Properties of Acids and Bases

Introduction

Acids

> Acids: Acids are defined as proton donors because they lose H^+ ions.
> Arrhenius definition for acids: Substances which ionizes in water and releases H^+ ions.
> All acids have hydrogen ions, in it. For e.g., HC, HNO_3.
> Acids can be categorized depending on the number of H^+ ions released by it.
> If an acid releases one H^+ ion, it is called monobasic acid, e.g., HCl, HNO_3, CH_3COOH.
> If an acid releases two H^+ ions, it is called dibasic acid, e.g., H_2SO_4, H_2CO_3.
> They can also be categorized based on the extent of their splitting into ions, when dissolved in water.
> If an acid dissociates (splits) completely into ions it is called strong acid, e.g., sulphuric acid (H_2SO_4).
> If an acid dissociates partially, it is called a weak acid, e.g., acetic acid and citric acid.
> Acids when dissolved in water release large amount of heat. If water is added to concentrated acid then the heat generated may cause the mixture to splash out and cause bums. Hence to avoid burns acid must be added drop wise into water with constant stirring. So that the heat generated spread over in water.

Acid + Water —> Highly exothermic reaction

Experimental behaviour of acids

> It turns blue litmus red and shows the pH range less than 7.
> On splitting, the H^+ ions can be replaced by positive ions like ammonium ions, metals ions and other metal compounds like metal oxide, metal hydroxide, metal carbonate and metal hydrogen carbonate.

$$\underset{\text{Hydrochloric acid}}{HCl\,(aq)} \longrightarrow \underset{\text{Hydrogen ion}}{H^+\,(aq)} + \underset{\text{Chloride ion}}{Cl^-\,(aq)}$$

- H^+ ions cannot exist alone, hence it combines with water to form hydronium ions (H_3O^+).

$$\underset{\text{Hydrochloric acid}}{HCl(aq)} + \underset{\text{Water}}{H_2O(l)} \longrightarrow \underset{\text{Hydronium ion}}{H_3O^+(aq)} + \underset{\text{Chloride ion}}{Cl^-(aq)}$$

- Acids react with reactive metals to release hydrogen gas. For e.g.,

$$\text{Acid} + \text{Metal} \longrightarrow \text{Salt} + \text{Hydrogen gas}$$

$$\underset{\text{Hydrochloric acid}}{2HCl(aq)} + \underset{\text{Zinc}}{Zn(s)} \longrightarrow \underset{\text{Zinc chloride}}{ZnCl_2(aq)} + \underset{\text{Hydrogen}}{H_2(g)}$$

- Acid reacts with carbonates and bicarbonates to release carbon dioxide gas. For e.g.,

$$\text{Acid} + \text{Metal carbonate} \longrightarrow \text{Salt} + \underset{\text{Carbon dioxide}}{CO_2} + \underset{\text{Water}}{H_2O}$$

$$\underset{\text{Hydrochloric acid}}{2HCl(aq)} + \underset{\text{Sodium carbonate}}{Na_2CO_3(s)} \longrightarrow \underset{\text{Sodium chloride}}{2NaCl\,(aq)} + \underset{\text{Water}}{H_2O(l)} + \underset{\text{Carbon dioxide}}{CO_2(g)}$$

$$\underset{\text{Hydrochloric acid}}{HCl\,(aq)} + \underset{\text{Sodium bicarbonate}}{NaHCO_3(s)} \longrightarrow \underset{\text{Sodium chloride}}{NaCl\,(aq)} + \underset{\text{Water}}{H_2O(l)} + \underset{\text{Carbon dioxide}}{CO_2(g)}$$

- Acids react with base to give salt and water. For e.g.,

$$\underset{\text{Hydrochloric acid}}{HCl\,(aq)} + \underset{\text{Sodium hydroxide}}{NaOH\,(aq)} \longrightarrow \underset{\text{Sodium chloride}}{NaCl\,(aq)} + \underset{\text{Water}}{H_2O(l)}$$

Bases

> Arrhenius definition of a base: Substance that releases OH^- ions when dissolved in water.
> When the base dissolves in water it is called an alkali.
> Alkalis can be categorized as strong or weak alkali, based on the extent of their splitting into ions, when dissolved in water.
> If an alkali dissociates (splits) completely into ions it is called strong alkali, e.g., sodium hydroxide.
> If an alkali dissociates partially, it is called a weak alkali, e.g., ammonium hydroxide.

Experimental Behaviour of Bases

It changes red litmus blue. Its pH is more than 7.
> When bases react with metals they do not release hydrogen gas. But few exceptional cases are there. For e.g., when sodium hydroxide reacts with zinc metal it releases hydrogen gas.

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

- Bases react with acids to form salt and water. For e.g.,

$$\underset{\text{Hydrochloric acid}}{HCl(aq)} + \underset{\text{Sodium hydroxide}}{NaOH(aq)} \longrightarrow \underset{\text{Sodium chloride}}{NaCl(aq)} + \underset{\text{Water}}{H_2O(l)}$$

- Bases do not react with solid sodium carbonate.
- Bases combine with carbon dioxide to form carbonate.

$$\text{Base} + \text{Carbon dioxide} \longrightarrow \text{Carbonate}$$

$$\underset{\text{Sodium hydroxide}}{2NaOH(aq)} + \underset{\text{Carbon dioxide}}{CO_2(g)} \longrightarrow \underset{\text{Sodium carbonate}}{Na_2CO_3(aq)} + \underset{\text{Water}}{H_2O(l)}$$

Hydrogen gas test: To test the hydrogen gas released in an experiment, bring a burning splinter near the mouth of
the test tube/container from which the hydrogen gas is released. Observation: The splinter burns with the pop sound.

$$\underset{\text{Hydrogen}}{2H_2(g)} + \underset{\text{Oxygen}}{O_2(g)} \longrightarrow \underset{\text{Water}}{2H_2O(l)}$$

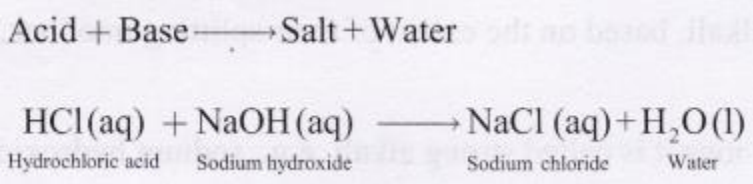
> **Carbon dioxide gas test:** To test the carbon dioxide gas, allow the gas to pass through freshly prepared lime water.
Observation: The freshly prepared lime water turns milky.

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

Action of acid and base on indicators:

Indicators	Acidic Solution	Basic Solution	Neutral Solution
Blue litmus	Red	No change	No change
Red litmus	No change	Blue	No change
Methyl orange	Red	Yellow	Orange
Phenolphthalein	Colourless	Red or Pink	Colourless

Neutralisation Reaction: Acids and bases react with each other to produce salt and water.



Science Lab Manual Experiment 2

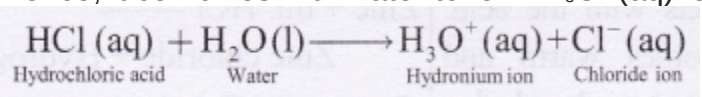
Aim

To study the properties of acids and bases (dilute HCl and dilute NaOH) by their reaction with
(a) Litmus solution (Blue/Red) (b) Zinc metal (c) Solid sodium carbonate

Theory

Hydrochloric acid

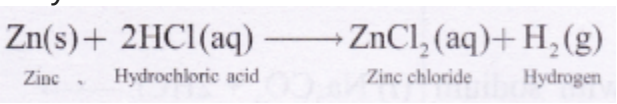
> Chemical formula of hydrochloric acid is HCl.
> When it is dissolved in water; releases H^+(aq) ions, these H^+ ions cannot exist alone. Hence, it combines with water to form H_3O^+ (aq) ions.



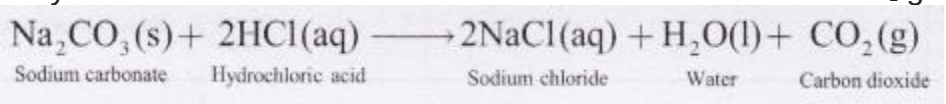
> The acidic property is seen due to this H^+(aq) ions/H_3O^+ ions.

Properties of hydrochloric acid

> It turns blue litmus solution red.
> Hydrochloric acid reacts with metals to release hydrogen gas.



> **Test for H_2 gas:** When a burning splinter is brought near the mouth of test tube releasing H_2 gas, it bums with a ‘pop sound’.
> Hydrochloric acid react with sodium carbonate to release CO_2 gas.



> **Test for CO_2 gas:** When CO_2 gas is allowed to pass through freshly prepared lime water, then the lime water turns milky or when a burning splinter is brought near the mouth of the test tube releasing CO_2 gas then the burning splinter extinguishes.
Sodium hydroxide
> Chemical formula of sodium hydroxide is NaOH.
> When it is dissolved in water releases OH^- ions.

Properties of Sodium hydroxide

> It turns red litmus solution blue.

> Not all bases react with zinc metal to release H_2 gas but sodium hydroxide solution reacts with zinc metal to release hydrogen gas.

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

> Sodium hydroxide do not react with solid sodium carbonate.

Materials Required

A test tube stand, test tubes, match box, test tube holder, droppers, a bent delivery tube, burner and cork.

Chemicals required: Dilute hydrochloric acid, dilute sodium hydroxide, blue litmus solution, red litmus solution, zinc metal granules or powdered zinc, solid sodium carbonate and freshly prepared lime water.

Procedure

(A) Properties of Hydrochloric Acid

	Experiment	Observation	Inference
1.	**Litmus Test** Take two clean test tubes. Pour 1 mL of dilute HCl solution in each test tube. Pour a drop of blue litmus in one test tube and a drop of red litmus solution in the second test tube.	Blue litmus solution turns red in first test tube. Red litmus solution shows no change in second test tube.	Dil. HCl shows acidic character.
2.	Reaction with Zinc Metal Take 1 mL of dilute HCl in a clean test tube. Add a small piece of zinc metal/ zinc powder in it. Light a matchstick and bring it near the mouth of the test tube, remove the thumb and observe.	Zinc metal reacts with the acid. Test tube becomes warm and pressure is exerted on thumb due to release of a gas. The matchstick bums with a pop sound.	Zinc + dil. HCl → Zinc chloride + Hydrogen gas Zn(s) + 2HCl(aq) → ZnCl2(aq) + H2(g) Hydrogen gas always bums with a pop sound when lighted matchstick is introduced in it.
3.	Reaction with Sodium Carbonat Take a clean test tube. Add 2 mL of dilute HCl. Now add lg/pinch of sodium carbonate in it. Immediately close the mouth with cork containing delivery tube. Hold a test tube with lime water at the other end of the delivery tube.	Dilute HCl reacts with sodium carbonate to release a colourless gas. The gas turns lime water milky.	(i) Na2CO3 + 2HCl → 2NaCl + H20 + CO2 (ii)Ca(OH)2+CO2 → Lime waterCaCO3 +H2O White insoluble ppt

(B) Properties of Sodium Hydroxide

Experiment		Observation	Inference
1.	**Litmus Test** Take two clean test tubes. Pour 1 mL of dilute NaOH in each test tube. Add a drop of blue litmus solution in one test tube and a drop of red litmus solution in the second test tube.	Blue litmus solution shows no change. Red litmus solution changes to blue colour.	Dil. NaOH shows basic character.
2.	**Reaction with Zinc Metal** Take a clean test tube. Add zinc metal granules/zinc powder in it. Pour 2 mL of NaOH solution in the tube. Hold the test tube with a test tube holder and heat it. Bring a burning matchstick near the mouth of the test tube.	On heating the mixture; reaction begins, colourless gas is evolved. The burning matchstick bums with a 'pop' sound.	Zn(s) + 2NaOH(aq) Na2ZnO2(aq) + H2(g) Hydrogen gas always bums with a pop sound.
3.	**Reaction with Solid Sodium Carbonate** Take a clean test tube. Add 2 mL of NaOH solution in a tube and 1 g of sodium carbonate. Heat the mixture.	No change.	Dil. NaOH doesn't react with sodium carbonate.

Precaution

1. Use clean test tubes.
2. Use very small amount of chemicals.
3. Handle hydrochloric acid and sodium hydroxide solutions very carefully.
4. Shake the solutions and reaction mixtures carefully without spilling.
5. Always carry out the test for hydrogen with a very small volume of gas.
6. For H_2 gas test, be careful as H_2 catches fire. The flame on test tube can be seen due to H_2 gas.
7. For lime water test, allow the CO_2 gas to pass through lime water and shake the test tube by placing thumb on the mouth of the tube to get quick result.

Science lab manual Viva Voce

Question 1:
Acid X reacts with sodium carbonate. Name the gas formed.
Answer:
The gas formed is CO_2

Question 2:
Name the ion released when alkali (bases) dissolve in water.
Answer:
Bases release OH^- ions when dissolved in water.

Question 3:
Name the metal with which NaOH reacts to release H_2 gas.
Answer:
NaOH reacts with zinc metal to release H_2 gas.

Question 4:
A substance X releases OH^- ions when dissolved in water. What is X?
Answer:
X is a base.

Question 5:
A liquid solution 'Y' turns blue litmus solution red. What is ' Y'?
Answer:
Y is an acid.

Question 6:
What is the chemical formula of sodium zincate?
Answer:
The chemical formula of sodium zincate is Na_2ZnO_2.

Question 7:
Name the metal which reacts with both acid and base to liberate H_2 gas.
Answer:
Zinc metal reacts with both acid and base to release H_2 gas.

Question 8:
What happens to the colour of zinc granules after it has reacted with dil. HCl?
Answer:
Zinc
granules turns black on reaction with dil. HCl.

NCERT Science lab manual Solutions for Practical Based Questions

Question 1:
Dry litmus paper does not show any colour change when brought close to dry HCl gas. Why?
Answer:

Acids show the acidic character only when they release H^+(aq) ions when dissolved in water.

Question 2:
If a wet blue litmus paper is brought closer to the dry HCl gas, what change will you observe and why?
Answer:
The blue litmus paper will turn red. This is because the litmus paper is wet and therefore H^+ (aq) ions are released by HCl gas.

Question 3:
Why does lime water turn milky when CO_2 gas is passed through it?
Answer:
Lime water ($Ca(OH)_2$) reacts with CO_2 to form white insoluble precipitate ($CaCO_3$) in water which makes lime water milky.

Question 4:
On passing excess CO_2 through lime water it becomes colourless. Explain.
Answer:
When excess CO_2 gas is passed through lime water, it forms calcium hydrogen carbonate which is soluble in water.

Question 5:
State the difference between alkali and base.
Answer:
Bases turn red litmus blue and all bases are not soluble in water. Those bases which are soluble in water are called alkali.

Question 6:
What are the products formed when NaOH solution reacts with zinc metal?
Answer:
NaOH solution reacts with zinc metal to give sodium zincate and hydrogen gas.

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

Question 7:
What happens if a burning splinter is brought near CO_2 gas?
Answer:
The burning splinter will extinguish, because carbon dioxide gas does not support combustion.

Question 8:
Why do we use zinc granules for the test in the lab?

Answer:
Zinc granules have increased surface area so that reaction occurs fast.

Question 9:
What is the effect of blue litmus and red litmus solution on HCl solution?
Answer:
Blue litmus solution turns red but there is no change in red litmus solution when HCl solution is added to it.

Question 10:
What type of reaction is seen when zinc is added to HCl solution?
Answer:
On adding zinc to HCl solution, the test tube becomes warm and the reaction is exothermic in nature.

Question 11:
What is the formula of lime and lime water?
Answer:
The chemical formula of lime is CaO and that of lime water is $Ca(OH)_2$.

Question 12:
If you have phenolphthalein as an indicator, how will you test for acid and base?
Answer:
Phenolphthalein turns red or pink in basic solution and remains colourless in acidic solution.

NCERT Chemistry lab manual Questions

Question 1:
What will be the colour of a blue litmus paper on bringing it in contact with a drop of dil. NaOH?
Answer:
The blue litmus paper remains blue when it comes in contact with a drop of dil. NaOH.

Question 2:
Explain why hydrogen gas is not collected by the downward displacement of air?
Answer:
Hydrogen gas is lighter than air and it will easily escape in the air. We cannot collect the lighter gas by downward displacement of air.

Question 3:
What will happen to a lighted candle if it is brought near the mouth of a gas jar containing hydrogen gas?

Answer:
The lighted candle will burn with the pop sound.

Question 4:
Which gas is produced when aluminium metal reacts with sodium hydroxide?
Answer:
Hydrogen gas is released when aluminium metal reacts with sodium hydroxide.

Question 5:
Hydrogen gas is neutral to litmus paper. Explain how?
Answer:
The litmus paper tests the acid or base due to the release of H^+ or OH^- ions in aqueous state. In hydrogen gas, the release of such ions is not seen hence the litmus paper does not show any colour change.

Question 6:
What are the metals (other than Al) which react with alkalies to produce hydrogen gas? What are these metals called?
Answer:
Zinc and lead metal will produce hydrogen gas when they react with alkalies. They are called as amphoteric metals.

Question 7:
What will be the colour of a blue litmus paper on bringing it in contact with a drop of dil. hydrochloric acid?
Answer:
The blue litmus paper turns red when it comes in contact with dil. HCl acid.

Question 8:
Which gas is produced when zinc metal reacts with hydrochloric acid?
Answer:
When zinc metal reacts with hydrochloric acid it releases hydrogen gas.

Question 9:
Which gas is liberated when sodium carbonate reacts with hydrochloric acid?
Answer:
When sodium carbonate reacts with hydrochloric acid, carbon dioxide gas is released. .

Question 10:
What is the utility of the reaction between $NaHCO_3$ and HCl in daily life situation?
Answer:
The reaction between $NaHCO_3$ and HCl in daily life situation is used to clean the metal surfaces which has developed the deposits of carbonate and hydrogen carbonates.

Question 11:
How can the deposits of carbonates and hydrogen carbonates on the metal surface be cleaned?
Answer:
The deposits of carbonates and hydrogen carbonates on the metal surface can be cleaned by using hydrochloric acid.

Chemistry Practicals Multiple Choice Questions (MCQs)

Questions based on Procedural and Manipulative Skills

1. A freshly prepared lime water is made with
(a) lime + water
(b) calcium oxide + water
(c) both (a) and (b)
(d) none of these.

2. Lime water is
(a) Calcium oxide
(b) Calcium carbonate
(c) Calcium hydroxide
(d) Calcium bicarbonate.

3. The chemical reaction in which zinc metal reacts with dil. HCl is an example of
(a) combination reaction
(b) decomposition reaction
(c) neutralisation reaction
(d) displacement reaction.

4. The zinc metal commonly used in the laboratory for doing experiments is in the form of
(a) filings
(b) strips
(c) granules
(d) pellets.

5. Sodium carbonate reacts with acids to give
(a) CO_2
(b) SO_2
(C) H_2
(d) O_2.

6. Hydrogen gas is not collected by downward displacement of air because:
(a) it is lighter than air

(b) it is explosive in nature
(c) it bums rapidly
(d) it is heavier than air.

7. Carbon dioxide gas is collected by the upward displacement of air because:
(a) it is lighter than air
(b) it is heavier than air
(c) it extinguishes fire
(d) it burns rapidly.

8. Hydrogen gas does not show any change with the litmus paper because:
(a) it does not react with litmus
(b) it is neither acidic nor basic
(c) both (a) and (b) are correct
(d) both (a) and (b) are incorrect.

9. $NaHCO_3$ is used as an antacid because:
(a) it neutralizes HCl in our stomach
(b) it dissolves HCl in our stomach
(c) it is acidic in nature
(d) it is neutral in nature.

10. A dull coin which is coated with deposits of carbonates and hydrogen carbonates can be cleaned with:
(a) dil. HCl
(b) acetic acid
(c) vinegar
(d) all of these.

Questions based on Observational Skills

11. When excess carbon dioxide gas is passed through lime water it becomes
(a) milky due to the formation of $CaCO_3$
(b) milky due to the formation of $CaHCO_3$
(c) colourless due to the formation of $CaCO_3$
(d) colourless due to the formation of $CaHCO_3$

12. The reaction between dilute hydrochloric acid and solid sodium carbonate shows the following:
(a) no change takes place
(b) a loud sound is produced
(c) a brisk effervescence occurs
(d) the solution turns blue.

13. When zinc metal reacts with dilute hydrochloric acid, the gas evolved
(a) supports combustion
(b) turns lime water milky
(c) bums with a pop sound
(d) has a pungent odour.

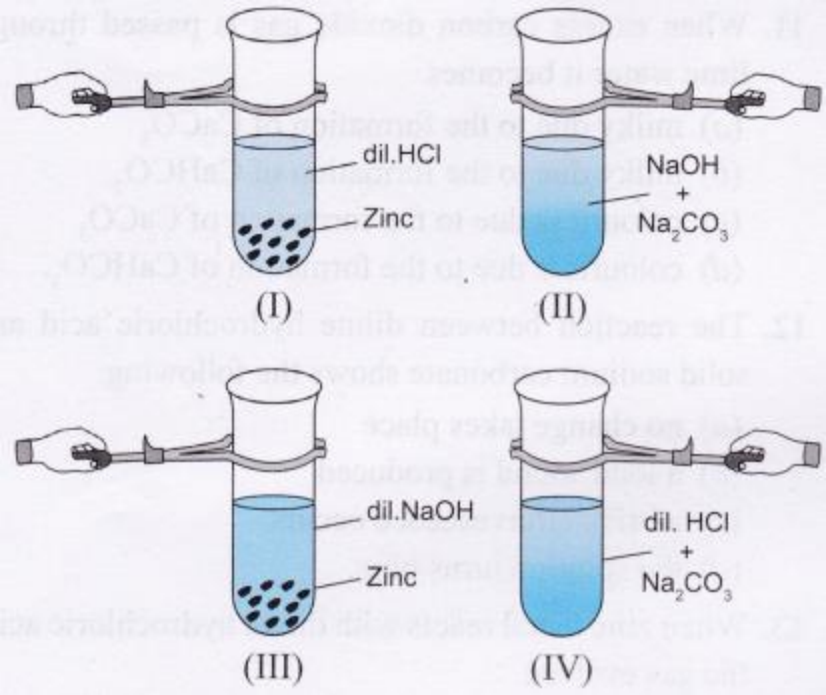
14. When zinc reacts with dilute hydrochloric acid
(a) the surface of zinc becomes brighter
(b) the surface of zinc becomes black and dull
(c) the metal turns into powder
(d) the reaction mixture turns green.

15. When dilute HCl is added to granulated zinc placed in a test tube, the observation made is:
(a) the surface of the metal turns shining
(b) the reaction mixture turns milky
(c) odour of chlorine is observed
(d) a colourless and odourless gas evolves with bubbles.

16. A student takes some zinc granules in a test tube and adds dilute HC1 to it. He would observe that the colour of the zinc granules changes to:
(a) brown
(b) black
(c) yellow
(d) white.

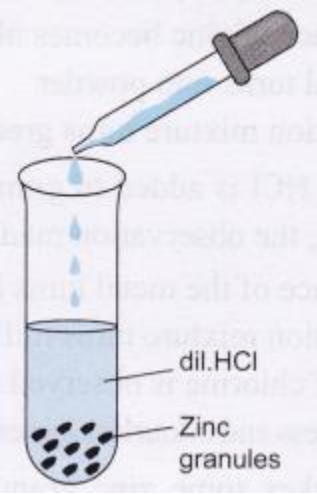
17. A student added dilute HCl to a test tube containing zinc granules and made following observations.
I. The surface of zinc becomes black
II. A gas evolved which burnt with a pop sound
III. The solution remains colourless.
The correct observations are:
(a) I and II (b) I and III
(c) II and III (d) I, II and III.

18. A student performed an experiment using zinc granules and sodium carbonate with sodium hydroxide and hydrochloric acid under different conditions as shown here:



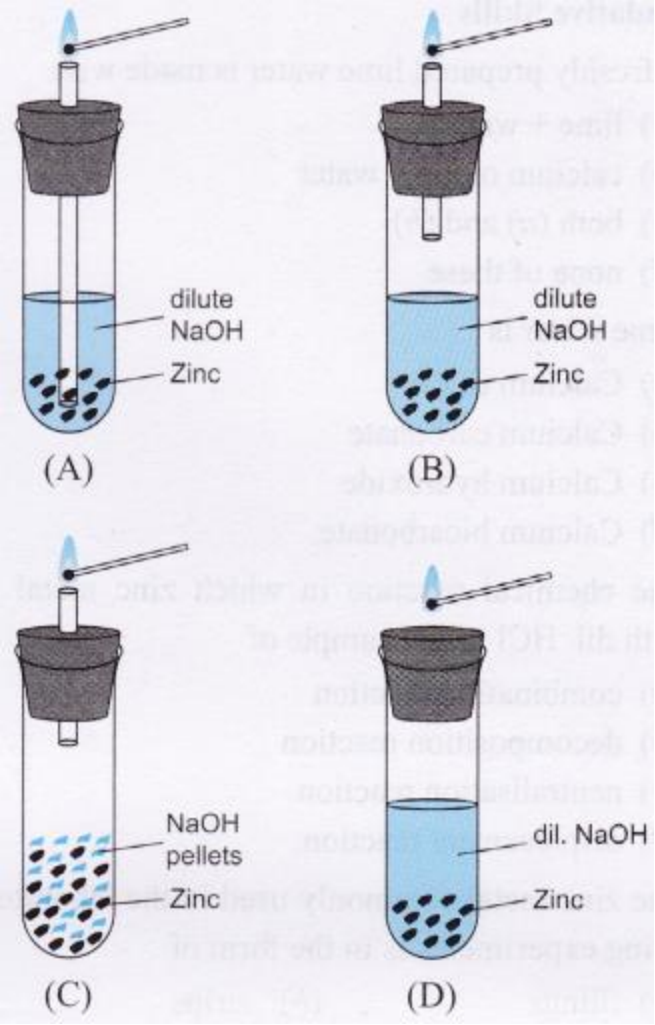
He would observe that no gas is evolved in the setup:
(a) I (b) II
(c) III (d) IV.

19. A student added dilute HCl to Zn granules taken in a test tube. The correct observation would be:



(a) zinc granules turned green
(b) formation of a precipitate
(c) bubbles of a gas
(d) no change.

20. Which one of the following set-up is the most appropriate for the evolution of hydrogen gas and its identification? **[CBSE Delhi 2008]**



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

21. When lighted candle is brought near the mouth of a gas jar containing hydrogen gas
(a) the candle is extinguished
(b) the gas will bum explosively with pop sound
(c) the gas burns and candle extinguishes
(d) none of the above.

22. Aluminium metaf reacts with sodium hydroxide solution and hydrochloric acid:
(a) hydrogen gas is released in both the cases
(b) hydrogen gas is released with dil HCl
(c) hydrogen gas is released with NaOH solution
(d) hydrogen gas is not released in any case.

Questions based on Reporting and Interpretation Skills

23. A substance X when dissolved in water releases OH ions, X is
(a) NaCl
(b) HCl
(c) NaOH
(d) Na_2CO_3.

24. A substance Y when dissolved in water forms H^+ ions, Y is
(a) NaCl
(b) HCI
(c) NaOH
(d) Na_2CO_3

25. A liquid sample turned red litmus paper blue. This indicates that the liquid sample is
(a) an alcohol
(b) hydrochloric acid
(c) distilled water
(d) sodium hydroxide solution.

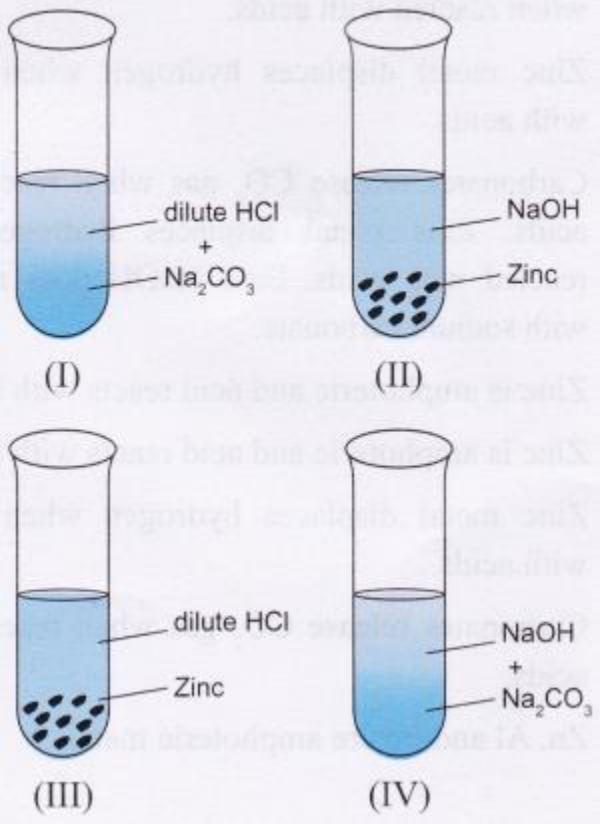
26. A metal powder was added to dilute HCl and dilute NaOH solution taken in separate test tubes. On making the contents react in both the test tubes, hydrogen gas was formed in both the cases. The metal used is
(a) Cu (b) Zn (c) Fe (d) Pb.

27. When a white powder was mixed with dilute acid, odourless gas was produced which turned lime water milky. The powder may be
(a) carbonate
(b) bicarbonate
(c) sulphate
(d) carbonate or bicarbonate.

28. When a powder was treated with dilute HC1, a gas was produced and when lighted matchstick is shown to it, the flame was put off and the gas also did not burn. The powder may be:
(a) $ZnSO_4$ (b) $CuSO_4$
(c) Na_2CO_3 (d) $Na2SO_4$.

29. Which of the following will give colourless gas that burns with a pop sound, on reaction with dilute HCl ?
(a) Solid sodium carbonate
(b) Zinc metal
(c) Sodium hydroxide
(d) Sodium bicarbonate.

30. Four students were asked by their teacher to arrange the set-up I-IV as given below and identify the gas evolved in each case, if any.

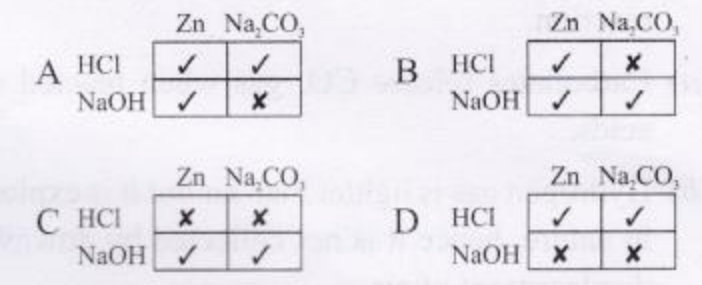


After observation, they arrived at the following inferences and recorded these in the form of a table given below:

Student	*I*	*II*	*III*	*IV*
A	H_2	No gas	CO_2	H_2
B	CO_2	H_2	No gas	CO_2
C	CO_2	H_2	H_2	No gas
D	No gas	CO_2	CO_2	H_2

The correct observation and inferences have been recorded by student
(a) A (b) B
(c) C (d) D.

31. Four students studied reactions of zinc and sodium carbonate with dilute HCl acid and dilute NaOH solution and presented their results as follows. The (V) represents evolution of gas whereas (x) represents no reaction.



The right set of observations is that of student:
(a) A (b) B
(c) C (d) D.

32. Four students performed the reactions of dilute HCl acid and a solution of sodium hydroxide with zinc metal and solid sodium carbonate separately. They reported the possible reaction by (V) no reaction by (x). In which of the following sets all observations are correct.

Set.	HCl + Zn	HCl + Na_2CO_3	NaOH + Zn	NaOH + Na_2CO_3
(a)	✓	✓	✓	✓
(b)	✗	✗	✓	✓
(c)	✓	✓	✗	✗
(d)	✓	✓	✓	✗

33. When zinc metal reacts with dilute hydrochloric acid, the gas evolved is
(a) carbon dioxide
(b) chlorine
(c) hydrogen
(d) oxygen.

34. When sodium carbonate reacts with hydrochloric acid the gas evolved is:
(a) carbon dioxide
(b) chlorine
(c) hydrogen
(d) oxygen.

35. The metals which react with acid and alkalies to produce hydrogen gas are
(a) Na and K
(b) Zn and Na
(c) Al and K

(d) Zn and Al.

ANSWERS

1. (c)	2. (c)	3. (d)	4. (c)	5. (a)
6. (b)	7. (b)	8. (b)	9. (a)	10. (d)
11. (d)	12. (c)	13. (c)	14. (b)	15. (d)
16. (b)	17. (d)	18. (b)	19. (c)	20. (b)
21. (b)	22. (a)	23. (c)	24. (b)	25. (d)
26. (b)	27. (d)	28. (c)	29. (b)	30. (c)
31. (a)	32. (d)	33. (c)	34. (a)	35. (d)

Chemistry Lab Manual – Scoring Key With Explanation

1. (c) Lime is calcium oxide and water reacts with it to form lime water.
2. (c) Lime is calcium oxide and water reacts with it to form calcium hydroxide.
3. (d) Zinc is more reactive than hydrogen and it will displace hydrogen ion.
4. (c) Granules has increased surface area for fast reaction.
5. (a) Carbonates release CO_2 gas when reacted with acids.
6. (b) Hydrogen gas is lighter than air but it is explosive in nature, hence it is not collected by downward displacement of air.
7. (b) Heavy gas does not diffuse fast and stays at urface.
8. (b) Hydrogen is neutral.
9. (a) Reaction of acid and base is a neutralization reaction and forms neutral salt.
10. (d) Acids react with it.
11. (d) Calcium bicarbonate dissolves in water.
12. (c) Carbon dioxide gas is released.
13. (c) Hydrogen gas is evolved and it gives pop sound with the burning splinter.
14. (b) Shiny surface of zinc gets coated with zinc chloride.
15. (d) Hydrogen gas is released which is colourless and odourless.
16. (b) Shiny surface of zinc gets coated with zinc chloride which is dull and black.
17. (d) Zinc gets coated with zinc chloride and turns black, it displaces hydrogen when reacted with acids.
18. (b) Bases do not react with solid sodium carbonate.
19. (c) Zinc metal displaces hydrogen when reacted with acids.
20. (b) The tube kept above the solution will release the gas out.
21. (b) Hydrogen gas is combustible.
22. (a) As Aluminium is amphoteric in nature.
23. (c) Bases release OH^- ions.
24. (b) Acids release hydrogen ions.
25. (d) Bases turn red litmus paper blue and sodium hydroxide solution is base.
26. (b) Zinc is amphoteric as it reacts with both acids and bases to form salt and water.
27. (d) Both carbonates and bicarbonates release CO_2 gas when reacted with acids.
28. (c) It contains carbonates, which release CO_2 gas when reacted with acids.

29. (b) Zinc metal displaces hydrogen when reacted with acids.
30. (c) Carbonates release CO_2 gas when reacted with acids. Zinc metal displaces hydrogen when reacted with acids. Base NaOH does not react with sodium carbonate.
31. (a) Zinc is amphoteric and acid reacts with base.
32. (d) Zinc is amphoteric and acid reacts with base.
33. (c) Zinc metal displaces hydrogen when reacted with acids.
34. (a) Carbonates release CO_2 gas when reacted with acids.
35. (d) Zn, Al and Pb are amphoteric metals.