

$$Na_2CO_3 + 2H_2O \longrightarrow H_2CO_3 + 2NaOH$$

It is used to remove the permanent hardness of water. Hard water is treated with a calculated amount of washing soda when chlorides and sulphates of calcium and magnesium present in hard water get precipitated as insoluble calcium and magnesium carbonates which can be easily filtered off. The water thus becomes soft.

$$CaCl_2 + Na_2CO_3 \longrightarrow CaCO_3\downarrow + 2NaCl$$
$$MgSO_4 + Na_2CO_3 \longrightarrow MgCO_3\downarrow + Na_2SO_4$$

66. (i) Only one half of water molecule is shown in the formula of plaster of Paris ($CaSO_4.\frac{1}{2}H_2O$) as one molecule of water is being shared by two molecules of calcium sulphate (CaSO4). So the effective water of crystallisation for one CaSO4 unit comes to half molecule of water.

(ii) Acidity can be neutralised by a base. Sodium hydrogen carbonate can be used as an antacid solution because it is a weak base and will react with excess acid roduced in the stomach due to hyperacidity and will neutralise it.
(iii) Blue coloured copper sulphate crystals are hydrated copper sulphate, CuSO4.5H2O. On heating blue copper sulphate crystals loses its water of crystallisation and turns into anhydrous copper sulphate which is white in colour.

$$\underset{\text{(Blue)}}{CuSO_4.5H_2O} \xrightarrow{\text{Heat}} \underset{\text{(White)}}{CuSO_4} + 5H_2O$$

67. (i) During electrolysis of brine, chlorine is obtained at anode. When chlorine is passed through slaked lime, bleaching powder is formed which is used for disinfecting drinking water. Hence, G is Cl_2 and C is $CaOCl_2$.

(ii) $2NaCl_{(aq)} + 2H_2O_{(l)} \xrightarrow{\text{Electrolysis}} 2NaOH_{(aq)} + \underset{(G)}{Cl_{2(g)}} + H_{2(g)}$

$$Ca(OH)_{2(s)} + Cl_{2(g)} \xrightarrow{[O]} \underset{(C)}{CaOCl_{2(s)}} + H_2O_{(l)}$$

(iii) Common name of C is bleaching powder. Its chemical name is calcium hypochlorite.

68. Sodium chloride is obtained by the neutralisation of sodium hydroxide (base) with hydrochloric acid (acid). It is a neutral salt. Common salt found in the form of solid deposits is often brown in colour due to presence of impurities which is called rock salt. Rock salt is formed by evaporation of salty water of inland lakes.

69. The white powder added while baking cakes to make it soft and spongy is baking powder. Its main ingredients are sodium hydrogen carbonate and a mild edible acid like tartaric acid or citric acid. $NaHCO_3$ decomposes to give out CO_2 which causes the cake to rise and makes it soft and spongy. The function of tartaric acid or citric acid is to neutralise sodium carbonate formed during heating which can otherwise make the cake bitter. Reaction taking place when the powder is heated:

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

70. (a) Sodium hydroxide is prepared by electrolysis of an aqueous solution of sodium chloride (brine). The complete reaction can be represented as :

$$2NaCl_{(aq)} + 2H_2O_{(l)} \xrightarrow[\text{electricity}]{\text{On passing}} 2NaOH_{(aq)} + Cl_{2(g)} + H_{2(g)}$$

The process of electrolysis of sodium chloride solution is called chlor-alkali process because of the products formed chlor for chlorine and alkali for sodium hydroxide. The three very useful products obtained by the electrolysis of sodium chloride solution are sodium hydroxide, chlorine and hydrogen.
(b) (i) Colour of copper sulphate crystals become white after heating.
(ii) Water droplets are noticed at the mouth side of the boiling tube which are obtained from water of crystallisation.

71. Salt used to make tasty and crispy pakoras is sodium bicarbonate ($NaHCO_3$), pH = 9. On large scale, sodium bicarbonate is prepared as:

$$\underset{\text{Sodium chloride}}{NaCl} + \underset{\text{Water}}{H_2O} + \underset{\text{Carbon dioxide}}{CO_2} + \underset{\text{Ammonia}}{NH_3} \longrightarrow \underset{\text{Ammonium chloride}}{NH_4Cl} + \underset{\text{Sodium bicarbonate}}{NaHCO_3}$$

Two uses of sodium bicarbonate are as follows:
(i) It is used as an antacid in medicines.
(ii) It is used as an additive in food and drinks.
Note: In the question paper, the given pH is 14 which should be 9.

72. (i)

Hydrated salt	Anhydrous salt
A salt with one or more chemically combined water molecule is called hydrated salt. *e.g.*, washing soda, $Na_2CO_3.10H_2O$	A salt in which all water molecules are removed, is called anhydrous salt. *e.g.*, soda ash, Na_2CO_3

(ii)

Washing soda	Soda ash
The hydrated salt of sodium carbonate containing 10 molecules of water of crystallisation, is known as washing soda *i.e.*, $Na_2CO_3 \cdot 10H_2O$.	The anhydrous sodium carbonate (Na_2CO_3) which does not contain water of crystallisation, is known as soda ash.

(iii)

Baking soda	Baking powder
Baking soda is sodium hydrogen carbonate with the formula, $NaHCO_3$.	Baking powder is a mixture of $NaHCO_3$ and tartaric acid or citric acid.

73.

Sample solution	Red litmus solution	Blue litmus solution	Phenolphthalein solution
Acetic acid (CH_3COOH)	No effect	Red	Colourless
Sodium hydroxide (NaOH)	Blue	No effect	Pink
Baking soda ($NaHCO_3$)	Blue	No effect	Pink

74. (a) Chemical name of the powder is calcium sulphate hemihydrate. Chemical formula of the powder is

$$CaSO_4 \cdot \frac{1}{2}H_2O.$$

(b) When water is added to plaster of Paris, it sets into a hard mass in about half an hour. The setting of plaster

of Paris is due to its hydration to form crystals of gypsum which set to form a hard, solid mass.

$$\underset{\text{Plaster of Paris}}{CaSO_4 \cdot \frac{1}{2}H_2O} + \underset{\text{Water}}{1\frac{1}{2}H_2O} \rightarrow \underset{\substack{\text{Gypsum} \\ \text{(sets as hard mass)}}}{CaSO_4 \cdot 2H_2O}$$

75. (a) Acid - base indicators: The indicators which show different colours in acidic and basic medium are called acid-base indicators. Phenolphthalein is a synthetic indicator.
(b) Acidity can be neutralised by a base. Hence, we should choose baking soda solution because it is a weak base and will react with excess acid produced in the stomach due to hyperacidity and will neutralise it.

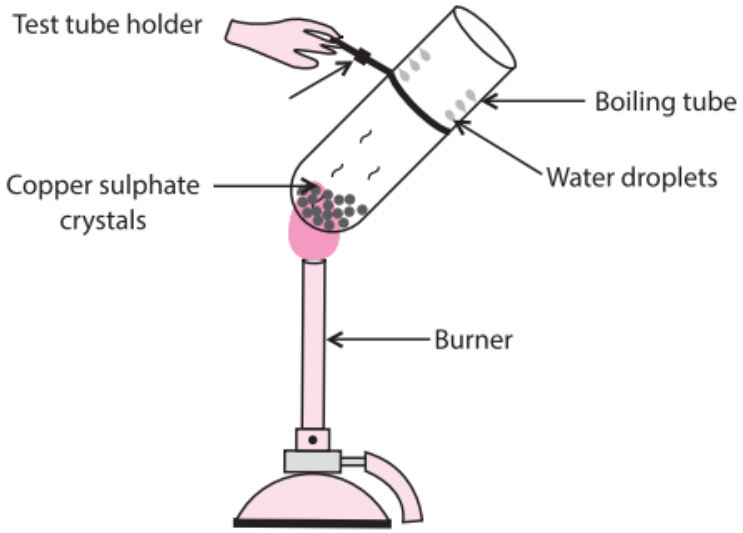
76. (a) Chemical fromula of 'X' is NaOH. Chemical/common name: Sodium hydroxide.

(b) $2NaCl_{(aq)} + 2H_2O_{(l)} \xrightarrow[\text{electricity}]{\text{On passing}} 2NaOH_{(aq)} + Cl_{2(g)} + H_{2(g)}$

(c) $2NaOH + CaCl_2 \longrightarrow 2NaCl + Ca(OH)_2$

$2NaOH + MgCO_3 \longrightarrow Na_2CO_3 + Mg(OH)_2$

77. Water of crystallisation: It is the fixed number of water molecules present in one formula unit of a salt. e.g., Gypsum ($CaSO_4.2H_2O$) has two molecules of water of crystallisation. In hydrated copper sulphate ($CuSO_4.5H_2O$), there are five molecules of water of crystallisation.
Activity:
- Take few crystals of copper sulphate in a dry boiling tube. These are blue in colour.
- Heat the boiling tube by holding it with a test tube holder on the flame of the burner.



Observations: You will observe that the colour of copper sulphate crystals after heating becomes white. You may also notice water droplets on the mouth side of the boiling tube which are obtained from water of crystallisation. After adding 2-3 drops of water on the white sample of copper sulphate (obtained after heating) you will observe that the blue colour of copper sulphate crystals is restored.

$$\underset{\text{(Blue)}}{CuSO_4 \cdot 5H_2O} \xrightarrow{\text{Heat}} \underset{\text{(White)}}{CuSO_4} + 5H_2O$$

$$\underset{\text{(White)}}{CuSO_4} + 5H_2O \longrightarrow \underset{\text{(Blue)}}{CuSO_4 \cdot 5H_2O}$$

78. (a) When marble reacts with dilute HCI carbon dioxide gas is liberated.

$$\underset{\text{Calcium carbonate}}{CaCO_3} + \underset{\text{Dil. hydrochloric acid}}{2HCl} \longrightarrow \underset{\text{Calcium chloride}}{CaCl_2} + \underset{\text{Water}}{H_2O} + \underset{\text{Carbon dioxide}}{CO_2\uparrow}$$

When CO2 gas is passed through lime water, insoluble calcium carbonate is formed which appears milky.

$$\underset{\text{Carbon dioxide}}{CO_{2(g)}} + \underset{\text{Calcium hydroxide (Lime water)}}{Ca(OH)_{2(aq)}} \longrightarrow \underset{\text{Calcium carbonate (insoluble)}}{CaCO_{3(s)}\downarrow} + \underset{\text{Water}}{H_2O_{(l)}}$$

(b) (i) The excess acid formed in the stomach due to various reasons (one being overeating) is neutralised by sodium hydrogen carbonate. Hence, it is

used as an ingredient of antacid.
(ii) Baking soda (sodium hydrogen carbonate) is a constituent of baking power. On heating it gives out CO_2 which causes the cake to rise and make it soft and spongy.

79. (a)

Hydrated salt	Anhydrous salt
A salt with one or more chemically combined water molecule is called hydrated salt. *e.g.*, washing soda, $Na_2CO_3.10H_2O$	A salt in which all water molecules are removed, is called anhydrous salt. *e.g.*, soda ash, Na_2CO_3

(b) It is prepared from gypsum which is calcium sulphate dihydrate ($CaSO_4$-$2H_2O$). Gypsum is heated in a kiln to a temperature of 100°C (373 K). At this temperature, it loses three-fourth of its water of crystallisation forming plaster of Paris.

$$\underset{\text{Gypsum}}{CaSO_4 \cdot 2H_2O} \xrightarrow{100°C\ (373K)} \underset{\text{Plaster of Paris}}{CaSO_4 \cdot \frac{1}{2}H_2O} + 1\frac{1}{2}H_2O$$

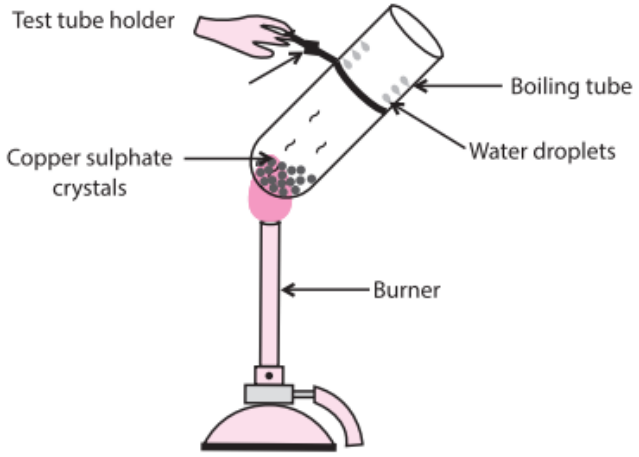
When water is added to plaster of Paris, it sets into a hard mass in about half an hour. The setting of plaster of Paris is due to its hydration to form crystals of gypsum which set to form a hard, solid mass.

$$\underset{\text{Plaster of Paris}}{CaSO_4 \cdot \frac{1}{2}H_2O} + 1\frac{1}{2}\underset{\text{Water}}{H_2O} \rightarrow \underset{\substack{\text{Gypsum} \\ \text{(sets as hard mass)}}}{CaSO_4 \cdot 2H_2O}$$

80. (a) The chemical formula of hydrated copper sulphate is CuSO4*5H2O(s) and anhydrous copper sulphate is $CuSO_{4(s)}$

Water of crystallisation: It is the fixed number of water molecules present in one formula unit of a salt. e.g., Gypsum ($CaSO_4$.$2H_2O$) has two molecules of water of crystallisation. In hydrated copper sulphate ($CuSO_4$.$5H_2O$), there are five molecules of water of crystallisation.
Activity:
- Take few crystals of copper sulphate in a dry boiling
tube. These are blue in colour.

- Heat the boiling tube by holding it with a test tube holder on the flame of the burner.



Observations: You will observe that the colour of copper sulphate crystals after heating becomes white. You may also notice water droplets on the mouth side of the boiling tube which are obtained from water of crystallisation. After adding 2-3 drops of water on the white sample of copper sulphate (obtained after heating) you will observe that the blue colour of copper sulphate crystals is restored.

$$\underset{\text{(Blue)}}{CuSO_4 \cdot 5H_2O} \xrightarrow{\text{Heat}} \underset{\text{(White)}}{CuSO_4} + 5H_2O$$

$$\underset{\text{(White)}}{CuSO_4} + 5H_2O \longrightarrow \underset{\text{(Blue)}}{CuSO_4 \cdot 5H_2O}$$

(b) Plaster of Paris is calcium sulphate hemihydrate; $CaSO_4 \cdot \frac{1}{2}H_2O$ and Gypsum is calcium sulphate dihydrate; $CaSO_4 \cdot 2H_2O$.

81. Sodium hydroxide is prepared by electrolysis of an aqueous solution of sodium chloride (brine). The complete reaction can be represented as:

$$2NaCl_{(aq)} + 2H_2O_{(l)} \xrightarrow[\text{electricity}]{\text{On passing}} 2NaOH_{(aq)} + Cl_{2(g)} + H_{2(g)}$$

The process of electrolysis of sodium chloride solution is called chlor-alkali process because of the products formed: chlor for chlorine and alkali for sodium hydroxide. The three very useful products obtained by the electrolysis

of sodium chloride solution are sodium hydroxide, chlorine and hydrogen.
(a) At anode : Cl_2 gas is liberated.
(b) At cathode : H_2 gas is liberated.
Uses of sodium hydroxide: In the manufacture of soaps and detergents. Uses of chlorine: As a germicide and disinfectant for sterilisation of drinking water and for water of swimming pools.
Uses of hydrogen: In the manufacture of ammonia which is used for the preparation of various fertilizers like urea, ammonium sulphate etc.

82. Water of crystallisation: 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 hydrated salt is known as washing soda which is sodium carbonate containing 10 molecules of water of crystallisation, i.e., it is sodium carbonate decahydrate. Its molecular formula is $Na_2CO_3.10H_2O$. It can be obtained by heating baking soda followed by recrystallisation from its aqueous solution.

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

$$Na_2CO_3 + 10H_2O \longrightarrow Na_2CO_3.10H_2O$$

Uses of sodium carbonate : (i) For the manufacture of glass, soap, papers and chemicals like caustic soda (NaOH), borax, etc.
(ii) For washing purposes (laundry works).

CBSE Sample Questions

1. (c) (1)

2. (b): Curry contains turmeric which acts as an acid- base indicator. Soap is basic in nature. Turmeric turns reddish brown in basic medium, i.e., in the presence of soap solution. On washing with plenty of water, soap is removed and yellow turmeric is left. (0.80)

3. (a): By adding acid to water with constant stirring. (0.80)

4. (b): Glowing of the bulb indicates that there is a flow of electric current through the solution. The bulb will start glowing in the case of acids and bases. The electric current is carried through the acidic or basic solution by ions. Sugar and alcohol solutions do not conduct electricity. (0.80)

5. (a): HCI is stronger acid than CH3COOH so, pH of acetic acid is more than that of hydrochloric acid. (1)

6. (a): Lower the pH value, more acidic is the solution and higher is the hydrogen ion concentration. (0.80)

7. (b): CO is neutral oxide while CO2 is an acidic oxide. Cl_2 is used in treatment of water. During respiration, CO_2 is produced while CO is produced during incomplete combustion. (1)

8. (d) : pH decreases as we add acid to the alkali. At neutralisation point, pH =

7. When more acid is added to the solution, pH decreases due to excess acid in the solution. At point D, both acid and salt are present. (0.80)

9. (b): H2CO3 + Ca(OH)2 → CaCO3 + $2H_2O$ (0.80)

10. (c) Addition of baking soda increases the pH value of milk. (0.80)

11. Sodium carbonate decahydrate (Na2CO3.10H2O) is used to remove permanent hardness of water. (1)

12. (a) At anode: Chlorine; At cathode: Hydrogen (b) Chlor-alkali process, as the products obtained are alkali, chlorine gas and hydrogen gas. (1)

(c) $2NaCl_{(aq)} + 2H_2O_{(l)} \xrightarrow{\text{Electric current}} 2NaOH_{(aq)} + Cl_{2(g)} + H_{2(g)}$

13. Milk of magnesia, pH = 10
Gastric juices, pH = 1
Brine, pH = 7
Aqueous sodium hydroxide, pH = 13 (2)
Baking soda undergoes thermal decomposition to form

Na_2CO_3, CO_2 and H_2O.

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

CO2 makes the cake fluffy and soft. Uses of baking soda: (2)
(i) It is used in fire extinguishers.
(ii) It is used to neutralise the effect of acid in insect sting.
(iii) It is used as antacid to neutralize excess acid in stomach. (any one) (1)

14. (i)

Samples :	A	B	C	D
pH values :	7	2	10.5	6
Colours on : pH paper	Green	Reddish pink	Blue	Orange

Sample B with pH = 2 is the most acidic and has the highest amount of H+ ion concentration. The decreasing order of their pH is
C>A>D>B (2)
(ii) Plaster of Paris absorbs moisture from the atmosphere and forms hard mass of gypsum.

$$CaSO_4 \cdot \frac{1}{2} H_2O + 1\frac{1}{2} H_2O \rightarrow CaSO_4 \cdot 2H_2O$$

Plaster of Paris Water Gypsum **(2)**

(iii) Plaster of Paris is used to make toys, dolls and statues. (1)