Acids, Bases and Salts

TOPICS COVERED

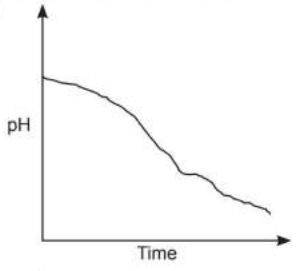
Properties and Strength of Acids and Bases

Multiple Choice Questions **1 Mark**

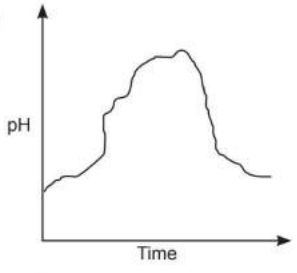
1. **Adding which of the following to a colourless solution would give an indication that the solution could possibly be hydrochloric acid?** [CFPQ, CBSE]
   (*a*) Copper metal strips
   (*b*) Silver metal strips
   (*c*) Calcium carbonate
   (*d*) Sodium chloride

2. **Which of these graphs shows how the pH of milk changes as it forms curd?** [CFPQ, CBSE]

(*a*)



(*b*)



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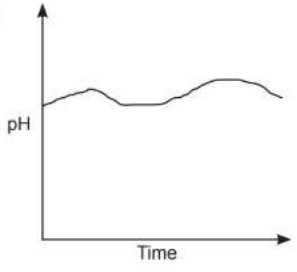
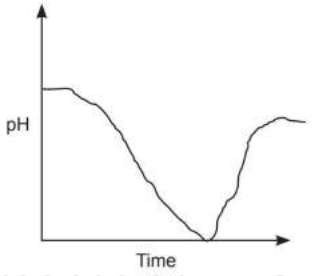


(*d*)



3. **Which fruit is basic in nature?** [CBSE T.E.R.M.*]
   (*a*) Apples (*b*) Strawberries
   (*c*) Oranges (*d*) Banana

4. **An oxide of an element 'P' is added to acid where it forms salt and water. The table shows the possible values of pH and type of element before the reaction.** [CBSE T.E.R.M.*]

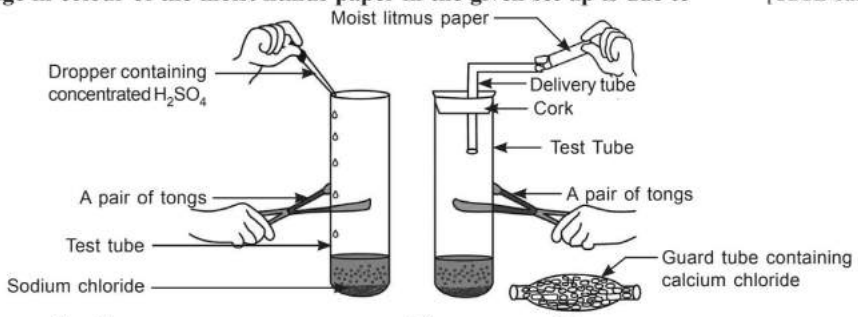
	pH	Type of Element
(*a*)	<7	Metal
(*b*)	<7	Non-metal
(*c*)	>7	Metal
(*d*)	>7	Non-Metal

Which option is correct?

5. **Which of the following will be present in dilute aqueous solution of sulphuric acid?** [DoE Pre-Board 2023]
   (*a*) $H_3O^+ + SO_4^{2-}$
   (*b*) $H_3O^+ + OH^-$
   (*c*) $OH^- + SO_4^{2-}$
   (*d*) $H_3O^+ + SO_2$

6. **A student learnts that plants grow when the pH of the soil is slightly acidic. Which range of pH is most suited for plant growth?** [CBSE T.E.R.M.*]
   (*a*) 1 – 3 (*b*) 5.5 – 7
   (*c*) 7 – 9 (*d*) 11 – 14

7. The change in colour of the moist litmus paper in the given set up is due to [CBSE Sample Paper 2023]



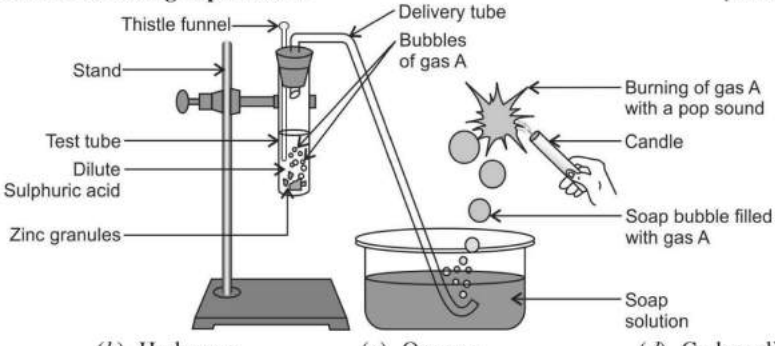
(*i*) presence of acid **(*ii*) presence of base**
(*iii*) presence of H^+(aq) in the solution **(*iv*) presence of litmus which acts as an indicator**
(*a*) (*i*) and (*ii*) (*b*) Only (*ii*) (*c*) Only (*iii*) (*d*) Only (*iv*)

8. With the reference to four gases CO_2, CO, Cl_2 and O_2, which one of the option in the table is correct? [CBSE Sample Paper 2023]

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

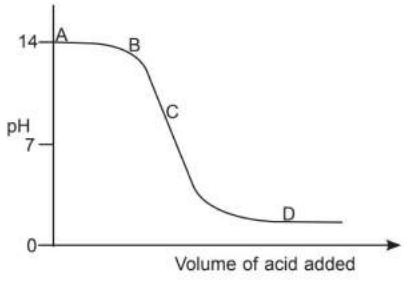
9. Anita added a drop each of diluted acetic acid and diluted hydrochloric acid on pH paper and compared the colors. Which of the following is the correct conclusion? [CBSE Sample Paper 2023]
(*a*) pH of acetic acid is more than that of hydrochloric acid.
(*b*) pH of acetic acid is less than that of hydrochloric acid.
(*c*) Acetic acid dissociates completely in aqueous solution.
(*d*) Acetic acid is a strong acid.

10. Identify gas A in the following experiment. [CBSE Sample Paper 2022]



(*a*) Nitrogen (*b*) Hydrogen (*c*) Oxygen (*d*) Carbon dioxide

11. 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? [CBSE Sample Paper 2022]

(*a*) A (*b*) B
(*c*) C (*d*) D

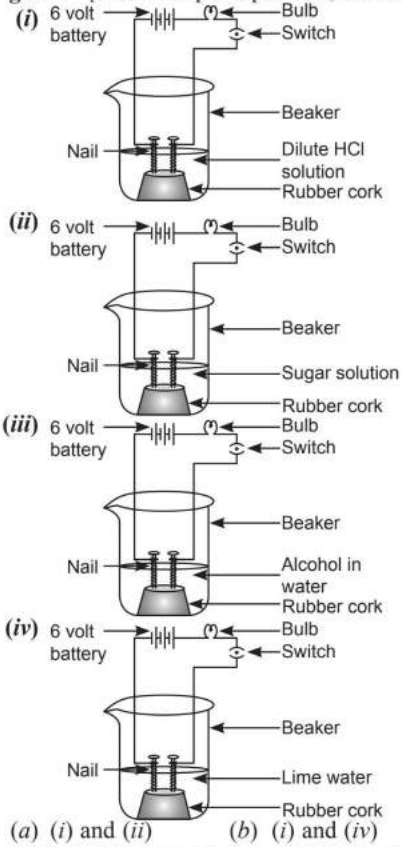
12. Which of the given options correctly represents the parent acid and base of calcium carbonate? [CBSE Sample Paper 2022]

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

13. How will you protect yourself from the heat generated while diluting a concentrated acid? [CBSE Sample Paper 2022]

(*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.

14. In which of the following setups would the bulb glow? [CBSE Sample Paper 2022; Similar CBSE 2023]



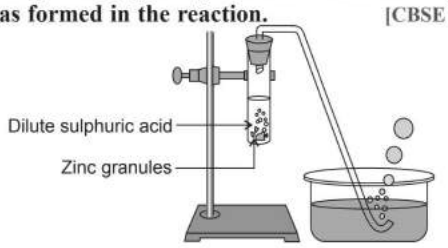
(*a*) (*i*) and (*ii*) (*b*) (*i*) and (*iv*)
(*c*) (*ii*), (*iii*) and (*iv*) (*d*) (*i*), (*ii*) and (*iv*)

15. Which of the following oxide(s) is/are soluble in water to form alkalies? [CBSE 2021]

(*i*) Na_2O (*ii*) SO_2 (*iii*) K_2O (*iv*) NO_2

(*a*) (*i*) and (*iii*) (*b*) (*i*) only
(*c*) (*ii*) and (*iv*) (*d*) (*iii*) only

16. Study the diagram given below and identify the gas formed in the reaction. [CBSE 2021]



(*a*) Carbon dioxide which extinguishes the burning candle.
(*b*) Oxygen due to which the candle burns more brightly.
(*c*) Sulphur dioxide which produces a suffocating smell.
(*d*) Hydrogen which while burning produces a popping sound.

17. Which of the options in the given table are correct? [CBSE 2021]

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*) (*b*) (*i*) and (*iv*)
(*c*) (*ii*) and (*iii*) (*d*) (*iii*) and (*iv*)

18. Select from the following the statement which is true for bases. [CBSE 2021]

(*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 phenolphthalein is added to them.

19. Study the following table and choose the correct option: [CBSE 2021]

	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

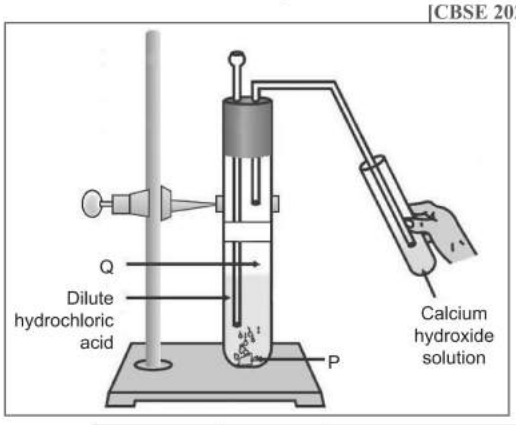
20. Consider the pH value of the following acidic samples: [CBSE 2021]

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

The decreasing order of their H^+ ion concentration is

(*a*) 3 > 4 > 1 > 2 (*b*) 2 > 1 > 3 > 4
(*c*) 2 > 1 > 4 > 3 (*d*) 3 > 4 > 2 > 1

21. Study the experimental set up shown in given figure and choose the correct option from the following: [CBSE 2021]



	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

22. An aqueous solution with pH = 1 is

(*a*) strongly acidic (*b*) strongly basic
(*c*) neutral (*d*) weakly acidic

23. Curd cannot be stored in [DoE]

(*i*) Brass vessel (*ii*) Copper vessel
(*iii*) Steel (*iv*) Bronze

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

24. When a small amount of acid is added to water, the phenomena which occur are:

(A) Dilution
(B) Neutralisation
(C) Formation of H_3O^+ ions
(D) Salt formation

The correct statements are: [CBSE 2020]

(*a*) (A) and (C) (*b*) (B) and (D)
(*c*) (A) and (B) (*d*) (C) and (D)

25. $NaHCO_3$ is formed by reaction of

(*a*) $NaOH + H_2CO_3$ (*b*) $NaCl + H_2CO_3$
(*c*) $Na_2CO_3 + HCl$ (*d*) $NaOH + Na_2CO_3$

26. pH of H_2O is

(*a*) 7 (*b*) 8 (*c*) 9 (*d*) 10

27. Ag_2S reacts with H_2SO_4 to form

(*a*) $AgSO_4$ (*b*) $Ag_2SO_4 + H_2S$
(*c*) $Ag_2O + H_2S$ (*d*) $AgOH + H_2S$

28. A solution turns the colour of turmeric to reddish brown. If the same solution is poured on universal indicator the colour would change to [CBSE 2023]

(*a*) violet (*b*) blue
(*c*) red (*d*) green

29. Acid present in tomato is [CBSE 2023]

(*a*) methanoic acid (*b*) acetic acid
(*c*) lactic acid (*d*) oxalic acid

Answers

1. (*c*) Calcium carbonate reacts with HCl to form brisk effervescence due to CO_2.
$CaCO_3 + 2HCl \longrightarrow CaCl_2 + H_2O + CO_2$
others will not react with HCl.
2. (*a*) Milk is nearly neutral. When it changes to curd its pH decreases as lactic acid is present in curd. pH keeps on decreasing, curd is acidic with low pH.
3. (*d*) Banana is basic in nature.
4. (*a*) The pH of acid before the reaction is less than 7. The element is metal which forms basic oxide.
5. (*a*) $H_2SO_4 + 2H_2O \longrightarrow H_3O^+ + SO_4^{2-}$
6. (*b*)
7. (*c*) Acids turn moist blue litmus paper red.
8. (*b*)
9. (*a*) Acetic acid is weaker acid with pH more than hydrochloric acid (strong acid).
10. (*b*) $Zn(s) + H_2SO_4(dil.) \longrightarrow ZnSO_4(aq) + H_2(g)$
11. (*d*) Salt and excess of acid is present.
12. (*b*) $H_2CO_3 + Ca(OH)_2 \longrightarrow CaCO_3 + H_2O$
13. (*a*) Cooling under running water will also help.
14. (*b*) Dil. HCl, lime water will conduct electricity, sugar solution and alcohol will not.
15. (*a*) $Na_2O + H_2O \longrightarrow 2NaOH$; $K_2O + H_2O \longrightarrow 2KOH$
16. (*d*)
17. (*c*)
18. (*d*) Bases turn phenolphthalein pink.
19. (*d*) CH_3COOH is weak acid and NaOH is strong base.
20. (*c*) Higher the concentration of H^+, lower will be pH.
21. (*d*) $K_2CO_3 + 2HCl \longrightarrow 2KCl + CO_2 + H_2O$;
$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$

22. (*a*) Lower the pH, stronger will be acid.
23. (*c*) Copper reacts with acid to form poisonous substance.
24. (*a*)
25. (*a*) $NaOH + H_2CO_3 \longrightarrow NaHCO_3 + H_2O$
26. (*a*) pH of H_2O is 7 because it is neutral.
27. (*b*) $Ag_2S + H_2SO_4 \longrightarrow Ag_2SO_4 + H_2S$
28. (*b*) $\because$ solution is basic in nature.
29. (*d*)

Very Short Answer Type Questions 2 Marks

30. To prepare a salad dressing, Parag adds a solution of sodium chloride in distilled water to vinegar. State what change will occur in the following:
(*a*) the pH of the vinegar
(*b*) the acidity of the vinegar [CFPQ, CBSE]

Ans. (*a*) The pH will increase because vinegar (dil. solution of acetic acid) is acidic in nature whereas NaCl(*aq*) is neutral (pH = 7).
(*b*) The acidity will decrease because NaCl(*aq*) is being added i.e., water is being increased. Acidity decreases with dilution.

31. pH is measured using a pH meter, which comprises a detecting unit consisting of a pH sensitive glass electrode and an indicating unit which indicates the pH as shown below.

To measure the pH of a solution, the glass electrode is dipped into the solution and the pH is displayed on the screen of the indicating unit. Before measuring the pH of another solution, the glass electrode is rinsed with distilled water and dried carefully with tissue paper.
How is the pH reading of the second solution likely to be affected if the glass electrode is not dried with tissue paper in the following cases?
(*a*) If the second solution being measured is acidic in nature.
(*b*) If the second solution being measured is basic in nature. [CFPQ, CBSE]

Ans. (*a*) The pH meter will indicate a slightly higher pH reading than the actual pH of the solution if the second solution is acidic because distilled water will decrease H_3O^+ concentration.
(*b*) The pH meter will indicate a slightly lower pH reading than the actual pH of the solution if the second solution is basic because distilled water will decrease (OH^-) and increase (H_3O^+).

32. Dipti has three flasks containing dilute hydrochloric acid, dilute sulphuric acid and dilute sodium hydroxide respectively. The flasks are not labeled and she does not have any pH indicator.
(*a*) Which of the solutions will she be able to identify just by making mixtures of pairs of the substances?
(*b*) What observation will help her to make this identification? [CFPQ, CBSE]

Ans. (*a*) The dilute sodium hydroxide
(*b*) The flasks containing mixtures of sodium hydroxide with hydrochloric acid and with sulphuric acid will be warm to touch.
$NaOH + HCl \longrightarrow NaCl + H_2O + heat$
$2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O + heat$
Neutralisation reactions are exothermic.

33. (*a*) What is the colour of litmus in a solution of ammonium hydroxide?
(*b*) A bud of *Petunia* became reddish purple after first shower of rain. What does it indicate?

Ans. (*a*) Red litmus will turn blue in ammonium hydroxide.
(*b*) The rain was acid-rain.

34. (*a*) How will you test for the gas which is liberated when hydrochloric acid reacts with an active metal?
(*b*) Which gas is evolved when sodium hydrogencarbonate reacts with dilute hydrochloric acid?

Ans. (*a*) Bring a burning matchstick near the gas. It burns with 'pop' sound showing that it is hydrogen.
(*b*) Carbon dioxide gas is evolved.

35. (*a*) A few drops of sulphuric acid is added to water before electrolysis, why?
(*b*) What effect does the concentration of $H^+(aq)$ have on the acidic nature of the solution?

Ans. (*a*) It makes water better conductor.
(*b*) Acidic nature increases with increase in conc. of H_3O^+ ion.

36. (*a*) Name the metals which are soluble in aqua regia.
(*b*) What will you do if conc. H_2SO_4 falls on your hand?

Ans. (*a*) Au and Pt can dissolve in aqua regia.
(*b*) Put hand in running water till irritation stops.

37. Out of the two — hydrochloric acid and acetic acid, which one is considered a strong acid and why? Write the name/molecular formula of one more strong acid. [CBSE 2021 (C)]

Ans. Hydrochloric acid is a strong acid because it has more number of hydronium (H_3O^+) ions whereas acetic acid contains less number of hydronium (H_3O^+) ions. So it is a weak acid.
Sulphuric acid (H_2SO_4) is also a strong acid.

38. What are the amphoteric oxides? Give an example. [CBSE 2021 (C)]

Ans. Amphoteric oxides have both acidic and basic properties. They form salts when they react with acids. They also react with alkalis to form complex salts. Examples: Al_2O_3.

39. Define olfactory indicators. Name two substances which can be used as olfactory indicators.

Ans. Those substances whose smell (odour) changes in acidic or basic solution are called olfactory indicators, e.g. onion and vanilla.

40. Classify the following into strong acids and weak acids.
CH_3COOH, H_2SO_4, H_2CO_3, HNO_3

Ans. H_2SO_4 and HNO_3 are strong acids.
CH_2COOH, H_2CO_3 and H_2SO_3 are weak acids.

41. Explain the action of dilute hydrochloric acid on the following with chemical equations: [CBSE 2015]
(*a*) Magnesium ribbon
(*b*) Crushed egg shells

Ans. (*a*) Hydrogen gas will be formed, e.g.
$Mg\ (s) + 2HCl\ (dil) \longrightarrow MgCl_2\ (aq) + H_2\ (s)$
(*b*) Crushed egg shells are made up of $CaCO_3$ which reacts with dil HCl to give brisk effervescence due to CO_2, e.g.
$CaCO_3\ (s) + 2HCl \longrightarrow CaCl_2 + H_2O + CO_2$

42. Write two example of neutralization reaction.

Ans. Examples of neutralization reaction are as follows:
(*i*) $HCl\ (aq) + NH_4OH\ (aq) \longrightarrow NH_4Cl\ (aq) + H_2O$
(*ii*) $NaOH\ (aq) + HCl\ (aq) \longrightarrow NaCl\ (aq) + H_2O$

43. A clear solution of slaked lime is made by dissolving $Ca(OH)_2$ in an excess of water. This solution is left exposed to air. The solution slowly goes milky as a faint white precipitate forms. Explain why a faint white precipitate forms, support your response with the help of a chemical equation.
[CBSE Sample Paper 2023]

Ans. Calcium hydroxide reacts with carbon dioxide present in the atmosphere to form calcium carbonate which results in milkiness/white ppt / Formation of calcium carbonate **(1 mark)**
$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$ **(1 mark)**
[CBSE Marking Scheme]

44. Keerti added dilute hydrochloric acid to four metals and recorded her observations as shown in the table given below:

Metal	Gas Evolved
Copper	Yes
Iron	Yes
Magnesium	No
Zinc	Yes

Select the correct observation(s) and give chemical equation(s) of the reaction involved.
[CBSE Sample Paper 2023]

Ans. $Fe + HCl \rightarrow FeCl_2/\ FeCl_3 + H_2$ **(1 mark)**
$Zn + HCl \rightarrow ZnCl_2 + H_2$ **(1 mark)**
[CBSE Marking Scheme]

Short Answer Type Questions 3 Marks

45. The pH of three solutions is given in the table. Answer the questions that follow.

Solution	pH
P	1
Q	7
R	14

(*a*) Which of these solutions could possibly react with zinc metal to produce hydrogen gas?
(*b*) Which of these solutions could be formed by the reaction of a metal oxide with water?
(*c*) Which of these solutions could be the raw material for the industrial manufacture of chlorine? [CFPQ, CBSE]

Ans. (*a*) – Solution P because it is acid (strong), will displace H_2 by reacting with zinc.
– Solution R because it is strong base, zinc reacts with strong base to form $H_2(g)$.
(*b*) Solution R because it is strong base, formed by reaction of metal oxide with water to form metal hydroxide (base).
(*c*) Solution Q is of NaCl (pH = 7) which on electrolysis will produce chlorine gas on industrial scale as a by-product in manufacture of NaOH.

46. Sunlta carried out the following reactions in the laboratory:
(*i*) Complete neutralisation of one mole of sodium carbonate with hydrochloric acid
(*ii*) Complete neutralisation of one mole of sodium bicarbonate with hydrochloric acid
She found that the amount of carbon dioxide formed in both the reactions was the same.
(*a*) Is her finding correct? Justify your answer.
(*b*) How does the amount of salt formed in case (*i*) compare with the amount of salt formed in case (*ii*)? [CFPQ, CBSE]

Ans. (*a*) Yes, her finding is correct.
1 mole of CO_2 is produced in both the cases.

$$Na_2CO_3(s) + 2HCl(dil.) \longrightarrow 2NaCl(aq) + H_2O + CO_2(g) \quad ...(i)$$

$$NaHCO_3(s) + HCl(dil.) \longrightarrow NaCl(aq) + H_2O(l) + CO_2(g) \quad ...(ii)$$

(*b*) The amount of salt (2 mole NaCl) formed in case (*i*) is twice the amount of salt (1 mole of NaCl) formed in case (*ii*).

Questions 47, 48 and 49 are based on the given passage.

Rajesh was given a substance and asked to identify it. He conducted three tests on the substance and recorded the results below.

P. It releases carbon dioxide, water and a sodium salt on heating with water.

Q. It turns universal indicator greenish-blue.

R. It can be prepared from ammonia as a raw material. **[CFPQ, CBSE]**

47. What substance was Rajesh given?

Ans. Sodium bicarbonate ($NaHCO_3$).

48. Give ONE use of the substance based on the properties mentioned in P and Q.

Ans. – Used as antacids
– Used as baking soda
– Used as a first aid in acidic insect bites
– Used in soda acid-fire extinguisher (*any one*)

49. Rajesh later read that recrystallisation of the sodium salt formed in P gives another basic salt that is used in manufacture of borax.
Identify the sodium salt formed in P.

Ans. Sodium carbonate (Na_2CO_3) is used for manufacture of borax ($Na_2B_4O_7.10H_2O$)

50. While constructing a house, a builder selects marble flooring and marble top for kitchen where vinegar and juices of lemon, tamarind etc. are more often used for cooking. Will you agree to this selection and why? **[DoE]**

Ans. No, I won't agree with the selection because vinegar, juices of lemon and tamarind contains organic acids like acetic acid, citric acid and tartaric acid. Marble is calcium carbonate. If accidentally juices of citrus fruits will fall on the marble floor, it will react with the calcium carbonate and will leave mark on the floor which will look really bed.

51. 1 g of solid sodium chloride is taken in a clean and dry test tube and 2 mL of conc. sulphuric acid is added to it. If the gas evolved is tested first with dry and then with wet blue litmus paper, in which case will the litmus paper change colour? Give reason for your answer with chemical equation for the reaction. **[CBSE 2018 (C)]**

Ans. The colour change will be observed in wet blue litmus paper because moisture/water is needed for the formation of hydronium ions due to which colour change of litmus paper take place.

$$2NaCl + H_2SO_4 \longrightarrow Na_2SO_4 + 2HCl$$

52. 2 mL of sodium hydroxide solution is added to a few pieces of granulated zinc metal taken in a test tube. When the contents 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. **[CBSE 2020, 18]**

Ans. (*a*) Zinc reacts with NaOH to form sodium zincate and hydrogen gas

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

(*b*) When a burning splinter is brought near the gas, the splinter will gives out a 'pop' sound which shows the gas evolved is hydrogen.

(*c*) Hydrogen gas will be evolved when Zn metal reacts with dilute solution of strong acid.

$$Zn(s) + H_2SO_4(aq) \longrightarrow ZnSO_4(aq) + H_2\uparrow$$

Long Answer Type Questions 5 Marks

53. A remarkable property of acids is that they can 'dissolve' metals. When metals are added to an acid, they disintegrate and disappear into the acid.

(*a*) State one other common observation when metals 'dissolve' in acids. Explain the reason for this observation.

(*b*) If the acid with the 'dissolved' metal is evaporated, can we get the metal back? Why or why not?

(*c*) In this question, the word 'dissolve' is used within quotes. This is because it is not actually an example of dissolving. What is the MAIN difference between a metal 'dissolving' in an acid and sugar dissolving in water?
[CFPQ, CBSE]

Ans. (*a*) **Observation:** Bubbling is seen.
Reason: Because hydrogen is produced, e.g.

$$Zn(s) + H_2SO_4(dil.) \longrightarrow ZnSO_4(aq) + H_2(g) + heat$$

Alternative solution:
Observation: The vessel becomes warm.
Reason: Because it is an exothermic reaction.

(*b*) – No, because metal has reacted with acid to form salt solution.
– The metal is present as a part of a salt solution.

(*c*) Metal dissolving in acid is a chemical change while sugar dissolving in water is a physical

change. In chemical change, metal cannot be recovered whereas in sugar solution, sugar can be obtained by crystallisation.

54. State reason for the following statements:

(*a*) Tap water conducts electricity whereas distilled water does not.

(*b*) Dry hydrogen chloride gas does not turn blue litmus red whereas dilute hydrochloric acid does.

(*c*) During summer season, a milk man usually adds a very small amount of baking soda to fresh milk.

(*d*) For a dilution of acid, acid is added into water and not water into acid.

(*e*) Ammonia is a base but does not contain hydroxyl group. **[CBSE 2015]**

Ans. (*a*) Tap water contains ions which conduct electricity, distilled water does not contain ions.

(*b*) Dry HCl does not form ions but HCl gives H^+ and Cl^-.

(*c*) Baking soda does not allow milk to change to lactic acid which makes milk sour.

(*d*) Adding water to acid is highly exothermic. Therefore, water is added to acid very slowly with cooling.

(*e*) Ammonia dissolves in water forms OH^-. Therefore, it is basic.

$NH_3 + H_2O \longrightarrow NH_4^+ + OH^-$

55. (*a*) The pH of soil A is 7.5 while that of soil B is 4.5. Which of the two soils A or B should be treated with powdered chalk to adjust its pH and why? **[CBSE 2016]**

(*b*) Name the chemical which is injected into the skin of a person:

(*i*) During an ant's sting

(*ii*) During the nettle leaf sting.

How can the effect of these stings be neutralised?

(*c*) Explain how the pH change in the river water can endanger the lives of aquatic animals like fish?

Ans. (*a*) Soil 'B' is acidic. It should be treated with powdered chalk which is basic so as to adjust its pH.

(*b*) (*i*) Formic acid, (HCOOH).

(*ii*) Formic acid, (HCOOH).

The effect of these stings neutralized by rubbing the skin with mild base like baking soda ($NaHCO_3$).

(*c*) If pH of river water changes, amount of oxygen dissolved in water may decrease. Acidic and basic water is harmful for skin of aquatic animals like fish.

PRACTICE QUESTIONS

1. Select the correct option(s) in the following table.

Option	Natural source	Acid present
(*i*)	Tamarind	Tartaric acid
(*ii*)	Tomato	Lactic acid
(*iii*)	Ant sting	Oxalic acid
(*iv*)	Nettle sting	Methanoic acid

[CBSE 2023]

(*a*) (*i*) only (*b*) (*iii*) only

(*c*) (*i*) and (*iv*) (*d*) (*i*), (*ii*) and (*iv*)

2. The aqua regia is

(*a*) $3HNO_3$(conc.) + 1 HCl (conc.)

(*b*) 3HCl (conc.) + 1 HNO_3 (conc.)

(*c*) HNO_3 (conc.) + H_2SO_4 (conc.)

(*d*) HNO_3(conc.) + HCl (conc.)

3. The acid having highest hydronium ion concentration is one with

(*a*) pH = 2.5 (*b*) pH = 1.8

(*c*) pH = 7 (*d*) pH = 10 **[KVS]**

4. The table below has information regarding pH and nature (acidic/basic) for four different solutions. Which one of the option in the table is correct? **[CBSE 2023]**

	Solution	Colour of pH paper	Approx pH	Nature of solution
(*a*)	Lemon juice	Orange	3	Basic
(*b*)	Milk of magnesia	Blue	10	Basic
(*c*)	Gastric juice	Red	6	Acidic
(*d*)	Pure water	Yellow	7	Neutral

5. Name the acid present in the following:

(*a*) Tomato (*b*) Vinegar **[CBSE 2015]**

6. Write any two natural and two synthetic indicators.

7. A student dropped few pieces of marble in dilute HCl contained in a test tube. The evolved gas was passed through lime water.

(*a*) What change would be observed in lime water?

(*b*) Write balanced chemical equation for the above change.

8. What happens when an acid reacts with metal oxides? Give two chemical equations of the reaction involved.

9. Name an indicator which is
   (*a*) pink in acidic solution and yellow in basic solution.
   (*b*) colourless in acidic solution and pink in basic solution.
10. (*a*) Which bases are called alkalies? Give an example of alkalies.
    (*b*) What is cure for bee sting? Why?
11. (*a*) The pH of a sample of vegetable soup was found to be 6.5. How is this soup likely to taste?
    (*b*) Which remedy you will suggest if someone in family is suffering from problem of acidity and why?
12. (*a*) What are antacids? Give one example.
    (*b*) State the purpose for which litmus is used in laboratories. **[CBSE 2021 (C)]**
13. (*a*) What is an alkali? Give an example.
    (*b*) Why do HCl, HNO_3, etc. show acidic characters in aqueous solutions while solutions of compounds like alcohol and glucose do not show acidic character?
14. Identify the acid and base which form sodium hydrogen carbonate. Write chemical equation in support of your answer. State whether this compound is acidic, basic or neutral. Also write its pH value. **[Delhi 2019]**
15. On passing excess carbon dioxide gas through lime water, it first turns milky and then becomes colourless. Explain why? Write all the chemical equations of the reactions involved. **[CBSE 2023, 20, 16]**
16. (*a*) What is pH value of salt formed by a
    (*i*) weak acid and strong base?
    (*ii*) strong acid and strong base?
    (*b*) 15 mL of water and 10 mL of sulphuric acid are to be mixed in a beaker
    (*i*) State the method that should be followed with reason.
    (*ii*) What is this process called? **[CBSE 2015]**
    (*c*) What is observed when sulphur dioxide is passed through
    (*i*) water (*ii*) lime water?
    Also write chemical equations for the reactions that take place.
17. (*a*) The soil in a field is highly acidic. List any two materials which can be added to this soil to reduce its acidity. Give the reason for your choice. **[CBSE 2016]**
    (*b*) A gas produced in the laboratory is highly soluble in water. Its colourless solution turns pink when a few drops of phenolphthalein is added to it. What is the nature of this gas?
18. (*a*) Explain the following chemical properties of acids with the help of balanced chemical equations only.
    (*i*) when an acid reacts with a metal carbonate
    (*ii*) when an acid reacts with a metal bicarbonate
    (*iii*) when an acid reacts with a metal oxide
    (*b*) You are given three solutions A, B and C with pH values 2, 10 and 13 respectively. Write which solution has more hydrogen ion concentration among the three and state the nature 'acidic or basic' of each solution.
19. (*a*) A metal compound 'X' reacts with dil. H_2SO_4 to produce effervescence The gas evolved extinguishes a burning candle. If one of the compounds formed is calcium sulphate, then what is 'X' and the gas evolved? Also write a balanced chemical equation for the reaction which occurred.
    (*b*) (*i*) Name one antacid. How does it help to relieve indigestion in stomach?
    (*ii*) A farmer treats the soil with quick lime or calcium carbonate. What is the nature of soil? Why does the farmer treat the soil with quick lime?

TOPIC COVERED

More about Salts

Multiple Choice Questions — 1 Mark

1. **Dry slaked lime reacts with Cl_2 gas to form**
   (*a*) $CaCl_2$ (*b*) $CaOCl_2$
   (*c*) $Ca(OH)_2$ (*d*) CaO
2. **Which of the following salts do not have the water of crystalisation?** **[CBSE 2021]**
   (*i*) Bleaching powder (*ii*) Plaster of Paris
   (*iii*) Washing soda (*iv*) Baking soda
   (*a*) (*ii*) and (*iv*)
   (*b*) (*i*) and (*iii*)
   (*c*) (*ii*) and (*iii*)
   (*d*) (*i*) and (*iv*)
3. **Which of the following is not a acidic salt?**
   (*a*) $CuSO_4$ (*b*) NH_4Cl
   (*c*) $FeCl_3$ (*d*) CH_3COONa

4. A solution of NaCl
(*i*) will turn red litmus blue
(*ii*) will turn pH paper green
(*iii*) will turn blue litmus red
(*iv*) will not affect litmus
(*a*) (*i*) and (*ii*) (*b*) (*i*), and, (*iii*)
(*c*) (*i*) and (*iv*) (*d*) (*ii*) and (*iv*)

5. Many salts absorbs water from atmosphere. This property is called
(*a*) deliquescence (*b*) efflorescence
(*c*) hydration (*d*) addition

6. $CaOCl_2$ will liberate Cl_2 gas in presence of
(*i*) CO_2 (*ii*) HCl (*iii*) CO (*iv*) NO
(*a*) (*i*) and (*ii*) (*b*) (*ii*) and (*iii*)
(*c*) (*i*) and (*iv*) (*d*) (*ii*) and (*iv*)

7. Egg shell is made up of
(*a*) $CaCO_3$ (*b*) CaO
(*c*) $Ca(OH)_2$ (*d*) $CaCl_2$

8. Two salts X and Y are dissolved in water separately. When phenolphthalein is added to these two solutions, the solution 'X' turns pink and the solution Y does not show any change in colour, therefore X and Y are [CBSE 2023]

	X	Y
(*a*)	Na_2CO_3	NH_4Cl
(*b*)	Na_2SO_4	$NaHCO_3$
(*c*)	NH_4Cl	Na_2SO_4
(*d*)	$NaNO_3$	Na_2SO_4

9. NaOH is obtained by electrolysis of
(*a*) Aq. solution of NaCl
(*b*) Aq. Na_2CO_3 (*c*) Aq. $NaHCO_3$
(*d*) Molten NaCl

10. Baking soda is a mixture of: [CBSE 2020]
(*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

11. The chemical formula for Plaster of Paris is: [CBSE 2020]
(*a*) $CaSO_4.2H_2O$ (*b*) $CaSO_4.H_2O$
(*c*) $CaSO_4.\frac{1}{2}H_2O$ (*d*) $2CaSO_4.H_2O$

Answers

1. (*b*) $Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2 + H_2O$
2. (*d*) Bleaching powder ($CaOCl_2$) and Baking soda ($NaHCO_3$) do not have water of crystalisation.
3. (*d*) It is basic salt of strong base NaOH and weak acid CH_3COOH.
4. (*d*) NaCl is neutral salt.
5. (*a*)
6. (*a*) $CaOCl_2 + CO_2 \longrightarrow CaCO_3 + Cl_2$
   $CaOCl_2 + 2HCl \longrightarrow CaCl_2 + Cl_2 + H_2O$
7. (*a*)
8. (*a*) Na_2CO_3 is basic turns phenolphthalein pink, NH_4Cl does not.
9. (*a*) $2NaCl + 2H_2O \longrightarrow 2NaOH + H_2 + Cl_2$
10. (*c*) Baking soda is mixture of $NaHCO_3$ and tartaric acid.
11. (*c*) $CaSO_4.\frac{1}{2}H_2O$ is Plaster of Paris.

VSA Very Short Answer Type Questions 2 Marks

12. (*a*) Why does bleaching powder act as bleaching agent?
(*b*) Write chemical equation representing the action of CO_2 present in atmosphere on bleaching powder left in open. [CBSE 2013]

Ans. (*a*) It is because it is oxidising agent.
(*b*) $CaOCl_2 + CO_2 \longrightarrow CaCO_3 + Cl_2(g)$

13. 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.

Ans. (*i*) The salt is sodium hydrogen carbonate ($NaHCO_3$) or sodium bicarbonate (pH = 8.4).
(*ii*) Manufacture of baking soda is as follows:
$NaCl + H_2O + CO_2 + NH_3 \rightarrow NH_4Cl + NaHCO_3$

SA Short Answer Type Questions 3 Marks

14. 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. [CBSE 2020]

Ans. Washing soda is perpared from sodium carbonate by crystallisation of saturated solution of sodium carbonate.

$$\underset{\text{Sodium carbonate}}{Na_2CO_3} + 10H_2O(l) \longrightarrow \underset{\text{Washing soda}}{Na_2CO_3.10H_2O(s)}$$

Sodium carbonate is basic salt because it is salt of strong base (NaOH) and weak acid (H_2CO_3).
It can be used for removal of permanent hardness of water.

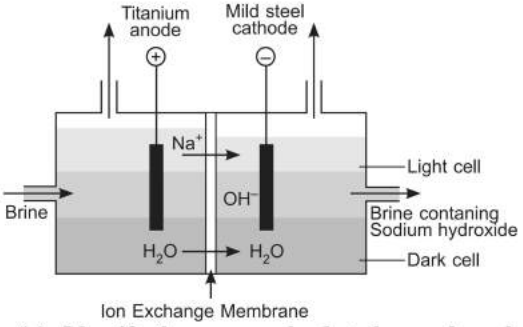
15. (*a*) Mention the pH of aqueous solution of the following salts as 7, more than 7, less than 7.
NH_4Cl, $NaNO_3$
(*b*) Two solutions 'A' and 'B' have pH value 3.0 and 10.5 respectively. Which of these will turn
(*i*) Blue litmus solution red.
(*ii*) Phenolphthalein from colourless to pink?
Justify you answer in each case.

Ans. (*a*) (*i*) NH_4Cl pH < 7
(*ii*) $NaNO_3$ pH = 7
(*b*) (*i*) pH = 3.0 will turn blue litmus red because it is acidic in nature.
(*ii*) pH = 10.5 will turn phenolphthalein colourless to pink because solution is basic in nature.

16. (*a*) Write the chemical equation involved in the preparation of sodium hydroxide. Name the process.
(*b*) Why does bleaching powder smell strongly of chlorine and does not dissolve completely in water? [DoE]

Ans. (*a*) $2NaCl(aq) + 2H_2O(l) \xrightarrow{\text{Electrolysis}} 2NaOH(aq) + H_2(g) + Cl_2(g)$
It is called chlor-alkali process.
(*b*) When bleaching powder is exposed to air, it gives strong smell of chlorine because bleaching powder reacts with carbon dioxide from the atmosphere to produce calcium carbonate and chlorine.
$CaOCl_2 + CO_2 \longrightarrow CaCO_3 + Cl_2$
Bleaching powder is a mixture of different calcium salts which are insoluble in water.

17.



(*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.
[CBSE Sample Paper 2023]

Ans. (*a*) Anode: Chlorine; Cathode: Hydrogen **(1 mark)**
(*b*) Chlor alkali process as the products obtained are alkali, chlorine gas and hydrogen gas. **(1 mark)**
(*c*) $2NaCl(aq) + 2H_2O(l) \xrightarrow{\text{Electric current}} 2NaOH(aq) + Cl_2(g) + H_2(g)$ **(1 mark)**
[CBSE Marking Scheme]

18. (*a*) For the preparation of cakes, baking powder is used. If at home your mother uses baking soda instead of baking powder, how will it affect the taste of the cake and why?
(*b*) How is baking soda be converted into baking powder? [CBSE 2020]
(*c*) What makes the cake soft and spongy? [CBSE 2018(C)]

Ans. (*a*) Baking powder consists of sodium hydrogencarbonate (baking soda) and tartaric acid. If only baking soda is used in making cake, then sodium carbonate is formed on heating which will give a bitter taste to cake.
(*b*) Baking soda can be converted into baking by adding starch and tartaric acid.
(*c*) Sodium hydrogencarbonate gives carbon dioxide (CO_2) gas which makes the cakes soft and spongy.

19. What is water of crystallisation? Name and give formula two salts which contain water of crystallisation. [CBSE 2018 for blind, CBSE 2020]

Ans. The water molecules present in crystalline salts are called water of crystallisation.
Hydrated copper sulphate (Blue vitriol)
$CuSO_4 . 5H_2O$
Hydrated ferrous sulphate (Green vitriol)
$FeSO_4 . 7H_2O$
Washing soda $Na_2CO_3 . 10H_2O$

20. White chemical compound becomes hard on mixing proper quantity of water. It is also used to maintain broken founts in fixed position. Name the chemical compound and write its chemical formula. Write the chemical equation to show what happens when water is added to this compound in proper quantity? [CBSE Sample Paper 2018]

Ans. The compound is Plaster of Paris. Its formula is
$CaSO_4 . \frac{1}{2}H_2O$
It changes into gypsum when proper quantity of water is added to it.
$CaSO_4 . \frac{1}{2}H_2O + \frac{3}{2}H_2O \longrightarrow CaSO_4 . 2H_2O$
Plaster of Pairs — Gypsum

PRACTICE QUESTIONS

1. Which of the following salts does not contain water of crystallisation? [KVS]
(*a*) Blue vitriol (*b*) Baking soda
(*c*) Gypsum (*d*) Washing soda

2. Select the washing soda from the following: [CBSE 2023]
(*a*) $NaHCO_3$
(*b*) $Na_2CO_3 . 5H_2O$
(*c*) $Na_2CO_3 . 10H_2O$
(*d*) $NaOH$

3. Few drops of aqueous solution NH_4Cl are put on universal indicator paper. The paper turns pink. Study the following table and choose the correct option. NH_4Cl is salt of [CBSE 2023]

	Nature	Acetic and Base	Range of pH
(*a*)	Acidic	Weak acid and strong base	< 7
(*b*)	Basic	Weak acid and strong base	> 7
(*c*)	Acidic	Strong acid and weak base	< 7
(*d*)	Basic	Strong acid and strong base	7

4. When dilute hydrochloric acid reacts with sodium hydrogen carbonate, then _____, carbon dioxide and water are formed.
   (*a*) sodium chloride (*b*) calcium chloride
   (*c*) sodium carbonate (*d*) calcium carbonate
5. Which of the following salts does not contain water of crystallisation?
   (*a*) Alum (*b*) Bleaching powder
   (*c*) Gypsum (*d*) Washing soda
6. List four uses of sodium bicarbonate.
7. 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 the change. [CBSE 2015][KVS]
8. A gas 'X' reacts with lime water and forms a compound 'Y' which is used as a bleaching agent in the chemical industry. Identify 'X' and 'Y'. Give the chemical equation of the reactions involved.
9. A compound which is prepared from gypsum has the property of hardening when mixed with proper quantity of water.
   (*a*) Identify the compound.
   (*b*) Write the chemical equation for its preparation.
   (*c*) Mention one important use of this compound.
10. List the important products of the Chlor-alkali process. Write one important use of each. [CBSE 2020]
11. (*a*) Crystals of a substance changed their color on heating in a closed test tube but regained it after some time when they were allowed to cool down. Name the substance and write its formula. Explain the phenomenon.
    (*b*) How is sodium carbonate prepared? Give two uses of the compound. [KVS]

INTEGRATED (MIXED) QUESTIONS

1. Answer the following questions:
   (*a*) State the colour of phenolphthalein in soap solution.
   (*b*) Name the by-product of chlor-alkali process which is used for the manufacture of bleaching powder.
   (*c*) Name one indicator which specifies the various levels of H^+ ion concentration. [CBSE 2016] **(3 Marks)**
2. (*a*) Which property do acids and bases have in common? Explain with the help of example.
   (*b*) A compound which is prepared from Gypsum has the property of hardening when mixed with water. Identify the compound and write its formula. How is compound prepared? Describe in form of chemical equation only. [CBSE 2023] **(3 Marks)**
3. Consider the following salts
   (*i*) YCl (*ii*) NH_4X and (*iii*) ZCO_3
   (*a*) What would be pH of salt solution of YCl if Y is Na?
   (*b*) If salt NH_4X, X is nitrate, then the solution will give what colour with universal indicator and why?
   (*c*) What will be change in colour in blue litmus solution if ZCO_3 is added to it and 'Z' is potassium. [CBSE 2023] **(3 Marks)**
4. (*a*) Given below are the pH values of four different liquids:
   7.0, 14.0, 4.0, 2.0
   Which of these could be that of
   (*i*) lemon juice,
   (*ii*) distilled water,
   (*iii*) 1 M sodium hydroxide solution,
   (*iv*) tomato juice? [KVS]
   (*b*) (*i*) What is the role of toothpastes in preventing cavities? [DoE]
   (*ii*) How washing soda is prepared from baking soda? [DoE] **(5 Marks)**
5. (*a*) What is chlor – alkali process? Give chemical equation of the reaction involved.
   (*b*) Write any two uses of bleaching powder.
   (*c*) Write equations to show the reaction between:
   (*i*) acid and bases
   (*ii*) acid and hydrogen carbonates **(5 Marks)**

6. (*a*) Identify the acid and the base whose combination forms the common salt that you use in your food. Write its formula and chemical name of this salt. Name the source from where it is obtained.

(*b*) What is rock salt? Mention its colour and the reason due to which it has this colour.

(*c*) What happens when electricity is passed through brine? Write the chemical equation for it.

(5 Marks)

ASSERTION AND REASON QUESTIONS

Direction: In the following Questions, the Assertion and Reason have been put forward. Read the statements carefully and choose the correct alternative from the following:

(*a*) Both the Assertion and the Reason are correct and the Reason is the correct explanation of the Assertion.

(*b*) The Assertion and the Reason are correct but the Reason is not the correct explanation of the Assertion.

(*c*) Assertion is true but the Reason is false.

(*d*) The statement of the Assertion is false but the Reason is true.

1. **Assertion:** Sodium hydrogen carbonate is used as an ingredient in antacids. **[CBSE 2021]**
   Reason: $NaHCO_3$ is a mild non-corrosive basic salt.
2. **Assertion:** Carbonic acid is weak acid
   Reason: It ionised completely in aqueous solution. **[KVS]**
3. **Assertion:** Copper sulphate is acidic salt.
   Reason: It is a salt of weak base $[Cu(OH)_2]$ and strong acid (H_2SO_4).
4. **Assertion:** Ammonium hydroxide is weak base.
   Reason: Phenolphthalein becomes pink in NH_4OH.
5. **Assertion:** Bleaching power liberate chlorine when kept in atmosphere.
   Reason: $CaOCl_2$ reacts with CO_2 present in atmosphere to form $CaCO_3$ and chlorine gas.
6. **Assertion:** Universal indicator gives green colour with distilled water.
   Reason: pH of distilled water is 7 and it is neutral and universal indicator gives green colour with neutral solution.
7. **Assertion:** The aqueous solutions of glucose and alcohol do not show acidic character.
   Reason: Aqueous solutions of glucose and alcohol do not give H^+ ions. **[KVS]**
8. **Assertion:** After white washing the walls, a shiny white finish on walls is obtained after two or three days.
   Reason: Calcium oxide reacts with carbon dioxide to form Calcium hydrogen carbonate which gives shiny white finish. **[CBSE Sample Paper 2021]**
9. **Assertion:** Ferrous sulphate is acidic salt.
   Reason: It is a salt of weak base $Fe(OH)_2$ and strong acid (H_2SO_4).
10. **Assertion:** Salts are formed by reaction of acid and base.
    Reason: Salts may be acidic, basic or neutral.
11. **Assertion:** Baking powder is used for making cake instead of baking soda.
    Reason: Baking powder contains tartaric acid which reacts with Na_2CO_3 and remove bitter taste.
12. **Assertion:** Pure water is neither acidic nor basic.
    Reason: The pH of solution is inversely proportional to conc. of $[H_3O]^+$.
13. **Assertion:** A gas is produced when conc. H_2SO_4 is added to NaCl in a test tube. The gas is passed over dry blue litmus paper, it changed to red.
    Reason: Blue colour of dry litmus paper does not change to red.
14. **Assertion:** A white coloured powder is used by doctors for supporting fractured bone. It is plaster of paris.
    Reason: It is gypsum.
15. **Assertion:** It is advised while diluting an acid, one should add water to acid, not acid to water keeping the solution continuously stirred.
    Reason: The process of dissolving an acid into water is highly exothermic.

CASE-BASED QUESTIONS

1. **Read the given passage and answer the questions based on passage and related studied concepts.**
   Taj Mahal, the great wonder of the world, is made of white marble which is composed of calcium carbonate. About 60 years ago it was discovered that this monument is being eaten away by acid rain. The Archeological survey of India, that looks after this building of historical importance is of the opinion

that the atmospheric pollution due to vehicular traffic and industries, mainly Mathura Refinery may be a major cause of acid rain in and around the monument. Normal rain is slightly acidic because it absorbs some CO_2 from the atmospheric air. Acid rain is more acidic than normal rain because it also has absorbed oxides of nitrogen and sulphur. [CBSE 2020]

(*a*) What is the formula of calcium carbonate?

(*b*) Name two gases which contribute to acid rain.

(*c*) What happens when acid rain falls on Taj Mahal? Write balanced chemical equation.

Or

(*c*) Name the acids and bases which will form calcium carbonate. What is nature of salt? Give reason.

2. Read the given passage and answer the questions based on passage and related studied concepts.

Salts are formed by reactions of acids and bases, strong acids react with strong bases to form neutral salt. Weak acids react with strong bases to form basic salts whose aqueous solution turned red litmus blue, phenolphthalein pink and universal indicator blue. Acidic salts are formed by strong acids and weak bases. Na_2CO_3 and $NaHCO_3$ are salts of NaOH (strong base) and H_2CO_3 (Carbonic acid) weak acid and are basic in nature. Electrolysis of brine solution gives caustic soda (NaOH), H_2 gas and Cl_2. Bleaching powder ($CaOCl_2$) is prepared when slaked lime reacts with dry chlorine gas used as disinfectant, washing soda is used to remove permanent hardness of water. Crystalline salts are hydrated and lose water of crystallisation on heating, may change colour and become amorphous (powdery). Gypsum on heating at 373K gives Plaster of Paris, used in making chalk, plastering fractured bones. $NaHCO_3$ is baking soda used in making crisp pakora and as antacid.

(*a*) What is formula of plaster of paris?

(*b*) What is composition of baking powder?

(*c*) What happens when milk of magnesia reacts with sulphuric acid? Write balanced chemical equation.

Or

(*c*) (*i*) Name an indicator used by visually impaired children.

(*ii*) Give one use of bleaching powder.

3. Answer the questions based on the paragraph given below and the related studied concepts.

The sour and bitter taste of food is due to acids and bases, respectively present in them. If some person is suffering from a problem of acidity after overeating, we give baking soda solution (ENO) to the person to give relief. Vinegar contains acetic acid, sour milk (curd) contains lactic acid, lemon contains citric acid where as nettle sting contains methanoic acid. Bitter gourd, cucumber, fenugreek are bitter in taste due to presence of bases in them.

(*a*) What is nature of bitter gourd juice?

(*b*) It soil is acidic in nature, which chemical is added to make it neutral?

(*c*) What happens when ammonium sulphate is warmed with aq. NaOH? What will be the nature of gas evolved and effect on litmus solution?

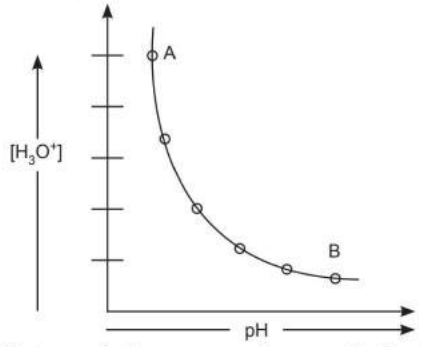
Or

(*c*)

Solution	Colour of universal indicator
A	Blue
B	Green
C	Red
D	Violet

Identify nature of A, B, C and D.

4. Observe the graph drawn between concentration of H_3O^+ Vs pH. Observe the graph carefully and answer the questions that follow:



(*a*) What conclusion can you draw on the basis of the graph?

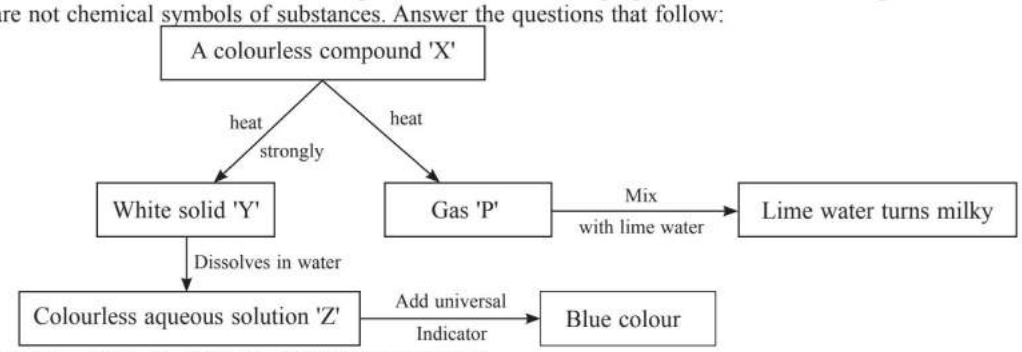
(*b*) Does base have H_3O^+ ? If yes then how are they basic?

(*c*) If pH = 2, what is concentration of H_3O^+?
[log $10^{-2} = -2$]

Or

(*c*) What is nature of 'A' and 'B' shown in graph? Give reason.

5. Lime is an alkaline substance. The figure shows some of the properties of a calcium compound 'X'. The letters are not chemical symbols of substances. Answer the questions that follow:



(*a*) Name an acid which can liberate 'P' from 'X'.
(*b*) Identify 'X' and 'Y'.
(*c*) Write chemical reaction from 'X' to 'Y' and identify 'P'.

Or

(*c*) Identify 'Z' and write equation between 'Z' and 'P'.

6. Mineral acids are strong acids as compared to organic acids. Mineral acids are HCl, H_2SO_4, HNO_3 which are obtained from minerals such as chlorides, sulphates and nitrates. Organic acids are present in living organisms. Strong acids are completely ionised in aqueous solution and their pH is close to 2. Weak acids do not ionise completely, their pH is close to 4. Acids combine with bases to form salts, which may be acidic, basic or neutral depending upon strength of acid and base.
(*a*) Name on organic acid.
(*b*) Give two examples of weak acids.
(*c*) What is nature of gastric juice secreted in our stomach? What is its pH?

Or

(*c*) Name one antacid. Give its pH in aqueous solution.

7. Crystalline salts have water of crystallisation. The number of water molecules associated with crystals depends upon size of cation. The colour and physical state may be different for crystalline and amorphous salt. Crystalline salts have well defined geometrical shape, sharp melting point. Amorphous compounds do not have well defined shape.
(*a*) What is colour of hydrated copper sulphate?
(*b*) What is formula of washing soda?
(*c*) What happens when hydrated copper sulphate is heated? Write chemical equation. **[CBSE 2023]**

Or

(*c*) What happens when water is added to anhydrous copper sulphate? Write chemical equation involved.

8. The teacher was conducting practicals in laboratory divided the students in three groups and gave them various solutions to find their pH and classify them into acidic, basic and neutral solutions.
Group A: Lemon juice, vinegar, colourless aerated drink.
Group B: Tomato juice, coffee, ginger juice.
Group C: Sodium hydroxide, sodium chloride lime water.
(*a*) For the solution provided, which group is/are likely to have pH value (*i*) < 7 (*ii*) > 7.
(*b*) List two ways of determining pH of a solution.
(*c*) Explain, why the sour substances such as lemon juice are effective in cleaning the tarnished copper vessels.

Or

(*c*) "pH has great importance in our daily life." Justify this statement giving two examples. **[CBSE 2023]**

NCERT ZONE

NCERT INTEXT QUESTIONS

Page 18

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

Ans. Dip red litmus paper in all the three test tubes. The one which changes its colour to blue contains basic solution. Now dip this blue litmus paper to each of

the two test tubes. The one which changes its colour to red is acidic solution, the remaining one is distilled water as it has no effect on any litmus paper.

Page 22

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

Ans. Curd and the sour substances if kept in brass or copper vessels react with them and form hydrogen and other harmful substances due to presence of acid in them. These toxic substance can cause food poisoning or other damage to health. Due to this reason, curd and the sour substances should not be kept in brass and copper vessels.

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

Ans. Usually, hydrogen gas is liberated when an acid reacts with a metal. For example, let us take the reaction between zinc and sulphuric acid.

Reaction of zinc granules with dil. H_2SO_4 to liberate hydrogen gas which burns with a 'pop' sound

1. Take 5 g of zinc granules in a Woulfe-bottle.
2. Set the apparatus as shown in the diagram.
3. Add 20 mL of dil. H_2SO_4 with the help of a thistle funnel.
4. Collect the gas evolved in a gas jar as shown in the figure.
5. Observe the colour and odour of the gas.
6. Bring a burning matchstick near the gas jar and record your observations.

Observation: A colourless, odourless gas is evolved. It burns explosively with a 'pop' sound when a burning matchstick is brought near it, indicating the presence of hydrogen gas.

***Chemical Reaction*:**

$$Zn(s) + H_2SO_4(dil) \longrightarrow ZnSO_4(aq) + H_2(g)$$

3. **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. Calcium carbonate (A), when reacts with hydrochloric acid, produces carbon dioxide gas with effervescence. Carbon dioxide gas is used as a fire extinguisher. Therefore, it extinguishes a burning candle. Hence, the metal compound A is calcium carbonate.

$$CaCO_3(s) + 2HCl(aq) \longrightarrow CaCl_2(s) + CO_2(g) + H_2O(l)$$

Page 25

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

Ans. HCl, HNO_3, etc. dissociate into their ions in the presence of water. They form hydrogen ions (H^+). These hydrogen ions combine with H_2O to form hydronium ions (H_3O^+). The reaction can be given as follows:

$$HCl \longrightarrow H^+ + Cl^-$$
$$H^+ + H_2O \longrightarrow H_3O^+$$
$$HCl + H_2O \longrightarrow H_3O^+ + Cl^- \quad \text{[CBSE 2020]}$$

Similarly,
$$HNO_3 \longrightarrow H^+ + NO_3^-$$
$$H^+ + H_2O \longrightarrow H_3O^+$$
$$HNO_3 + H_2O \longrightarrow H_3O^+ + NO_3^-$$

Due to this property, HCl and HNO_3 show acidic character in aqueous solutions. On the other hand, alcohol and glucose cannot dissociate in water to form hydrogen ions. Hence, they do not show acidic character.

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

Ans. An aqueous solution of an acid conduct electricity because of the presence of charged particles called ions in it. When dissolved in water, acids dissociate to form ions, e.g.

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

These ions are responsible for conducting electricity.

3. **Why does dry HCl gas not change the colour of the dry litmus paper?** [CBSE 2023]

Ans. We know that the colour of the litmus is changed by H^+ ions of an acid. Dry HCl does not dissociate to give H^+ ions. Acids dissociate to give ions only in the aqueous medium. Since in this case, neither HCl is in aqueous form nor is the litmus paper wet, so the colour of litmus paper does not change.

4. **While diluting an acid, why is it recommended that the acid should be added to water and not water to the acid?** [CBSE 2023]

Ans. The process of dissolving an acid in water is a highly exothermic reaction. The acid must always be added slowly to water with constant stirring. If water is added to a concentrated acid, the heat generated may cause the mixture to splash out and cause severe burns. The glass container may also break due to excessive heating.

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

Ans. Concentration of hydronium ions (H_3O^+) decreases when a solution of an acid is diluted.

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

Ans. Concentration of hydroxide ions (OH^-) increases when excess base is dissolved in a solution of sodium hydroxide.

Page 28

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

Ans. Solution A has more H^+ ion concentration. A pH value of less than 7 indicates the acidic nature while greater than 7 indicates the basic nature of a solution. So, solution A is acidic and solution B is basic.

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

Ans. As the concentration of H^+ ions increases, the solution becomes more acidic while a decrease of H^+ ion causes an increase in the basicity of the solution.

3. **Do basic solutions also have H^+ (*aq*) ions? If yes, then why are these basic?** [CBSE 2023]

Ans. Yes, basic solutions also have H^+ ions. However, their concentration is less as compared to the OH^- ions that makes the solution basic.

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

Ans. If the farmer finds his soil to be more acidic, then to increase the basicity of the soil, he should treat the soil of his field with quick lime (calcium oxide) or slaked lime (calcium hydroxide) or chalk (calcium carbonate).

Page 33

1. **What is the common name of the compound $CaOCl_2$?** [CBSE 2023]

Ans. Bleaching powder.

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

Ans. Dry slaked lime [$Ca(OH)_2$].

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

Ans. Washing soda, i.e. sodium carbonate ($Na_2CO_3.10H_2O$).

4. **What will happen if a solution of sodium hydrocarbonate is heated? Give the equation of the reaction involved.** [CBSE 2023]

Ans. When sodium hydrogen carbonate is heated, sodium carbonate and water are formed along with the liberation of carbon dioxide gas, e.g.

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

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

Ans. $$\underset{\text{Plaster of Paris}}{CaSO_4.\frac{1}{2}H_2O} + \frac{3}{2}H_2O \longrightarrow \underset{\text{Gypsum}}{CaSO_4.2H_2O}$$

NCERT EXERCISES

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

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

Ans. (*d*) pH = 10, bases turn red litmus blue and their pH is more than 7.

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

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

Ans. (*b*) Egg shells are made up of $CaCO_3$ which reacts with HCl to form CO_2 and this CO_2 turns lime water milky, e.g.

$$CaCO_3(s) + 2HCl(dil) \longrightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

$$Ca(OH)_2(aq) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(l)$$

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

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

Ans. (*d*) ∴ 10 mL of NaOH will neutralise = 8 mL of HCl.

∴ 20 mL of NaOH will neutralise

$$= \frac{8}{10} \times 20 = 16 \text{ mL}.$$

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

(*a*) Antibiotic (*b*) Analgesic

(*c*) Antacid (*d*) Antiseptic

Ans. (*c*) Antacids are used to neutralise hyperacidity in the stomach due to excess of HCl which causes indigestion. Antibiotics are used to fight infections. Analgesics are pain killer while antiseptics prevent growth of bacteria and other micro-organisms on wounds.

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

(*a*) dilute sulphuric acid reacts with zinc granules.

(*b*) dilute hydrochloric acid reacts with magnesium ribbon.

(*c*) dilute sulphuric acid reacts with aluminium powder.

(*d*) dilute hydrochloric acid reacts with iron filings.

Ans. (*a*) $Zn(s) + H_2SO_4(dil) \longrightarrow ZnSO_4(aq) + H_2(g)$
Zinc; Sulphuric acid; Zinc sulphate; Hydrogen gas

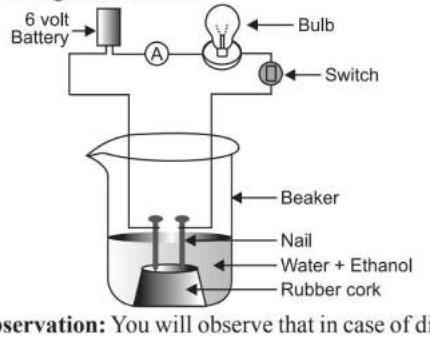
(*b*) $Mg(s) + 2HCl(dil) \rightarrow MgCl_2(aq) + H_2(g)$
Magnesium; Hydrochloric acid; Magnesium chloride; Hydrogen gas

(*c*) $2Al(s) + 3H_2SO_4(dil) \longrightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$
Aluminium; Sulphuric acid; Aluminium sulphate; Hydrogen gas

(*d*) $Fe(s) + 2HCl(aq) \longrightarrow FeCl_2(aq) + H_2(g)$
Iron; Hydrochloric acid; Iron(II) chloride; Hydrogen gas

6. Compounds such as alcohols and glucose also contain hydrogen but are not categorised as acids. Describe an Activity to prove it. **[CBSE 2023]**

Ans.
- Fix two iron nails on a cork and place this cork in a beaker.
- Connect the nails to the two terminals of a 6 volt battery through a switch and a bulb as shown in figure.
- Now add some dilute hydrochloric acid in beaker and switch on the current. Take the observation.
- Repeat the experiment separately with alcohol and glucose solution.



Observation: You will observe that in case of dilute hydrochloric acid bulb glows but when glucose or alcohol solution is taken in beaker, the bulb does not glow.

Conclusion: The aqueous solution of hydrochloric acid conducts electricity due to presence of types of charged particles – hydrogen ions and chloride ions. Unlike acids glucose and ethanol do not ionise in aqueous solution, i.e. they do not give H^+ ions, therefore they cannot conduct electricity. Thus, glucose and ethanol are not categorised as acids.

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

Ans. Distilled water, does not contain any ionic compounds like acids, bases or salts. Therefore, it does not dissociate into ions as it is a weak electrolyte. Salts are present in rain water which help in dissociation of rain water into ions which help in conduction of electricity.

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

Ans. It is because acids do not dissociate into ions in absence of water. But when an acid is dissolved in water, it forms hydrogen ions and hence, shows acidic behaviour, e.g.

$$HCl(g) \xrightarrow{\text{dissolve in water}} H^+(aq) + Cl^-(aq).$$

9. 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*) 'D' with pH = 7 is neutral.
(*b*) 'C' with pH = 11 is strongly alkaline.
(*c*) 'B' with pH = 1 is strongly acidic.
(*d*) 'A' with pH = 4 is weakly acidic.
(*e*) 'E' with pH = 9 is weakly alkaline.
'C', 'E', 'D', 'A', 'B' is increasing order of H^+ ion concentration.

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

Ans. Fizzing occurs more vigorously in hydrochloric acid (A) than in acetic acid (B) because HCl is stronger acid than acetic acid. HCl dissociates into H^+ and Cl^- ions completely whereas acetic acid partially dissociates into its ions.

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

Ans. Milk contains a carbohydrate lactose. When milk sets into curd, lactose gets converted into an acid called lactic acid. Due to formation of lactic acid, pH of milk falls below 6.

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

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

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

Ans. (*a*) It is done to increase the shelf life of milk.
(*b*) The alkaline milk takes a longer time to set into curd because lactic acid being formed has to neutralise the alkali present in it.

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

Ans. It will absorb water to form gypsum which set into hard solid mass. This will make Plaster of Paris useless after some time, e.g.

$$\underset{\text{Plaster of Paris}}{CaSO_4 \cdot \frac{1}{2} H_2O} + \frac{3}{2} H_2O \longrightarrow \underset{\text{Gypsum}}{CaSO_4 \cdot 2H_2O}$$

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

Ans. The reaction in which a base reacts with an acid is called neutralisation reaction.

Examples:

$NaOH(aq) + HCl(aq) \longrightarrow NaCl(aq) + H_2O(l)$

$H_2SO_4(aq) + 2NH_4OH(aq) \longrightarrow (NH_4)_2SO_4(aq) + 2H_2O(l)$

$HCl(aq) + NH_4OH(aq) \longrightarrow NH_4Cl(aq) + H_2O(l)$

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

Ans. Uses of washing soda:
(*i*) It is used in the manufacture of glass, soap, paper and other sodium compounds like borax, etc.
(*ii*) It is used in softening of hard water.

Uses of baking soda:
(*i*) It is used as antacid to neutralise excess of acidity (hyper-acidity) in the stomach.
(*ii*) It is an ingredient of baking powder which contains $NaHCO_3$ and tartaric acid.

SELECT NCERT EXEMPLAR PROBLEMS

1. What happens when a solution of an acid is mixed with a solution of a base in a test tube?
(*i*) The temperature of the solution increases
(*ii*) The temperature of the solution decreases
(*iii*) The temperature of the solution remains the same
(*iv*) Salt formation takes place.
(*a*) (*i*) only (*b*) (*i*) and (*iii*)
(*c*) (*ii*) and (*iii*) (*d*) (*i*) and (*iv*)

Ans. (*d*) Acid + base ⟶ salt + water + heat

2. An aqueous solution turns red litmus solution blue. Excess addition of which of the following solution would reverse the change? [KVS]
(*a*) Baking power
(*b*) Lime
(*c*) Ammonium hydroxide solution
(*d*) Hydrochloric acid

Ans. (*d*) HCl will neutralise base and become in excess.

3. During the preparation of hydrogen chloride gas on a humid day, the gas is usually passed through the guard tube containing calcium chloride. The role of calcium chloride taken in the guard tube is to
(*a*) absorb the evolved gas
(*b*) moisten the gas
(*c*) absorb moisture from the gas
(*d*) absorb Cl^- ions from the evolved gas

Ans. (*c*)

4. Which of the following salts does not contain water of crystallisation?
(*a*) Blue vitriol (*b*) Baking soda
(*c*) Washing soda (*d*) Gypsum

Ans. (*b*)

5. Sodium carbonate is a basic salt because it is a salt of [CBSE 2023 (Similar)]
(*a*) strong acid and strong base.
(*b*) weak acid and weak base.
(*c*) strong acid and weak base.
(*d*) weak acid and strong base.

Ans. (*d*) H_2CO_3 is weak acid, NaOH is strong base.

6. Calcium phosphate is present in tooth enamel. Its nature is [KVS] [CBSE 2023]
(*a*) basic (*b*) acidic
(*c*) neutral (*d*) amphoteric

Ans. (*a*) $Ca(OH)_2$ is strong base, H_3PO_4 is weak acid.

7. A sample of soil is mixed with water and allowed to settle. The clear supernatant solution turns the pH paper yellowish-orange. Which of the following would change the colour of this pH paper to greenish-blue?
(*a*) Lemon juice (*b*) Vinegar
(*c*) Common salt (*d*) An antacid

Ans. (*d*) Antacid is basic in nature.

8. Which of the following gives the correct increasing order of acidic strength ? [CBSE 2023]
(*a*) Water <Acetic acid <Hydrochloric acid
(*b*) Water <Hydrochloric acid <Acetic acid
(*c*) Acetic acid <Water <Hydrochloric acid
(*d*) Hydrochloric acid <Water <Acetic acid

Ans. (*a*) HCl is strong acid and CH_3COOH is weak acid.

9. Which of the following phenomena occur, when a small amount of acid is added to water ?
(*i*) Ionisation
(*ii*) Neutralisation
(*iii*) Dilution
(*iv*) Salt formation

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

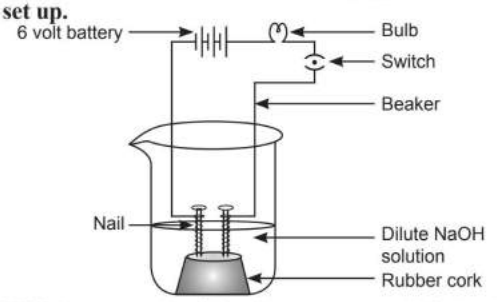
Ans. (*b*)

10. Which one of the following can be used as an acid-base indicator by a visually impared (blind) student? [KVS]

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

Ans. (*c*) Its colour changes in acids and bases.

11. In an attempt to demonstrate electrical conductivity through an electrolyte, the following apparatus was set up.



Which among the following statement(s) is (are) correct?

(*i*) Bulb will not glow because electrolyte is not acidic.
(*ii*) Bulb will glow because NaOH is a strong base and furnishes ions for conduction.
(*iii*) Bulb will not glow because circuit is incomplete.
(*iv*) Bulb will not glow because it depends upon the type of electrolytic solution.

(*a*) (*i*) and (*iii*) (*b*) (*ii*) and (*iv*)
(*c*) (*ii*) only (*d*) (*iv*) only

Ans. (*c*)

12. Which of the following is used for dissolution of gold?

(*a*) Hydrochloric acid (*b*) Sulphuric acid
(*c*) Nitric acid (*d*) Aqua regia

Ans. (*d*) Aqua regia is $3HCl + 1HNO_3$(conc).

13. Which among the following is not a base ?

(*a*) NaOH (*b*) KOH
(*c*) NH_4OH (*d*) C_2H_5OH

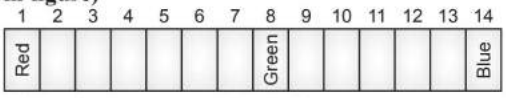
Ans. (*d*) C_2H_5OH does not ionise.

14. Which of the following statement is not correct?

(*a*) All metal carbonates react with acid to give salt, water and carbon dioxide.
(*b*) All metal oxides react with water to give salt and acid.
(*c*) Some metals react with acids to give salt and hydrogen.
(*d*) Some non-metal oxides react with water to form an acid.

Ans. (*b*) Metal oxides react with water to form metal hydroxide.

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



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

Ans. (*c*) pH = 7 because NaCl is neutral.

16. Which of the following is(are) true when HCl (*g*) is passed through water?

(*i*) It does not ionise in the solution as it is a covalent compound.
(*ii*) It ionises in the solution.
(*iii*) It gives both hydrogen and hydroxyl ion in the solution.
(*iv*) It forms hydronium ion in the solution due to the combination of hydrogen ion with water molecule.

(*a*) (*i*) only (*b*) (*iii*) only
(*c*) (*ii*) and (*iv*) (*d*) (*iii*) and (*iv*)

Ans. (*c*) $HCl + H_2O \longrightarrow H_3O^+ + Cl^-$

17. Which of the following statements is true for acids?

(*a*) Bitter and change red litmus to blue.
(*b*) Sour and change red litmus to blue.
(*c*) Sour and change blue litmus to red.
(*d*) Bitter and change blue litmus to red.

Ans. (*c*) Acids are sour, and change blue litmus to red.

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

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

Ans. (*a*) $HCl + H_2O \longrightarrow H_3O^+ + Cl^-$

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

(*i*) It turns lime water milky
(*ii*) It extinguishes a burning splinter
(*iii*) It dissolves in a solution of sodium hydroxide
(*iv*) It has a pungent odour

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

Ans. (*b*) $CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2$, CO_2 turns lime water milky, non-supporter of combustion, dissolves in NaOH, is colourless and odourless.

20. Common salt, besides being used in kitchen, can also be used as the raw material for making
(*i*) washing soda
(*ii*) bleaching powder
(*iii*) baking soda
(*iv*) slaked lime
(*a*) (*i*) and (*ii*) (*b*) (*i*), (*ii*) and (*iv*)
(*c*) (*i*) and (*iii*) (*d*) (*i*), (*iii*) and (*iv*)

Ans. (*c*) $Na_2CO_3.10H_2O$ and $NaHCO_3$ are prepared from NaCl (Brine solution).

21. Which of the following statements is correct about an aqueous solution of an acid and of a base ?
(*i*) Higher the pH, stronger the acid
(*ii*) Higher the pH, weaker the acid
(*iii*) Lower the pH, stronger the base
(*iv*) Lower the pH, weaker the base
(*a*) (*i*) and (*iii*) (*b*) (*ii*) and (*iii*)
(*c*) (*i*) and (*iv*) (*d*) (*ii*) and (*iv*)

Ans. (*d*) Lower pH, more H^+, stronger acid. Lower pH, less OH^-, weaker base.

22. The pH of the gastric juices released during digestion is
(*a*) less than 7 (*b*) more than 7
(*c*) equal to 7 (*d*) equal to 0

Ans. (*a*) Its pH = 2 due to secreation of HCl.

23. Which of the following substance will not give carbon dioxide on treatment with dilute acid ?
(*a*) Marble (*b*) Limestone
(*c*) Baking soda (*d*) Lime

Ans. (*d*) Lime is CaO, does not give CO_2 with HCl. Others are carbonates. Marble is $CaCO_3$ (lime stone). $NaHCO_3$ (baking soda) will give CO_2 with HCl.

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

Ans. (*b*) Citric acid is organic acid, not a mineral acid.

25. Identify the correct representation of reaction occurring during chloralkali process.
(*a*) $2NaCl(l) + 2H_2O(l) \longrightarrow 2NaOH(l) + Cl_2(g) + H_2(g)$
(*b*) $2NaCl(aq) + 2H_2O(aq) \longrightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$
(*c*) $2NaCl(aq) + 2H_2O(l) \longrightarrow 2NaOH(aq) + Cl_2(aq) + H_2(aq)$
(*d*) $2NaCl(aq) + 2H_2O(l) \longrightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$

Ans. (*d*) NaOH, H_2 and Cl_2 are formed by electrolysis of brine solution.

26. Match the important chemicals given in Column (A) with the chemical formulae given in Column (B).

	Column (A)		**Column (B)**
	(*a*) Plaster of Paris	**(*i*)**	**$Ca(OH)_2$**
	(*b*) Gypsum	**(*ii*)**	**$CaSO_4.1/2H_2O$**
	(*c*) Bleaching Powder	**(*iii*)**	**$CaSO_4.2H_2O$**
	(*d*) Slaked Lime	**(*iv*)**	**$CaOCl_2$**
Ans.	(*a*) Plaster of Paris	(*ii*)	$CaSO_4 \cdot ½H_2O$
	(*b*) Gypsum	(*iii*)	$CaSO_4 \cdot 2H_2O$
	(*c*) Bleaching powder	(*iv*)	$CaOCl_2$
	(*d*) Slaked lime	(*i*)	$Ca(OH)_2$

27. What will be the action of the following substances on litmus paper?
Dry HCl gas, Moistened NH_3 gas, Lemon juice, Carbonated soft drink, Curd, Soap solution.

Ans. Dry HCl gas will not have any effect on litmus paper. Moistened NH_3 gas will turn red litmus blue. Curd, lemon juice, carbonated soft drink will turn blue litmus red. Soap solution will turn red litmus blue.

28. 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.

Ans. Ant sting contains methanoic acid (formic acid). Its chemical formula is HCOOH. The common method to get relief is to apply paste of $NaHCO_3$ (baking soda) on it.

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

Ans. Egg-shell is made up of calcium carbonate which will react with HNO_3 to form CO_2 (g) and H_2O (*l*) along with calcium nitrate, e.g.
$CaCO_3 + 2HNO_3 \longrightarrow Ca(NO_3)_2 + CO_2 + H_2O$

30. 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? **[HOTS]**

Ans. Add phenolphthalein to a portion of each solution in separate test tube. If it turns pink, the beaker contains base whereas if it remains colourless, it is an acid. If phenolphthalein is not available, pH paper can be used. Acid will turn pH paper red, base will turn pH paper blue.

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

Ans. 'X' is chlorine gas.
$2NaCl + 2H_2O \xrightarrow{\text{Electricity}} 2NaOH + H_2(g) + \underset{\text{'X'}}{Cl_2(g)}$
[CBSE 2023]

$$\underset{\text{Lime water}}{Ca(OH)_2} + Cl_2(g) \longrightarrow \underset{\text{'Y'}}{CaOCl_2} + H_2O$$

Bleaching powder

'X' is Cl_2 gas, 'Y' is $CaOCl_2$.

32. Fill in the missing data in the following table:

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

Ans.

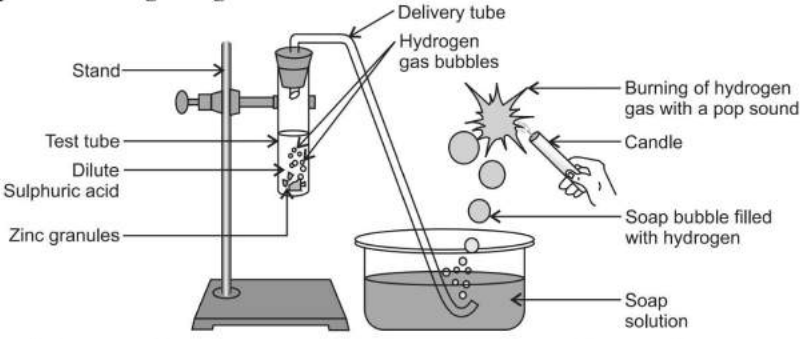
	Formula	Base	Acid
(*i*)	NH_4Cl	NH_4OH	HCl
(*ii*)	$CuSO_4$	$Cu(OH)_2$	H_2SO_4
(*iii*)	NaCl	NaOH	HCl

[CBSE 2020]

[CBSE 2023, 20]

	Formula	Base	Acid
(*iv*)	$Mg(NO_3)_2$	$Mg(OH)_2$	HNO_3
(*v*)	K_2SO_4	KOH	H_2SO_4
(*vi*)	$Ca(NO_3)_2$	$Ca(OH)_2$	HNO_3

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



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

Ans. (*a*) The reaction will become faster because zinc dust has more surface area.
(*b*) Nearly same amount of hydrogen gas will be evolved.
(*c*) No reaction will take place as copper is less reactive than hydrogen.
(*d*) The reaction will take place and hydrogen gas will be evolved.

$$\underset{\text{Zinc}}{Zn} + \underset{\text{Sodium hydroxide}}{2NaOH} \xrightarrow{\text{Heat}} \underset{\text{Sodium zincate}}{Na_2ZnO_2} + \underset{\text{Hydrogen}}{H_2(g)}$$

[CBSE 2023]

34. 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. **[HOTS]**

Ans. 'X' is calcium carbonate.

$$\underset{\text{'X'}}{CaCO_3(s)} + 2HCl(dil) \rightarrow CaCl_2(g) + CO_2(g) + H_2O\,(l)$$

$$\underset{\text{'Y'}}{Ca(OH)_2} + CO_2 \longrightarrow \underset{\text{'X'}}{CaCO_3\,(s)} + H_2O$$

'Y' is calcium hydroxide.

$$\underset{\text{(Brine)}}{2NaCl + 2H_2O} \rightarrow 2NaOH + \underset{\text{(At anode) 'G'}}{Cl_2(g)} + \underset{\text{(At cathode)}}{H_2(g)}$$

The gas 'G' is chlorine gas which is obtained at anode.

$$\underset{\text{Dry slaked lime 'Y'}}{Ca(OH)_2} + \underset{\text{'G'}}{Cl_2} \longrightarrow \underset{\text{'Z'}}{CaOCl_2} + H_2O$$

'Z' is calcium oxychloride used for disinfecting drinking water.

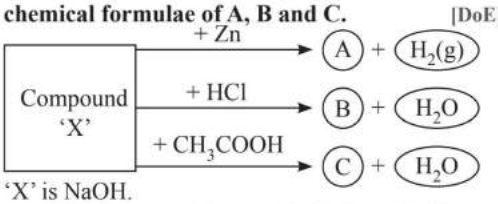
35. A sulphate salt of Group 2 element of the Periodic Table is a white, soft substance, which can be moulded into different shapes by making its dough. When this compound is left in open for sometime, it becomes a solid mass and cannot be used for moulding purposes. Identify the sulphate salt. Why does it show such a behaviour? Give the reaction involved.

Ans. Salt is $CaSO_4 \cdot \frac{1}{2}H_2O$, Plaster of Paris, white soft substance. It can be dough, moulded into different shapes, as 2 moles of $CaSO_4$ share 1 mole of H_2O molecule.

$$CaSO_4 \cdot \frac{1}{2}H_2O + \frac{3}{2}H_2O \longrightarrow CaSO_4 \cdot 2H_2O$$

When it is left in open, it becomes solid mass $CaSO_4 \cdot 2H_2O$ (Gypsum) which cannot be used for moulding purposes as it is hard solid mass.

36. Identify the compound X on the basis of the reactions given below. Also, write the name and chemical formulae of A, B and C. **[DoE]**



Ans. 'X' is NaOH.

$$\underset{\text{'X'}}{2NaOH} + Zn \longrightarrow \underset{\text{'A'}}{Na_2ZnO_2} + H_2(g)$$

Sodium hydroxide — Sodium zincate

$$\underset{\text{'X'}}{NaOH} + HCl \longrightarrow \underset{\text{'B'}}{NaCl} + H_2O$$

Sodium chloride

$$\underset{\text{'X'}}{NaOH} + CH_3COOH \longrightarrow \underset{\text{'C'}}{CH_3COONa} + H_2O$$

Sodium ethanoate