Chapter 10

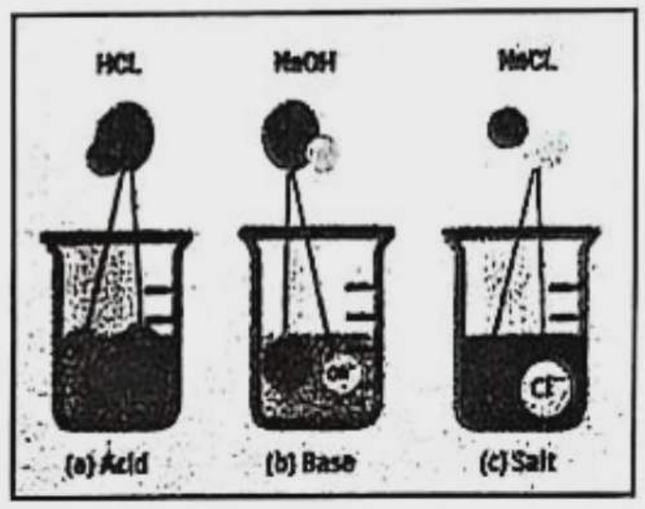
Acid, Base and Salt

Contents for Discussion

• Acid, base and indicators • Use of acids and bases • Some important properties of acid and alkali • Acid, alkali and salt identification

Learning Outcomes : After studying this chapter I will be able to–

- explain the characteristics of bases and acid;
- explain the properties of base;
- explain the properties of salts;
- explain the neutral substances;
- use instruments properly for experimental works;
- appreciate the importance of acids, bases and salts in our life;
- create consciousness amongst the member of the group about the importance of taking safety measures during the experiments.



Practice

Multiple Choice, Short & Creative Q/A following 100% accurate format for best prep.

Dear learners, the Q/A of this chapter have been divided into exercise, multiple choice, short, creative & exercise-based activities in light of the learning outcomes. Practice the questions well to ensure the best preparation in the exam.

Textual Q/A — Let's learn the textbook Q/A

Fill in the Blanks

a. Acids produce — in water.
b. Alkali is a kind of base which are —.
c. All alkalis are — but all — are not alkalis.
d. By the reaction of acids and bases — are produced.
e. Antacids are — like materials.

Ans. a. hydrogen ion; b. water soluble; c. bases, bases; d. salt and water; (e) base.

Short Answer Questions

Question 1. What is the main difference between an acid and a base?

Ans. The key difference between acids and bases is that acids produce hydrogen ions (H^+) in water. But alkalis give hydroxyl ions (OH^-) to water. For example–

$HCl \xrightarrow{H_2O} H^+ + Cl^-$; $CH_3COOH \xrightarrow{H_2O} H^+ + CH_3COO^-$

$NaOH \xrightarrow{H_2O} Na^+ + OH^-$; $Ca(OH)_2 \xrightarrow{H_2O} Ca^{2+} + 2OH^-$

Question 2. Explain the sentence– All alkaline are bases but all bases are not alkalis.

Ans. We know, bases are oxides/hydroxides of metals or metal-like elements. Some bases dissolve in water and some do not. The bases that dissolve in water are alkalis. It means that alkalis are special forms of bases. It also means that bases are at the same time alkalis also. For example, NaOH, KOH, $Ca(OH)_2$ and NH_4OH are at the same time bases and alkalis. But bases like $Al(OH)_3$, CuO, Na_2O do not dissolve in water. So they are not alkalis in spite of being bases.

Question 3. What type of chemical reaction occurs when carbon dioxide is introduced in lime water? Describe with corresponding reaction.

Ans. Adding water to lime or CaO produces lime water or calcium hydroxide. $CaO + H_2O \rightarrow Ca(OH)_2 + heat$

The heat generated by this reaction causes the water to boil. In calcium hydroxide [$Ca(OH)_2$] i.e. lime water, carbon dioxide (CO_2) gas is produced to form insoluble calcium carbonate ($CaCO_3$) and hydrogen (H_2) gas.

$Ca(OH)_2 + CO_2 \rightarrow CaCO_3\downarrow + H_2$

This reaction makes lime water turbid.

Question 4. Does litmus paper change colour due to salt or pure water? Give explanation in favour of your answer.

Ans. Both clean water and table salt are neutral substances. They are neither acidic nor basic. This is why sodium chloride solution causes no change in the colour of litmus paper. If it were acidic, it would turn blue litmus red. If it were basic, it would turn red litmus blue.

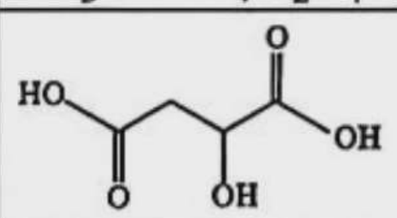
Question 5. What do you understand by indicators?

Ans. The substances which indicate whether a substance is acid or alkaline or neither by hanging their color are called indicators. Such as 'litmus paper, methyl orange, phenolphthalein, ethyl red etc. indicators. They help to understand whether an unknown substance is acid, alkaline or neutral.

MCQs with Answers

1. **What type of acid is there in tomato?**
   ⓐ Acetic acid ⓑ Oxalic acid
   ⓑ ⓒ Maleic acid ⓓ Citric acid

   »» **Explanation :**

Fruit/Food	Organic Acid	Formula
Tomato	Oxalic acid	$C_2H_2O_4$
Lemon, Grapes	Citric acid	$C_6H_8O_7$
Vineger	Acetic	$CH_3COOH/C_2H_4O_2$
Apple, pineapple	Malic acid	
Temarind	Tertaric acid	$C_4H_6O_6$
Card	Lactic acid	$C_3H_6O_3$

2. **Which acid is edible?**
   ⓐ HNO_3 ⓑ HCl
   ⓓ ⓒ H_2SO_4 ⓓ CH_3COOH

   »» **Explanation :** All the acids present in fruits or vegetables are called organic acids. They are edible and essential for the human body. For example: Vinegar or acetic acid (CH_3COOH) is an organic acid. On the other hand, mineral acids and inorganic acids obtained from minerals are not suitable for consumption and are harmful to the human body. For example– HNO_3, HCl, H_2SO_4 etc. are inorganic acids.

Read the following sentence and give answers to questions no 3 and 4 :

Adil once carried out a reaction between zinc and hydrochloric acid.

3. **The compound produced by the reaction is —.**
   i. salt ii. base iii. alkali
   Which one of the following is correct?
   ⓐ i & ii ⓑ i & iii ⓒ ii & iii ⓓ i, ii & iii

   »» **Explanation :** According to stimulus data, the reaction carried out by Adil is–

$$\underset{\text{Zinc oxide (Base)}}{ZnO} + \underset{\text{Hgdrochloric Acid}}{HCl} \rightarrow \underset{\text{Zinc Chloride Salt}}{ZnCl_2} + \underset{\text{Water (Acid)}}{H_2O}$$

   It appears that the product compounds in the reaction are salt and water and the reactant compounds are base and acid.
   NB : Only (i) is Correct.

4. **What will be produced if there is a reaction between the carbonate containing salt and the second compound?**
   ⓒ ⓐ H_2 ⓑ O_2 ⓒ CO_2 ⓓ Cl_2

   »» **Explanation :** According to stimulus information, the second compound is hydrochloric acid, denoted by HCI. Again salt with carbonate: $CaCO_3$
   The reaction is–

$$\underset{\text{Calcium Carbonate}}{CaCo_3} + \underset{\text{Hydrochlonic Acid}}{HCl} \rightarrow \underset{\text{Calcium Chloride}}{CaCl_2} + \underset{\text{Carbon Dioxide}}{CO_2} + \underset{\text{Water}}{H_2O}$$

   So, the products of the reaction are $CaCl_2$, CO_2 and H_2O.

Creative Questions with Answers

Ques. 01 Farah likes only fatty food. Recently he is often feeling stomach pain. When he met the doctor he was told that he has got acidity. Doctor besides advising him about changing his food habit, prescribed him a medicine.

a. What is salt? 1
b. What is meant by milk or lime? 2
c. What type of medicine did the doctor prescribe and why did he do so? 3
d. What type of compound is in the component that is producing the acid referred in the paragraph? And why?— Explain. 4

Answer to Question No. 01 :

a Salt is a special type of compound. It is a neutral substance having neither acidity or basicity. It is the main product of reaction either between an acid and a base or between a metal and an acid.

b Milk of lime is a paste made of calcium hydroxide and water. Milk of lime is prepared by mixing enough water with lime. In that case the reaction is -

$$\underset{\text{Milk of Lime}}{CaO + H_2O \quad Ca(OH)_2} + H_2$$

Milk of lime is used to repel insects.

c The doctor prescribed Farah to take antacid medicine.

Reason : Farah likes oily food. The amount of acid in her stomach increased due to eating oily food. If the amount of this acid increases, it

causes abdominal pain. The doctor advised her to take antacid medicine. This is because antacids are alkaline substances containing alkaline $Mg(OH)_2$ or $Al(OH)_3$. Medicinally it is magnesium hydroxide [$Mg(OH)_2$] or [$Al(OH)_3$]. It is in two forms: suspension and tablets. Acidity occurs when excess hydrochloric acid (HCl) is produced in the stomach. $Mg(OH)_2$ or $Al(OH)_3$ reacts with Hydrochloric acid (HCl) and produces neutral substance magnesium chloride $MgCl_2$ or $AlCl_3$ and water. As a result, HCl relieves stomach pain.

$$Mg(OH)_2 + 2HCl \rightarrow \underset{\text{salt}}{MgCl_2} + 2H_2O$$

$$Al(OH)_3 + 3HCl \rightarrow \underset{\text{salt}}{AlCl_3} + 3H_2O$$

d Hydrochloric acid (HCl) is essential in the stomach to digest food. Excess of this HCl acid produces acidity in the stomach. So HCl is the ingredient that makes Farah's acidity. This HCl is acidic or acidic compound. Why hydrochloric acid is an acidic compound is highlighted through the following properties–

1. HCl turns blue litmus paper red.
2. It has a sour taste.
3. It produces hydrogen ions (H+) in water.
4. It reacts with carbonate to form carbon dioxide.
   $CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2\uparrow$
5. It reacts with baking soda ($NaHCO_2$) to produce sodium chloride salt, water and CO_2, gas.
   $NaHCO_3 + HCl \rightarrow NaCl + H_2O + CO2\uparrow$
6. It reacts with zinc to produce bubbles of hydrogen gas.
   $Zn + 2HCl \rightarrow ZnCl_2 + H_2\uparrow$
7. It reacts with metals to form metal chlorides (salts).
   $Mg + 2HCl \rightarrow MgCl_2 + H_2$

Acidic compounds usually exhibit all these religions. Therefore the compound HCl is an acidic compound.

Ques. 02 Mansura occasionally chews betel leaves. One day she put lime in water in a pot. After some time, she observed that the pot has become hot. She also marked that when she was taking some lime from the pot, the lime water turned cloudy due to her breath reaching the lime water.

a. What is Alkali? 1
b. Why the lime water turned cloudy? 2
c. Explain the various uses of the watery compound in Mansura's pot. 3
d. Explain the fact that the first compound in the paragraph shows the properties of both an alkali and base. 4

Answer to Question No. 02 :

a The water soluble bases are called alkalis.

b Lime reacts with water to form lime water or calcium hydroxide. By driving carbon dioxide into this lime water, the lime water becomes turbid. CO_2 gas is released with human breathing. When Mansura Khanam took lime from the pot, she breathed carbon dioxide into the lime water, which reacted with the lime water to produce insoluble calcium carbonate ($CaCO_3$) and water (H_2O). As a result, the lime water becomes turbid.

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

c The compound soaked in this Masura Khanam pot is called lime or calcium oxide (CaO). This calcium oxide reacts with water to produce $Ca(OH)_2$, known as quicklime.

Its uses are as follows–

i. **In construction work :** A dilute solution of CaO is used to whitewash the masonry in masonry construction. It is used for cleaning houses.
ii. **In agriculture :** A paste made of calcium hydroxide and water known as milk of lime. It is used to control insects.
iii. **As cleaners :** The bleaching powder produced by the reaction of dry $Ca(OH)_2$ and Cl_2 gas. It is used in various applications including disinfectants and deodorizers.
iv. **Chemical industry :** Industrially, soda lime is used as an alkaline in the production of lime and in the extraction of metals.

d According to the stem, the first produced compound is calcium hydroxide [$Ca(OH)_2$].

$$CaO + H_2O \rightarrow Ca(OH)_2$$

$Ca(OH)_2$ is at the same time a base and an alkali in the sense that it has the properties of both bases and alkalis. It is a base in the sense that it is a hydroxide of a metal-like element (Ca) and it produce salts reacting with acids.

$$Ca(OH)_2 + \underset{\text{acid}}{H_2SO_4} \longrightarrow \underset{\text{salt}}{CaSO_4} + H_2O$$

$$Ca(OH)_2 + \underset{\text{acid}}{HNO_3} \longrightarrow \underset{\text{salt}}{Ca(NO_3)_2} + H_2O$$

$Ca(OH)_2$ is an alkali in the sense that it dissolves in water. It tastes bitter, feels sleepery and turns red litmus blue. So it is a base and an alkali at the same time.

Multiple Choice Q/A Designed as per topic

Lesson 1-4 : Acid, base and indicators

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1. Which one of the following is a salt? *(Knowledge)*
ⓐ $Ca(OCl)Cl$ ⓑ $C_{17}H_{35}COONa$
ⓒ ⓒ $Al(NO_3)_3$ ⓓ NH_4OH

2. Which one of the following is an acid? *(Knowledge)*
ⓐ $HOOC-COOH$ ⓑ $NaHCO_3$
ⓐ ⓒ $Ca(OCl)Cl$ ⓓ $KClO_3$

3. What is the main ingredient of soap? *(Knowledge)*
ⓐ KOH ⓑ NaOH
ⓑ ⓒ K_2CO_3 ⓓ Na_2CO_3

4. Which one of the following does not release H^+ in water? *(Knowledge)*
ⓓ ⓐ HCl ⓑ HSO_4 ⓒ H_2SO_4 ⓓ CH_4

5. Which one of the following is an inorganic acid? *(Knowledge)*
ⓐ $HClO_4$ ⓑ CH_3COOH
ⓐ ⓒ $HOOC-COOH$ ⓓ all the above

6. Agents for fermentation of litmus —. *(Higher ability)*
i. K_2CO_3
ii. H_2SO_4
iii. NH_3
Which one of the following is correct?
ⓒ ⓐ i & ii ⓑ ii & iii ⓒ i & iii ⓓ i, ii & iii

7. Edible acids —. *(Higher ability)*
i. CH_3COOH
ii. $HOOC-COOH$
iii. $HClO_4$
Which one of the following is correct?
ⓐ ⓐ i & ii ⓑ i & iii ⓒ ii & iii ⓓ i, ii & iii

8. Which of the following has citric acid? *(Knowledge)* *[DB '19]*
ⓐ Orange ⓑ Tamarind
ⓐ ⓒ Tomato ⓓ Apple

9. Which is the main element of producing soap? *(Knowledge)* *[DB '19]*
ⓐ $Al(OH)_3$ ⓑ $Ca(OH)_2$
ⓒ ⓒ NaOH ⓓ NH_4OH

10. What is the chemical name of vinegar? *(Comprehension)* *[RB '19]*
ⓐ Citric acid ⓑ Acetic acid
ⓑ ⓒ Maleic acid ⓓ Hydrochloric acid

11. Which one of the following is the formula of Vinegar? *(Comprehension)* *[JB '19]*
ⓐ HOOC-COOH ⓑ H_2S0_4
ⓓ ⓒ HCl ⓓ CH_3COOH

12. Which one is base? *(Knowledge)* *[SB '19]*
ⓐ NaOH ⓑ NH_4OH
ⓓ ⓒ $Ca(OH)_2$ ⓓ m $AI(OH)_3$

13. Which one does not change the colour of litmus paper? *(Comprehension)* *[SB '19]*
ⓐ HCl ⓑ NaCl
ⓑ ⓒ NH_3 ⓓ $Ca(OH)_2$

14. Which acid present in tamarind? *(Knowledge)*
ⓐ Malic ⓑ Citric
ⓓ ⓒ Oxalic ⓓ Tartaric

15. Which acid is present in Tomato? *(Knowledge)* *[MB '19]*
ⓐ Nitric acid ⓑ Carbolic acid
ⓒ ⓒ Oxalic acid ⓓ Ascorbic acid

16. Which base does not dissolve in water? *(Comprehension)* *[RB '18]*
ⓐ NaOH ⓑ $Ca(OH)_2$
ⓒ ⓒ $Al(OH)_3$ ⓓ NH_4OH

17. Which kind of fruits contain oxalic acid? *(Knowledge)* *[CB '18]*
ⓐ Tamato ⓑ Emblica
ⓐ ⓒ Pineapple ⓓ Grape

18. Malic acid is available in —. *(Knowledge)* *[CtgB '18]*
ⓐ Tamarind ⓑ Amloki
ⓒ ⓒ Pineapple ⓓ Orange

19. Which of the following is main component of Soap? *(Comprehension)* *[CtgB '18]*
ⓐ $Ca(OH)_2$ ⓑ NaOH
ⓑ ⓒ NH_4OH ⓓ $Mg(OH)_2$

20. Which acid is present in tomato? *(Knowledge)* *[SB '18]*
ⓐ Citric ⓑ Oxalic
ⓑ ⓒ Ascurbic ⓓ Malic

21. What compound produces hydrogen ion (H^+) in water? *(Application)* *[JB '17]*
ⓓ ⓐ CH_4 ⓑ NH_3 ⓒ NaOH ⓓ HCl

22. Which acid remains in amloki? *(Knowledge)* *[CB '17]*
ⓐ Citric ⓑ Tartaric
ⓒ ⓒ Ascorbic ⓓ Xratic

23. In which fruit, Oxalic acid is present? *(Knowledge)* *[SB '17]*
ⓑ ⓐ Orange ⓑ Tomato ⓒ Apple ⓓ Lemon

24. Which one is mineral acid? *(Knowledge)* *[SB '17]*
ⓐ CH_3COOH ⓑ $HOOC-COOH$
ⓓ ⓒ NH_4OH ⓓ $HClO_4$

25. Which acid is contained in grapes? *(Knowledge)* *[BB '17]*
ⓐ Malic acid ⓑ Oxalic acid
ⓒ ⓒ Citric acid ⓓ Ascorbic acid

26. Characteristics of alkali is —. *(Knowledge)* *[DjB '17]*
i. they are slippery and bitter taste
ii. they turn blue litmus paper to red in colour
iii. they give OH^- ion in water
Which one is correct?
ⓑ ⓐ i & ii ⓑ i & iii ⓒ ii & iii ⓓ i, ii & iii

Science

27. **What is the name of acid present in apple?** *(Knowledge)* *[DjB '17]*
ⓐ Malic acid ⓑ Oxalic acid
ⓐ ⓒ Tartaric acid ⓓ Ascorbic acid

28. **Which one of the following is the base?** *(Knowledge)* *[DB '16]*
ⓑ ⓐ HCl ⓑ NaOH ⓒ NaCl ⓓ HNO_3

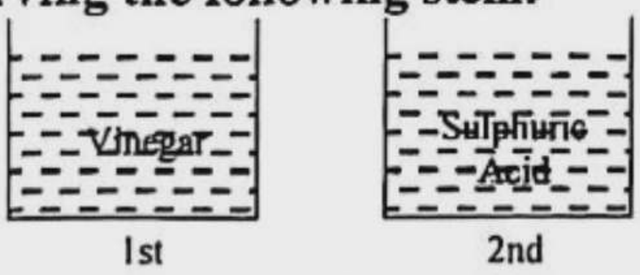
29. **Which one of the following is the formula of edible soda?** *(Knowledge)* *[RB '16]*
ⓐ $NaHCO_3$ ⓑ Na_2CO_3
ⓐ ⓒ HCl ⓓ $ZnSO_4$

30. **Which one is the formula of vinegar?** *(Knowledge)* *[SB '16]*
ⓐ H_2SO_4 ⓑ HOOC–COOH
ⓒ ⓒ CH_3COOH ⓓ $HClO_4$

31. **Which one of the following is only base?** *(Comprehension)* *[SB '16]*
ⓐ NaOH ⓑ $Ca(OH)_2$
ⓒ ⓒ $Al(OH)_3$ ⓓ NH_4OH

32. **In which fruits has tartaric acid?** *(Knowledge)* *[DjB '16]*
ⓐ Apple ⓑ Tamarind
ⓒ ⓒ Tomato ⓓ Pineapple

Answer the question No. 33 and 34 by observing the following stem.



[Ideal School & College. Dhaka]

33. **Which type of substance is in the 2nd Beaker?** *(Comprehension)*
ⓐ Organic acid ⓑ Inorganic acid]
ⓑ ⓒ Base ⓓ Indicator

34. **Which ion will be produced in the solution of 1st beaker?** *(Application)*
ⓐ – OOC – COO – ⓑ SO_4^{2-}
ⓒ ⓒ CH_3COO^- ⓓ $CH_3CH_2COO^-$

35. **Which one is Mineral Acid?** *(Knowledge)* *[Ideal School & College, Dhaka]*
ⓐ $HClO_4$ ⓑ CH_3COOH
ⓐ ⓒ HCOOH ⓓ HOOC – COOH

36. **What is the chemical name of vinegar?** *(Knowledge) [Viqarunnesa Noon School & College, Dhaka]*
ⓐ Citric acid ⓑ Acitic acid
ⓑ ⓒ Malic acid ⓓ Nitric acid

Lesson 5-6 : Use of acids and bases

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37. **What gas do you need to produce bleaching powder?** *(Knowledge)*
ⓐ Chlorine ⓑ Hydrogen
ⓐ ⓒ Carbon dioxide ⓓ Sulpher dioxide

38. **Which of the following acids cures scurvy?** *(Knowledge)*
ⓐ Acetic acid ⓑ Auxalic acid
ⓒ ⓒ Ascorbic acid ⓓ Uric acid

39. **Which of the following compounds ensures digestion?** *(Comprehension)*
ⓓ ⓐ H_3PO_4 ⓑ $HClO_4$ ⓒ H_2SO_4 ⓓ HCl

40. **Which is appropriate to remove acidity in the stomach?** *(Comprehension)* *[D.B.-'19]*
ⓐ Cabium Hydroxide
ⓑ Acetic Acid
ⓒ Aluminium Hydroxide
ⓒ ⓓ Ammonium Hydroxide

41. **Which is the most essential acid in a fertilizer factory?** *(Comprehension)* *[CtgB '19]*
ⓐ HCl ⓑ H_2SO_4
ⓑ ⓒ HNO_3 ⓓ H_3PO_4

42. **Which one is used as insecticide?** *(Comprehension)* *[BB '19]*
ⓐ NH_4OH ⓑ NaOH
ⓓ ⓒ $Mg(OH)_2$ ⓓ $Ca(OH)_2$

43. **Which acid of the following is edible?** *(Comprehension)* *[MB '19]*
ⓐ Phosphoric acid ⓑ Malic acid
ⓑ ⓒ Perchloric acid ⓓ Hydrochloric acid

44. **Particular amount of what is useful for body?** *(Knowledge)* *[JB '18]*
ⓐ HCl ⓑ H_2SO_4
ⓐ ⓒ HOOC – COOH ⓓ HNO_3

45. **Which one is used to protect from snakes?** *(Comprehension)* *[SB '18]*
ⓐ Hydrochloric acid ⓑ Sulphuric acid
ⓓ ⓒ Carbonic acid ⓓ Carbolic acid

46. **HNO_3 is used —.** *(Higher ability)* *[DjB '18]*
i. gold from the mine
ii. leather industries
iii. to produce fertilizer
Which one of the following is correct?
ⓐ i & ii ⓑ i & iii
ⓑ ⓒ ii & iii ⓓ i, ii & iii

47. **What compound produce when CO_2 flow in lime water?** *(Comprehension)* *[JB '17]*
ⓑ ⓐ CaO ⓑ $CaCO_3$ ⓒ $Ca(OH)_2$ ⓓ $CuCO_3$

48. **Which one is known as "milk of magnesia"?** *(Knowledge)* *[DB '16]*
ⓐ Al_2O_3 ⓑ $Al(OH)_3$
ⓒ ⓒ $Mg(OH)_2$ ⓓ MgO

49. **Which gas is used to produce bleaching powder?** *(Comprehension)[Ideal School & College, Dhaka]*
ⓐ NH_3 ⓑ CH_4
ⓒ ⓒ Cl_2 ⓓ N_2

50. $NaCO_3 + 2HCl \rightarrow 2\ NaCl + H_2O + X$ *(Higher ability)* *[Viqarunnesa Noon School & College, Dhaka]*
i. Needed to produce plant food
ii. It is gaseous substance
iii. It put out the fire
Which one is correct?
ⓒ ⓐ i & ii ⓑ ii & iii ⓒ i & iii ⓓ i, ii & iii

Lesson 7-10 : Some important properties of acid and alkali

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51. $CaCO_3 + HCl \longrightarrow$? *(Comprehension)*
ⓐ $CaCl_2 + H_2O + CO_2$ ⓑ $CaCl_2 + H_2O$
ⓐ ⓒ $Ca(OCl)Cl + CO_2$ ⓓ $Ca(OCl)Cl + H_2O$

52. **Acid + Base ⟶ ?** *(Comprehension)*
ⓐ Alkali + Neutral ⓑ Neutral + Neutral
ⓑ ⓒ Alkali + Acid ⓓ Neutral + Acid

■ **Look at the reactions below and answer the question numbers 53 and 54 :**
$Ca(OH)_2 + H_3PO_4 \rightarrow Ca_3(PO_4)_2 + H_2O$
$Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$
$Na_2CO_3 + HCl \rightarrow NaCl + H_2O + CO_2$

53. **What is the nature of these reactions?** *(Comprehension)*
ⓐ Base-forming ⓑ Alkali forming
ⓓ ⓒ Acid forming ⓓ Salt forming

54. **$Ca(OH)_2$ —.** *(Higher ability)*
i. releases H^+ in solution
ii. is a base
iii. is an alkali
Which one of the following is correct?
ⓑ ⓐ i & ii ⓑ ii & iii ⓒ i & iii ⓓ i, ii & iii

55. **$NaOH + HCl \longrightarrow X + H_2O$.**
in this reaction the 'X' compound is—
(Application) *[DjB '19]*
ⓐ acid ⓑ base
ⓒ ⓒ salt ⓓ alkali

56. **Which one is salt?** *(Knowledge)* *[RB '18]*
ⓐ CaO ⓑ NaOH
ⓓ ⓒ HCl ⓓ $CaSO_4$

57. **Which one is produced when lemon is added to edible soda?** *(Comprehension)* *[JB '18]*
ⓐ Carbon dioxide ⓑ Oxygen
ⓐ ⓒ Sulphur dioxide ⓓ Hydrogen

58. **Which one is the formula of ammonium nitrate?** *(Comprehension)* *[SB '17]*
ⓐ $NH_4(NO_3)_2$ ⓑ NH_4NO_2
ⓒ ⓒ NH_4NO_3 ⓓ $(NH_4)_2NO_3$

■ **Read the following passage and answer the following two questions :**
Nabila reacted zinc oxide and hydrochloric acid one day. *[RB '17]*

59. **In the reaction the products are—** *(Higher ability)*
i. Salt ii. Alkali
iii. Water
Which one is correct? *(Higher ability)*
ⓑ ⓐ i & ii ⓑ i & iii ⓒ ii & iii ⓓ i, ii & iii

60. **When lime water is reacted with sulphuric acid, then it is produced —.** *(Higher ability)* *[SB '16]*
i. $CaSO_4$ ii. $CaCO_3$
iii. H_2O
Which one is correct?
ⓑ ⓐ i & ii ⓑ i & iii ⓒ ii & iii ⓓ i, ii & iii

61. **Which one is the formula of lime stone?** *(Knowledge)* *[SB '16]*
ⓐ $CaCO_3$ ⓑ CaO
ⓐ ⓒ $CaCl_2$ ⓓ $Ca(OH)_2$

62. **In case of acid–** *(Higher ability)* *[Rajuk Uttara Model College, Dhaka]*
i. it produces H+ in water
ii. it converts red litmus paper into blue
iii. it produce H_2 when reacts with metal
Which one is correct?
ⓑ ⓐ i & ii ⓑ i & iii ⓒ ii & iii ⓓ i, ii & iii

63. **What is the formula of lime stone?** *(Comprehension)* *[Ideal School & College, Dhaka]*
ⓐ $NaHCO_3$ ⓑ KOH
ⓒ ⓒ $CaCO_3$ ⓓ KNO_3

Lesson 11-13 : Acid, alkali and salt identification

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64. **What are chemicals that make the red litmus paper blue called?** *(Comprehension)* *[JB '17]*
ⓐ Alkali ⓑ Acid
ⓐ ⓒ Salt ⓓ Indicator

65. **Which vapour solution change the colour of red litmas paper?** *(Comprehension)* *[CB '18]*
ⓐ NaOH ⓑ $CaCO_3$
ⓐ ⓒ H_3PO_4 ⓓ $CuSO_4$

66. **[E] + Blue litmas paper → Red colour.**
What is 'E' in the above flow-chart? *(Comprehension)* *[DB '15]*
ⓐ Indicator ⓑ Base
ⓓ ⓒ Salt ⓓ Acid

67. **X + blue litmus paper ⟶ red colour, what type of substance is X?** *(Application)* *[Ideal School & College, Dhaka]*
ⓐ Acid ⓑ Base
ⓐ ⓒ Salt ⓓ Indicator

68. **Which one does not change the colour of litams?** *(Comprehension)* *[Viqarunnesa Noon School & College, Dhaka]*
ⓓ ⓐ HCl ⓑ NaCl ⓒ NH_3 ⓓ $Ca(OH)_2$

Science

Short Q/A Designed as per topic

Lesson 1-4 : Acid, Base and Indicator

Textbook Page 104

Question 1. How is litmus paper made?
Ans. To make litmus paper, a colored substance is extracted from a type of plant called lichens. This extracted colored substance is mixed with water to create a solution. Then, filter paper is dipped into this solution and dried to make litmus paper.

Question 2. How does litmus paper change color?
Ans. The colored substance present in litmus paper acts as an indicator. When this paper is dipped into an acid or alkaline solution, its color changes depending on the pH of the solution. In acidic solutions, blue litmus paper turns red, and in alkaline solutions, red litmus paper turns blue.

Question 3. Why does lemon juice not change the color of red litmus paper?
Ans. Lemon juice contains citric acid. When red litmus paper is dipped into it, no chemical reaction occurs, and therefore, there is no change in the color of the litmus paper. However, if blue litmus paper is dipped into lemon juice, a chemical reaction takes place with the citric acid, causing the litmus paper to change color and become red.

Question 4. Why are grapes sour in taste?
Ans. Grapes and similar fruits contain various types of acids. In the case of grapes, this acid is citric acid. Acids are generally sour in taste. Therefore, the sour taste of grapes is due to the presence of citric acid.

Question 5. Mention the names and sources of two organic acids.
Ans. The names and sources of two organic acids are mentioned below :

Organic Acid Name	Source
Citric acid	Lemon, Grapes, Orange
Tartaric acid	Tamarind

Question 6. How does the color of litmus paper change in lime water?
Ans. Lime water is an alkaline substance. Therefore, when red litmus paper is dipped into lime water, it changes color and becomes blue. However, when blue litmus paper is dipped into it, there is no change in color.

Question 7. Write two uses of sodium hydroxide.
Ans. Two uses of sodium hydroxide are :
1. Sodium hydroxide is the main component in soap production.
2. It is used in the paper and rayon industry.

Question 8. Why is litmus paper called an indicator?
Ans. Litmus paper is called an indicator because it indicates whether a solution is acidic or alkaline. This paper, made from a colored substance obtained from lichens, turns red in an acidic environment and blue in an alkaline environment. This color change indicates the nature of the acid or alkali in a solution, which is why it is called an indicator.

Question 9. Why is HCl called an acid?
Ans. HCl is called an acid because when it dissolves in water, it produces hydrogen ions (H^+).

$$HCl \xrightarrow{H_2O} H^+ + Cl^-$$

Also, when blue litmus paper is dipped into an aqueous solution of HCl, it turns red. That's why HCl is called an acid.

Question 10. Why is CH4 not an acid?
Ans. It is known that a compound that partially or completely dissociates in water to produce H+ ions is called an acid. Although methane (CH4) contains hydrogen, it cannot produce hydrogen ions (H+) in water, so methane (CH4) is not an acid.

Question 11. Why is NaOH called a base?
Ans. NaOH is called a base because when it dissolves in water, it produces hydroxide ions (OH^-).

$$NaOH \xrightarrow{H_2O} Na^+ + OH^-$$

Also, when red litmus paper is dipped into an aqueous solution of NaOH, it turns blue. That's why NaOH is called a base.

Question 12. Write two properties of acid.
Ans. Two properties of acid are :
1. They produce hydrogen ions (H^+) in aqueous solution.
2. They turn blue litmus paper red.

Question 13. Write two properties of base.
Ans. Two properties of base are :
1. They produce hydroxide ions (OH^-) in aqueous solution.
2. They turn red litmus paper blue.

Question 14. Explain why $Al(OH)_3$ is a base but not an alkali.
Ans. $Al(OH)_3$ is called a base but not an alkali because to be an alkali, it must be soluble in water and produce hydroxide ions (OH^-) in aqueous solution. Although aluminum hydroxide ($Al(OH)_3$) contains oxygen (O) and hydrogen (H), $Al(OH)_3$ cannot dissolve in water. Therefore, even though it is a base, it is not considered an alkali.

Question 15. Explain the sentence: "All alkalis are bases, but all bases are not alkalis."
Ans. Some bases are soluble in water, while others are not. Bases that dissolve in water are called alkalis. So, alkali is a special type of base. NaOH, $Ca(OH)_2$, and NH_4OH are alkalis. They are also bases. On the other hand, aluminum hydroxide [$Al(OH)_3$] does not dissolve in water, so it is a base but not an alkali. Therefore, it can be said that all alkalis are bases, but not all bases are alkalis.

Question 16. Write two differences between acid and base.

Ans. Two differences between acid and base are :

Acid	Base
1. Acids are generally sour in taste and produce hydrogen ions (H^+) when dissolved in water.	1. Bases are generally bitter in taste and produce hydroxide ions (OH^-) when dissolved in water.
2. Acids turn blue litmus paper red.	2. Bases turn red litmus paper blue.

Lesson 5-6 : Uses of Acids and Bases

▸ Textbook Page 106

Question 17. Mention two uses of calcium-containing bases.

Ans. Two uses of calcium-containing bases are :

1. A dilute solution of calcium hydroxide, known as lime water, is used for whitewashing buildings.
2. A paste made of water and calcium hydroxide, commonly known as milk of lime, is used as an insecticide.

Question 18. What is meant by antacid?

Ans. Antacid medicine is mainly magnesium hydroxide [$Mg(OH)_2$], which is available both as a suspension and as tablets. The suspension of magnesium hydroxide [$Mg(OH)_2$] is more commonly known as milk of magnesia. Sometimes, antacids also contain aluminum hydroxide [$Al(OH)_3$].

Question 19. Discuss the types of acids.

Ans. Acids are generally of two types: 1. Organic acids and 2. Inorganic acids. The acids found in fruits and vegetables are organic acids, such as ascorbic acid. On the other hand, some acids, like HCl, H_2SO_4, and HNO_3, are made from mineral substances and are called mineral acids or inorganic acids.

Question 20. Mention the negative impacts of acid throwing.

Ans. Throwing acid causes severe burns to the human body. If acid is thrown on the face, it becomes disfigured. As a result, victims of acid attacks often do not want to appear in public with their disfigured faces, and in many cases, they even resort to suicide.

Question 21. Why is the punishment for acid throwing death penalty?

Ans. The punishment for acid throwing is the death penalty because, firstly, it is an extremely cruel and inhumane crime that causes permanent physical and mental damage. Secondly, it creates fear and panic in society and poses a major threat to women's safety.

Question 22. Why should people be made aware of the use of acid?

Ans. Evil-minded people are committing serious crimes by throwing acid, as well as wasting valuable acids that could be used in industries. This is causing a lot of harm to people and the environment. Therefore, we must be vocal about the sale and use of acid and raise awareness among people. This will protect us from heinous crimes like acid throwing.

Question 23. Mention the uses of acid and base as cleaning agents.

Ans. Acid and base have widespread use as cleaning agents. The well-known cleaning agent bleaching powder is made by the reaction between dry $Ca(OH)_2$ base and Cl_2 gas. On the other hand, the cleaning agents we use to clean toilets contain acid.

Question 24. Mention the uses of sulfuric acid in industries.

Ans. Sulfuric acid is used in batteries for various industrial applications, such as IPS, cars, microphones, and solar electricity generation. Sulfuric acid is also an essential component in fertilizer factories. In addition, a large amount of H_2SO_4 is used in the production of various chemicals, starting from detergents, paints, medicines, insecticides, paper, explosives, and rayon.

Question 25. Mention two uses of HCl.

Ans. Two uses of HCl are :

1. Hydrochloric acid (HCl) is an essential acid in our stomach for digesting food.
2. HCl is used in many industries, such as steel mills, medicine production, and leather processing.

Question 26. What is nitric acid used for?

Ans. Nitric acid has various uses in daily life and industries. Nitric acid is used in fertilizer factories to produce fertilizers. It is also needed to extract precious metals like gold from mines. Additionally, nitric acid is an important component in the preparation of explosives and rocket fuel.

Lesson 7-10 : Some Important Properties of Acid and Alkali

▸ Textbook Page 108

Question 27. Present the reaction of acid with metallic carbonate with an equation.

Ans. Acid reacts with metallic carbonate to produce salt, water, and carbon dioxide gas. For example, when sodium carbonate reacts with hydrochloric acid, it produces sodium chloride, water, and carbon dioxide.

Reaction : $Na_2CO_3 + 2HCl = 2NaCl + H_2O + CO_2$

Salt + Water + Carbon dioxide

Question 28. What happens when acid is mixed with baking soda? Write with reaction.

Ans. Baking soda is sodium bicarbonate. When acid is mixed with baking soda, a neutralization reaction occurs. This reaction produces salt, water, and carbon dioxide gas. For example, when baking soda is mixed with hydrochloric acid, it produces sodium chloride, water, and carbon dioxide.

Reaction : NaHCO3 + HCl = NaCl + H2O + CO2

Salt + Water + Carbon dioxide

Question 29. What happens in the reaction between metal and acid? Write with reaction.
Ans. Metal reacts with acid to produce salt and hydrogen gas. In this reaction, the hydrogen ions of the acid react with the metal to form a salt, and hydrogen gas is released. For example, when zinc metal reacts with hydrochloric acid, it produces zinc chloride and hydrogen gas.
Reaction : $Zn + 2HCl = ZnCl_2 + H_2$
Salt + Hydrogen gas

Question 30. Explain how salt is produced by the reaction of acid and base.
Ans. When acid and base react, they produce salt and water. This is called a neutralization reaction. The hydrogen ions (H+) of the acid and the hydroxide ions (OH-) of the base react with each other to form water (H2O). The remaining ions combine to form salt. For example, when hydrochloric acid and calcium hydroxide base react, they produce calcium chloride salt and water.

Question 31. How is NaCl salt produced?
Ans. NaCl or common salt is produced through a neutralization reaction. To make NaCl, hydrochloric acid (HCl) and sodium hydroxide (NaOH) base are mixed together. This reaction produces sodium chloride (NaCl) and water (H_2O).
Reaction : $HCl + NaOH \rightarrow NaCl + H_2O$
Salt + Water

Lesson 11-13 : Acid, alkali and Salt Identification

Textbook Page 110

Question 32. How would you identify whether a solution of KOH is a base or an acid?
Ans. KOH is an alkaline solution. If red litmus paper is dipped into this solution and turns blue, then we can understand that it is an alkali or base. Also, if the color of blue litmus paper remains unchanged when dipped into the solution, we can also understand that it is a base.

Question 33. How would you identify whether an aqueous solution of H_2SO_4 is a base or an acid?
Ans. An aqueous solution of H_2SO_4 is acidic. If blue litmus paper is dipped into this solution and turns red, then we can understand that it is an acid. Also, if the color of red litmus paper remains unchanged when dipped into the solution, we can also understand that it is an acid.

Creative Q/A Designed as per learning outcomes

Ques. 01

$$CaO + H_2SO_4 \longrightarrow CaSO_4 + H_2O$$
(A) (B) (D)

a. What is formula? 1
b. What is meant by the atomic number of Nitrogen is 7? 2
c. Hydrogen ion is produced from the compound 'B'.—Explain with equation. 3
d. What will happen in case of the change of the colour of litmus paper, if CO2 gas passes through the mixture of A and D? Give logic in favour of your answer. 4

• *[Barishal Board 2019]*

Answer to Question No. 01 :

a The short expression of molecule of compound is called formula. For example formula of hydrogen molecule is H_2.

b Atomic number refers to the number of protons present in an atom.
The atomic number of nitrogen is 7 by which we mean that nitrogen atom has 7 protons in the nucleus.

c The compound B or H_2SO_4 contains two hydrogen atoms, one Sulphur atom and four oxygen atoms. The hydrogen atom present in compound H_2SO_4 produces hydrogen ions H^+ in the presence of water.

$$H_2SO_4 \xrightarrow{H_2O} H^+ + HSO_4^-.$$

d Here, A is CaO and D is H_2O.

$$CaO + (D) \quad H_2O \longrightarrow Ca(OH)_2$$
Calcium oxide water calcium hydroxide

Due to the addition of water into lime. There is a chemical reaction between them and calcium hydroxide is formed. There chemical reaction is shown in above.
Again $Ca(OH)_2$ is a base and it change red litmus paper into blue but it does not change colour of blue litmus paper into red.
If CO_2 gas is passed through $Ca(OH)_2$, the following chemical reaction takes place.

$$CO_2(g) + Ca(OH)_2 \longrightarrow CaCO_3 + H_2O$$
Carbondixide Lime water Calcium Carbonate water

The lime water becomes opaque due to formation of calcium carbonate.

Ques. 02 (i) ☐ + NaOH → NaCl + H2O.

(ii) ☐ + CuSO4 → FeSO4 + Cu.

a. What is indicator? 1
b. Why CaSO4 is called neutral substance? 2
c. What type of reaction of the (ii) no. reaction —Explain. 3
d. Is there any change, if blue litmus paper is entered into two reactants separately of (i) no. equation? Give your opinion with logic. 4

• *Rajshahi Board 2018*

Answer to Question No. 02 :

a Materials which identify whether a substance is an acid or a base or none of these are called indicators.

b $CaSO_4$ or calcium sulphate is a salt. It is called neutral substance having neither acidity or basicity. It is the main product of reaction either between an acid and a base or between a metal and an acid. It does not makes any change to litmus paper.

c Reaction no. (ii) is written as follows —

$Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

Here a chemical reaction taken place, as a result ferrous sulphate and copper have been formed. The colour of iron sulphate is light green which turns the blue colour of the solution into light green.

Fe + CuSO4 ⟶ FeSO4 + Cu

Iron Copper sulphate Ferrous sulphate Copper

In this reaction iron is removing copper from copper sulphate and occupying is place to form ferrous sulphate and pure copper.

This type of chemical reaction, where an element replaces another element from a compound band occupies its place producing a new compound is called displacement reaction.

d Reaction no. (ii) is written as follows —

$HCl + NaOH \rightarrow$

Hydrochloric Acid Dodium Hydronide

$NaCl + H_2O$

Sodium Chloride Water

Here, the two reactants are HCl (hydrochloric acid) and NaOH (Sodium hydroxide). HCl is a strong acid. Whereas, NaOH is a base. The produced NaCl is a salt.

Now, if blue litmus paper is kept in two reactants separately, the following changes will occure —.

i. If blue litmus paper is kept in HCl, the litmus paper will turn into red colour.
because acid turns to blue litmus paper red.
HCl + blue litmus paper → Red litmus paper.

ii. If blue litmus paper is kept in NaOH, no chemical reaction takes place and consequently no change of colour of litmus paper will occurs because NaOH is a base. And a base turns to red litmus paper blue.
NaOH + blue litmus paper → No change

Ques. 03 Arpa observed that bubbles is produced in the two test tubes where HNO3 is added with Δ limestone and audible soda which are kept separately in the two test tubes in the laboratory of her school.

a. What is indicator? 1
b. Is methane an acid? Explain it. 2
c. How can you identify the substance that is mixed in the stem, either acid or base? Explain it. 3
d. Analyze the reasons for which Arpa observed the bubbles in both the text tubes with equation. 4

● *Sylhet Board 2018*

Answer to Question No. 03 :

a Materials like litmus paper which identify whether a substance is an acid or a base or none of these are called indicators.

b No. it is not an acid. Methane has four hydrogen atoms. It does not produce H+ in water.

c The mixing compound referred to as the stimulus is HNO. This compound is an acid. Because it's replaceable H+ atoms. HNO_3 is an acid and it can be identified by the following process–

1. It is known that indicators indicate whether a compound is acid, alkaline or neutral by changing their own color. Red litmus paper turns blue in alkaline solution and blue litmus paper turns red in acidic solution. Blue litmus paper dipped in a solution of HNO_3 turns red, indicating the specific nature of the acid.
2. Again, we know that in a neutralization reaction, acids and bases react to produce the neutral substances salt and water. Hence the mixed compound namely HNO_3 reacts With $Mg(OH)_2$. Addition of alkali produces salt and water by neutralization reaction.
$Mg(OH)_2 + HNO_3 \rightarrow Mg(NO_3)_2 + H_2O$
salt

Thus, it is confirmed by this experiment that, HNO_3 is an acid.

d The chemical reaction takes place when HNO_3 is added to limestone. The equation is as below :

$CaCO_3 + HNO_3 \rightarrow Ca(NO_3)_2 +$

Calcium carbonate Nitric Acid Calcium Nitrate

$H_2O + CO_2\uparrow$

Water Carbon dioxide

Again, chemical reaction takes place while adding HNO_3 to backing powder ($NaHCO_3$) the equation is as follows :

$NaHCO_3 + HNO_3 \rightarrow NaCO_3 +$

Sodium bicarbonate Nitric Acid Sodium Nitrate

$H_2O + CO_2\uparrow$

Water Carbon dioxide

Arpa observed the bubbles in both two test tubes. Carbon dioxide makes the air bubble while coming out.

Ques. 04 Baking soda + Vinegar→Sodium aeitate + CO_2 + H_2O.

a. What is formula? 1
b. Why is isotope used in agriculture? 2
c. Of what type is the reaction mentioned in the stem? 3
d. In the reaction mentioned in the stem, the second reactant compound and the produced first compound are of same nature—Analyze. 4

● *[Cumilla Board 2019]*

Answer to Question No. 04 :

a The short expression of molecules of a compound is called formula.

b The unstable isotopes radiate different radiations and particles due to radioactive decay. In agriculture, the radiation from isotopes are used to control insects. It is also used to find out what type of fertilizer and what amount of fertilizer is needed for a specific crop.

c The reaction of the stem is given below–

Baking soda + vinegar → sodium acetate + CO_2 + H_2O

Baking soda is known as sodium bi-carbonate ($NaHCO_3$) and vinegar is acetic acid (CH_3COOH).

So, reaction can be written as follows–

$$\underset{\text{Sodium bicarbonate}}{NaHCO_3} + \underset{\text{Vinegar}}{CH_3COOH} \rightarrow \underset{\text{Sodium acetate}}{CH_3COO\,Na} + \underset{\text{Carbon dioxide}}{CO_2} + \underset{\text{Water}}{H_2O}$$

Hence, baking soad or sodium bi-carbonate is a base and vinegar is an acid. The produced Sodium acetate is a salt which is a neutral substance. So, it is a neutralization reaction. This type of reaction where substances of opposite characteristics react with each others and produce neutral substance is called neutralization reaction.

d In the reaction of the stem, the second reactant compound is vinegar or acetic acid (CH_3COOH). On the other hand, the produced first compound is sodium acetate which is a salt.

So, the two compounds are not the same.

Characteristics of acids are–

i. They produce hydrogen ion (H^+) in water.
ii. Acids make blue litmus paper into red colour.
iii. There is one or more hydrogen atoms.

Characteristic of salts are–

i. They are neither acidic nor alkaline, that is neutral.
ii. They cause no change of colour of litmus paper.

Ques. 05

H_2SO_4 1st	$Ca(OH)_2$ 2nd	NaCl 3rd

a. What is indicator? 1
b. "All alkali are bases, but all bases are not alkali."— Explain it. 2
c. What type of changes of colour is ocurred when litmus paper is added with the aqueous solution of the above stem's compound? Describe it. 3
d. "A compound is as like the third compound is produced when the first and second compound is reacted with each other."— Analyze is with equation. 4

● *Rajshahi, Sylhet Board 2017*

Answer to Question No. 05 :

a Materials which identify whether a substance is an acid or a base or none of these are called indicators.

b We know, bases are oxides/hydroxides of metals or metal-like elements. Some bases dissolve in water and some do not. The bases that dissolve in water are alkalis. It means that alkalis are special forms of bases. It also means that bases are at the same time alkalis also. For example, NaOH, KOH, $Ca(OH)_2$ and NH_4OH are at the same time bases and alkalis. But bases like $Al(OH)_2$ do not dissolve in water. So they are not alkalis in spite of being bases. CuO is another example of this fact– a base but not an alkali.

c In the stem, three chemical compounds are shown. The 1st compound is H_2SO_4 or sulphuric acid which is a strong acid, the 2nd compound is $Ca(OH)_2$ or calcium hydroxide which is a base and the 3rd compound is NaCl or sodium chloride which is a salt. Litmus paper is an indication which can indicate whether a substance is an acid or base by change of colour.

Acids turn blue litmus paper into red, bases turn red litmus paper into blue and salts which are neutral will cause no change of colour of litmus paper.

Now, if blue litmus paper is added to the first solution of the stem, it turns into red colour, because H_2SO_4 is an acid. After that, if red litmus paper is added to the aqueous solution of 2nd compound it turns into blue, because $Ca(OH)_2$ is a base.

Finally if litmus paper is added to the aqueous solution of 3rd compound it will cause no change of colour of litmus paper. Because NaCl is a neutral salt.

d In the stem, the 1st compound H_2SO_4 is an acid, the 2nd compound $Ca(OH)_2$ is a base and the third compound NaCl is a salt. The reaction in which two compounds of different features (acid and base) react each other to form salt and water is called a neutralization reaction.

An acid and a base react with each other to form water and a salt. An acid contains hydrogen ion and a base contains oxygen ion and so water is formed. For example, the reaction between H_2SO_4 and $Ca(OH)_2$ produce $CaSO_4$ and water.

$$\underset{\text{Base}}{Ca(OH)_2} + \underset{\text{Acid}}{H_2SO_4} \longrightarrow \underset{\text{Salt}}{CaSO_4} + \underset{\text{Water}}{2H_2O}$$

So, it is seen that, a compound is as like the third compound is produced when the first and second compound is reacted with each other.

Ques. 06 $MgCO_3 + HCl \rightarrow MgCl_2 + H_2O + Y\uparrow$
(x) (z)

a. What is formula? 1
b. What type of reaction is occurred when $NaClO_3$ is heated? Explain it. 2
c. Explain die characteristics of the compound-Y. 3
d. Compare the properties of the compounds X and Z of the stimulate reaction with discussion. 4

● *Sylhet Board 2019*

Answer to Question No. 06 :

a The short expression of molecules of a compound is called formula.

b When $NaClO_3$ is heated, it decomposes into sodium chloride (NaCl) and oxygen gas (O_2).

$2NaClO_3 \xrightarrow{heat} 2NaCl + 3O_2$

This type of reaction which causes the decomposition of a compound to from more than one compound is called decomposition reaction.

c The reaction of the stem is given below–

$MgCO_3 + HCl \longrightarrow MgCl_2 + H_2O + CO_2\uparrow$

So, the compound is carbon-dioxide (CO_2) gas. characteristic of CO_2 gas is described below–

(i) It is a gescous substance.
(ii) It is used as fire extinguisher.
(iii) It makes lime water turbid.

d 'X' compound of the stem is hydrochloric acid or HCl.

It is a strong as well as mineral acid. Characteristics of HCl acid is given below–

i. It produces hydrogen ion (H^+) in water.
ii. It turns blue litmus paper into red.
iii. It contains replaceable hydrogen atom (s).
iv. It produces neutral salt reacting with a base.
v. Its pH is less than 7.
vi. HCl acid is produced in the stomach and used to digest food.

On the other hand, compound 'Z' is $MgCl_2$ which is a salt. Characteristics of salt are given below —

i. It is a neutral substance, neither acidic, nor alkaline.
ii. It causes no change in litmas paper.

Ques. 07 Soumita took two beakers and put sodium hydroxide in one beaker and vinegar in the other beaker. She put a piece of red litmus paper in the solutions of the two beakers and observed the change of colour.

a. What is indicator? 1
b. Why do green mangoes taste sour? 2
c. Write the result of Soumita's observation. 3
d. The use of one of the two solutions observed by Soumita is more important in our everyday life. Analyse. 4

● *Chattogram Board 2018*

Answer to Question No. 07 :

a Materials like litmus paper which identify wheather a substance is an acid or a base on none of these are called indicators.

b Green mangoes taste sour because different types of acid present in it. This is why green mangoes taste sour.

c To observe Soumita takes sodium hydroxide (NaOH) in one and vinegar (CH_3COOH) in the other beaker. Here NaOH is base and CH_3COOH is acid. She adds red litmus paper to both beakers. As we know, litmus paper works as an indicator. Red litmus paper does not show any change in its color in acidic solution. But red litmus paper turns blue in alkaline solution. So red litmus paper will turn blue in alkaline NaOH solution. On the other hand, vinegar is a solution of acetic acid. Red litmus paper will not show any color change in vinegar as it is acidic.

Therefore, red litmus changes its color in sodium hydroxide solution but does not change color in vinegar.

d Observed solutions of Soumita are sodium hydroxide (NaOH) solution and vinegar (CH_3COOH) solution. Among these solutions, the use of vinegar is more important in daily life. The matter is analyzed below–

Vinegar is an aqueous solution of acetic acid. One of the most important uses of vinegar is as a food preservative. Vinegar is widely used in the preservation of foods as an approved food preservative. In addition, vinegar is used for important purposes in the production of beauty products, to increase soil fertility, as a brightness enhancer, to make buttermilk, as a refrigerator cleaner, as a stainless steel signer, etc. Vinegar is now used in many everyday applications, including as a salad dressing and pickling. Vinegar has many uses as a cleaner.

On the other hand, sodium hydroxide is used in industry but has little use in daily life. Therefore, overall it can be said that among the observed substances of mildness, the use of vinegar is more important in daily life.

Ques. 08 $HCl \xrightarrow{H_2O} H^+ + Cl^-$

a. What kind of acid is there in lemon? 1
b. What do you mean by indicator? 2
c. Explain the characteristics of the compound in the above reaction. 3
d. Discuss the uses of the mentioned compound. 4

● *Dhaka Board 2017*

Answer to Question No. 08 :

a Lemons contain citric acid.

b An indicator is such a substance that determines whether other substances are acids or bases and also whether a substance is acidic or basic. Litmus paper is an universal indicator. The other universal indicators are litmus solution, methyl orange and phenolphthalein.

c The reactant compound is HCl, which is an acid. The properties of HCl acid are explained below–

1. It is soluble in water.
2. It has replaceable hydrogen (H) atoms and forms H^+ ions in water.
3. It tastes sour.

4. It turns blue litmus paper red.
5. If different indicator solutions are added to it, its color change can be observed.
6. It reacts with various metals to produce hydrogen gas.
7. It reacts with alkali to produce salt and water.
8. It reacts with carbonated salts to form carbon dioxide.

d The compound HCI is an acidic substance. Hydrochloric acid HCl is a very necessary reagent in the laboratory. Its uses are discussed below–

1. All the cleaners we use for toilet cleaning contain HCI acid.
2. Hydrochloric acid (HCI) is essential in the stomach to digest food.
3. HCl acid is used in the industrial production of chlorine.
4. HCI is used in many industries like steel making, medicine, leather etc.

Ques. 09 The science teacher was teaching the following reaction — $Mg(OH)_2 + H_2SO_4 \longrightarrow MgSO_4 + 2H_2O$. He noticed that Ratan sat holding his belly tightly. While he was asked he answered that last night he ate birani and he could not sleep at night. The teacher told him that the solution of your problem was in the reaction.

a. What is meant by indicator? 1
b. We cannot survive without NaCl. Why? 2
c. How the problem of Ratan can be solved by the reaction of the stem? Explain. 3
d. Though the reactants of the two reaction of the stem are different yet they have importance in the field of industry.— Analyze. 4

● *Dhaka Board 2018*

Answer to Question No. 09 :

a Materials which identify whether a substance is an acid or a base or none of these are called indicators.

b NaCl or sodium chloride is called table salt. It is essential for cooking. Moreover, it contains iodine. Sodium is essential for most of the body cells and body fluids. Iodized NaCl prevents iodine deficiency diseases like goiter, cretinism and thyroid problem. That's why we cannot survive without NaCl.

c The problem of Ratan is acidity in stomach, and this is due to fatty food (biriani). To digest food substance hydrochloric acid is required in stomach in a particular amount. However, if the amount of acid increases in the stomach that condition is termed as stomach acidity. Oily food is one of the reasons for stomach acidity. Acids release hydrogen ion (H^+) in solution. This is responsible for stomach pain and heartburn. For stomach acidity, antacid is used which is basically magnesium hydroxide [$Mg(OH)_2$]. Magnesium hydroxide [$Mg(OH)_2$] suspension is commonlly called milk of magnesia. It reacts with HCl acid and neutralizes it by neutralization reaction.
$Mg(OH)_2 + HCl \rightarrow MgCl_2 + H_2O$.

The reaction of the stem is also a neutralization reaction. Thus the problem of Ratan can be solved by the reaction of the stem.

d The reactatnts of the reaction in the stem are Magnesium hydroxide [$Mg(OH)_2$] and sulphuric acid (H_2SO_4). Magnesium hydroxide is a base. On the other hand, sulphuric acid is an acid. Both the substance are different yet they have importance in the field of industry.

Use of $Mg(OH)_2$:

i. Magnesium hydroxide [$Mg(OH)_2$] is used in pharmaceutical industry to produce antacid medicine. Antacid tablets or syrap are nothing but suspension of magnesium hydroxide. This is called milk of magnesia.

Use of H_2SO_4 :

i. H_2SO_4 is used in preparing of chemical namely detergents, paints, medicines, insecticides, paper, explosives and rayons.
ii. H_2SO_4 is used in batteries, used in IPS, motor car, mike, production of solar power etc.
iii. H_2SO_4 is an important raw matrical for producing chemical fertilizer in fertilizer factory.

Ques. 10

Compound-A consist of H and Cl + Compound-B consist of Mg and O → Product-C + H_2O

[Both A and B change the colour of litmus paper]

a. What is Milk of Magnesia? 1
b. What is indicator, explain it. 2
c. Explain the characteristics of compound– A of the stem. 3
d. Complete the reaction of the stem and explain what type of reaction it is. 4

● *Chattogram Board 2017*

Answer to Question No. 10 :

a The magnesium hydroxide suspension is called milk of magnesia. The formula of it is [$Mg.(OH)_2$]

b Materials or substances which can indicate whether a substance is an acid or base by change of its colour is indicator. Materials like litmus paper which identify whether a substance is an acid or a base or none of these are called indicators. Like litmus paper Methyl orange, Phynolphthylene methyl red all are indicators.

c According to the stem, compound-A is formed combining H and Cl. So, it is hydrochloric acid or HCl. It is a strong as well as mineral acid. Characteristics of HCl acid is given below–

i. It produces hydrogen ion (H^+) in water.
ii. It turns blue litmus paper into red.
iii. It contains replaceable hydrogen atom (s).
iv. It produces neutral salt reacting with a base.
v. Its pH is less than 7.
vi. HCl acid is produced in the stomach and used to digest food.

d According to the stem, compound-B is formed combining Mg and O. So, it is Magnesium oxide which is a base. Compound-A is formed combining H and Cl. So, it is hydrochloric acid which is a strong acid. A chemical reaction between Magnesium oxide (MgO) and hydrochloric acid (HCl) has taken place as under producing compound-'C' and water (H_2O) :

MgO + HCl
Magnesium oxide Hydrochloric acid
→ $MgCl_2$ + H_2O
Magnesium chloride Water

So, compound 'C' is Magnesium chloride which is a salt. The above reaction is a neutralization reaction. In this chemical reaction, a salt and water is produced from a base and an acid. This type of reaction where substances of opposite characteristics react with each others and produce neutral substance are called neutralization reaction.

Ques. 11 (i) $A + ZnO \rightarrow ZnSO_4 + H_2O$
(ii) $A + KOH \rightarrow K_2SO_4 + H_2O$

a. What is called base? 1
b. Why methane is not an acid? 2
c. Explain the uses of the 'A' marked compound. 3
d. Explain the comparative analysis in between the reactants of the reaction (ii). 4

● *Rajshahi Board 2016*

Answer to Question No. 11 :

a A metal oxide or a hydroxide is known as a base, pH value of whose solution is more than 7.

b We know that those chemical substances are acids which have one or more hydrogen atoms for producing H^+ in water. Methane (CH_4) is a chemical substance containing four hydrogen atoms, but it does not produce H^+ in water. So, CH_4 is not an acid.

c 'A' marked compound in the stem is an acid named sulphuric acid (H_2SO_4). Though it is very harmful for human health and other materials used in our daily life, but there are manifold uses of it. It is used in household toilet cleaner. Moreover, H_2SO_4 is used in the lead storage battery used in vehicles, to run IPS, to produce electricity by solar panel and in what not. Plant nutrients like $(NH_4)SO_4$ is produced using sulphuric acid.

d The complete form of reaction (ii) is given below :

H_2SO_4 + KOH
Salphuric acid Potassium hydroxide
→ K_2SO_4 + H_2O
Potassium sulphate Water

From the above reaction, it is seen that reactants H_2SO_4 and KOH take part in the chemical reaction producing a salt (K_2SO_4) and water (H_2O). Here reactant H_2SO_4 is an acid and reactant KOH is a base. A comparative analysis in between the said reactants are given below :

1. H_2SO_4 tastes sour whereas KOH tastes pangent.
2. H_2SO_4 turns blue litmus into red but KOH turns red litmus into blue.
3. In aqueous solution, H_2SO_4 gives H^+ ion, on the other hand, KOH gives OH^- ion.
4. H_2SO_4 is an important raw material for producing chemical fertilizer in fertilizer factory whereas KOH is used as an important raw material for producing shaving foam or soft soap in chemical industries.
5. When H_2SO_4 reacts with alkali, it produces salt and water. On the other hand, KOH reacting with acid produces salt and water.
6. Aqueous solution of both H_2SO_4 and NaOH serves as conductor of electricity.

Ques. 12 (i) $CaCO_3 + HCl \rightarrow$
(ii) $Na + H_2SO_4 \rightarrow$
(iii) $CaO + CH_3COOH \rightarrow$

a. What is litmus paper? 1
b. The valency of oxygen is 2; what does it mean? 2
c. Complete the above mentioned equations i, ii & iii and balance them. 3
d. "Different acids and bases are used in different fields."– Analyze this statement by taking the acid and base mentioned in the stem. 4

● *Rajuk Uttara Model College, Dhaka*

Answer to Question No. 12 :

a Litmus paper is an indicator used to identify acid and base.

b Valency is the number of atoms of a particular element that is combined with one atom of another element to form a molecule. Atomic number of oxygen is 8. Electronic configuration of oxygen is 2.6. So in the last orbit oxygen needs 2 electrons to complete its octet. This is why O has a valency of 2.

c Completed and balanced form of equation (i) is as follows :

$CaCO_3 + 2HCl \longrightarrow CaCl_2 + H_2O + CO_2 \uparrow$

Hydrochloric acid (HCl) is an acid and it reacts with calcium carbonate ($CaCO_3$) forming a slat, calcium chloride ($CaCl_2$), carbon dioxide (CO_2) and water (H_2O).

Completed and balanced form of equation (ii) is as follows :

$Na + H_2SO_4 \longrightarrow Na_2SO_4 + H_2$

Sodium (Na) is a metal and it reacts with H_2SO_4 and forms a salt (Na_2SO_4) and hydrogen gas (H_2). It is an example of substitution reaction.

Completed and balanced form of equation no. (iii) :

$CaO + 2CH_3COOH \longrightarrow (CH_3COO)_2 Ca + H_2O$

Lime Acetic acid Calcium acetate Water

Here lime is alkaline substance and acidic acid is acidic substance. This type of reaction where substances of opposite characteristics react with each others and produce neutral substance is called neutralization reaction.

Science

d Acids and bases are of many uses in our daily life as well as in industrial world.
The most commonly made industrial chemical in the world, sulphuric acid (H_2SO_4) has numerous application across the industry. H_2SO_4 is also used in preparing fertilizer, detergent, paint, medicine, insecticide, paper, explosive and rayon, etc. The steel industry, medicine and leather industry use hydrochloric acid (HCl) to clean the sheets.

CH_3COOH or ethanoic acid is an organic acid used to prepare vinegar. Vinegar is widely used in cooking.
Again the dilute solution of calcium hydroxide or lime water is used for the white wash of our buildings. On the other hand the pest of calcium hydroxide with water, known as milk of lime is used as insecticide.

Knowledge & Comprehension-based Q/A Designed as per topic

Preparatory Knowledge-based Q/A

Question 1. What is acid?
Ans. Acids are those chemicals which contain one or more replaceable hydrogen atoms and which produce H^+ ions in water.

Question 2. What is alkali?
Ans. Alkalis are those bases which dissolve in water.

Question 3. What is an indicator?
Ans. The substances which indicate whether one of the compounds is an acid or a base or neither by changing their color are called indicators.

Question 4. What is litmus?
Ans. Litmus is a type of indicator, which helps to understand whether an unknown substance is acid, alkaline or neutral.

Question 5. What type of acid is in lemon?
Ans. Lemon contains citric acid ($C_2H_3O_2$).

Question 6. Amaloki contains any acid?
Ans. Amaloki contains ascorbic acid.

Question 7. What acid is in the human stomach?
Ans. Human stomach contains hydrochloric acid (HCl).

Question 8. What acid is in tea?
Ans. Tannic acid is present in tea.

Question 9. What is the symbol of oxalic acid?
Ans. Oxalic acid symbol : $H_2C_2O_4$.

Question 10. What is the symbol of acetic acid?
Ans. The symbol of acetic acid is CH_3COOH.

Question 11. What is the symbol of perchloric acid?
Ans. The symbol for perchloric acid is $HCLO_4$.

Question 12. Write the symbol of vinegar.
Ans. The symbol for vinegar is CH_3COOH.

Question 13. What is the symbol of milk of magnesia?
Ans. Milk of Magnesia symbol : $Mg(OH)_2$.

Preparatory Comprehension-based Q/A

Question 1. What does indicator mean?
Ans. Substances which indicate whether one of the compounds is acid or base or neither by changing their colour are called indicators. Indicators such as litmus paper, methyl orange, phenolphthalein, methyl red etc., which help to understand whether an unknown substance is acid, alkaline or neutral.

Question 2. Why is it necessary to eat amloki?
Ans. Amaloki contains the organic acid ascorbic acid, which is vitamin 'C'. Amloki prevents scurvy. Amloki's antioxidants keep the heart healthy, reduce cholesterol levels in the blood. Prevents stomach acidity problems, skin problems, hair loss etc. Amloki contains iron and phosphorus. In short, it is necessary to eat amloki to increase the immunity of the body.

Question 3. Why does NaCl not change the color of litmus paper?
Ans. Litmus paper is a type of indicator. It indicates by color change when immersed in acid or alkali, whether the substance is acid or alkali. On the other hand, no change in color occurs when it is immersed in a neutral substance. NaCl is a neutral substance. It does not dissociate in aqueous solution to give H^+ or OH^- ions. Instead, it gives Na^+ and Cl^- ions.
Hence NaCl cannot change the color of litmus paper.

Question 4. Antacids are unique in treating acidity in the stomach – explain.
Ans. Hydrochloric acid is produced by the stomach wall. When acidity develops, the amount of hydrochloric acid in the stomach increases and abdominal pain begins. In this condition, we have to take antacid medicine.

Because antacids are alkalis called magnesium hydroxide or aluminum hydroxide. Which removes the acidity by reacting with the hydrochloric acid produced in the stomach through the neutralization reaction.

Question 5. Is methane an acid? explain.

Ans. CH_4 i.e. methane is not acidic. It is explained below–

It is known that substances which give protons ie H+ ions in aqueous solution are acids.

The symbol for methane is CH_4. It contains hydrogen atoms. But methane does not produce hydrogen ions (H^+). That's why methane is not an acid.

Question 6. Why is lime water cloudy in breath?

Ans. Lime water contains $Ca(OH)_2$. On the other hand, carbon dioxide (CO_2) is released during breathing. CO_2 reacts with $Ca(OH)_2$ in lime water to form calcium carbonate ($CaCO_3$). $CaCO_3$ is very slightly soluble in water. So clear lime water becomes cloudy.

Question 7. Why is CO_2 gas is used in fire extinguishers?

Ans. Carbon-dioxide (CO_2) helps in extinguishing fire. (CO_2) is a gas, it does not burn by itself and does not help fire. Wind can extinguish a fire or increase it. It depends on how much oxygen or carbon dioxide is in the air. If the concentration of O_2 in the air is high, the fire will grow and if the concentration of CO_2 is high, the fire will be put out. CO_2 gas is used in fire extinguishers because of this special belief that carbon-dioxide can put out fires.

Science

Solutions to Textual Activities Along with textual reference

Project 01 Give a presentation of the list that you have prepared on the various acids, bases and salts that are used in our households.

▸ Textbook Page 113

Solution : A list of various acids, bases and salts that are used in households is presented below :

Acids are sour in taste and produce hydrogen ions in water. Bases are bitter in taste, and salts are neutral substances produced by the reaction of acid and base or metal and acid.

Household Substances	Acid	Base	Salt
1. Tea, lemonade, vinegar	✓		
2. Lime water		✓	
3. Table salt, beet salt			✓
4. Antacid medicine		✓	
5. Grapes, oranges, lemons	✓		
6. Lime for eating		✓	
7. Milk of lime		✓	
8. Toilet cleaner	✓		
9. Baking soda		✓	
10. IPS battery	✓		
11. Bleaching powder		✓	
12. Cheese, egg yolk			✓
13. Detergent		✓	
14. Marine fish			✓
15. Spinach, stem amaranth			✓
16. Tamarind, amloki, pineapple	✓		

Super Suggestions

Super Suggestions with 100% preparatory questions selected by the Master Trainer Panel

Dear learners, important multiple choice, short, creative, knowledge & comprehension-based questions of this chapter selected by Master Trainer Panel for Half-Yearly and Annual Exams are presented below. Learn the answers to the mentioned questions well to ensure 100% preparation.

Question Pattern	7★	5★
○ MCQs with Answers	Learn each MCQs in this chapter thoroughly.	
○ Short Q/A	5, 10, 14, 16, 18, 28, 29	7, 12, 24, 26, 32
○ Creative Q/A	1, 2, 4, 8, 11	5, 7, 10, 12
○ Knowledge-based Q/A	1, 3, 4, 6, 10, 11, 13	2, 5, 8
○ Comprehension-based Q/A	1, 5, 6	3, 4

Exclusive Tips ▸▸ Master the solutions to all the activities in this chapter along with exercise and other Q/A to develop the creative thinking and assess your talent.

Assessment & Evaluation

A question bank presented in the form of a class test to assess the preparation

Class Test Time : 3 hours

Science

Full marks : 100

Class : Eight

Multiple Choice Questions (Each question carries 1 mark) 1 × 30 = 30

*[N.B. : Answer all the questions. Each question carries **one** mark. Block fully, with a ball-point pen, the circle of the letter that stands for the correct/best answer in the "Answer Sheet" for Multiple Choice Question Type Examination.]*

1. Which one of the following is an acid?
ⓐ HOOC – COOH ⓑ $NaHCO_3$
ⓒ Ca(OCl)Cl ⓓ $KClO_3$

2. Which one of the following is an inorganic acid?
ⓐ $HClO_4$ ⓑ CH_3COOH
ⓒ HOOC – COOH ⓓ all the above

3. Which acid present in tamarind?
ⓐ Malic ⓑ Citric ⓒ Oxalic ⓓ Tartaric

4. Which kind of fruits contain oxalic acid?
ⓐ Tamato ⓑ Emblica ⓒ Pineapple ⓓ Grape

5. Which acid remains in amloki?
ⓐ Citric ⓑ Tartaric ⓒ Ascorbic ⓓ Xratic

6. Which acid is contained in grapes?
ⓐ Malic acid ⓑ Oxalic acid
ⓒ Citric acid ⓓ Ascorbic acid

7. Which one of the following is the formula of edible soda?
ⓐ $NaHCO_3$ ⓑ Na_2CO_3
ⓒ HCl ⓓ $ZnSO_4$

8. What compound produce when CO_2 flow in lime water?
ⓐ CaO ⓑ $CaCO_3$ ⓒ $Ca(OH)_2$ ⓓ $CuCO_3$

9. What is the nature of these reactions?
ⓐ Base-forming ⓑ Alkali forming
ⓒ Acid forming ⓓ Salt forming

10. Which one is salt?
ⓐ CaO ⓑ NaOH ⓒ HCl ⓓ $CaSO_4$

11. Which one is the formula of ammonium nitrate?
ⓐ $NH_4(NO_3)_2$ ⓑ NH_4NO_2
ⓒ NH_4NO_3 ⓓ $(NH_4)_2NO_3$

12. Which one is the formula of lime stone?
ⓐ $CaCO_3$ ⓑ CaO ⓒ $CaCl_2$ ⓓ $Ca(OH)_2$

13. What is the formula of lime stone?
ⓐ $NaHCO_3$ ⓑ KOH ⓒ $CaCO_3$ ⓓ KNO_3

14. Acid + Base ⟶ ?
ⓐ Alkali + Neutral ⓑ Neutral + Neutral
ⓒ Alkali + Acid ⓓ Neutral + Acid

15. What are chemicals that make the red litmus paper blue called?
ⓐ Alkali ⓑ Acid ⓒ Salt ⓓ Indicator

16. Which vapour solution change the colour of red litmas paper?
ⓐ NaOH ⓑ $CaCO_3$ ⓒ H_3PO_4 ⓓ $CuSO_4$

17. X + blue litmus paper ⟶ red colour, what type of substance is X?
ⓐ Acid ⓑ Base ⓒ Salt ⓓ Indicator

18. Ion will be produced in the solution of 1st beaker?
ⓐ – OOC – COO – ⓑ SO_4^{2-}
ⓒ CH_3COO^- ⓓ $CH_3CH_2COO^-$

19. What gas do you need to produce bleaching powder?
ⓐ Chlorine ⓑ Hydrogen
ⓒ Carbon dioxide ⓓ Sulpher dioxide

20. Which of the following compounds ensures digestion?
ⓐ H_3PO_4 ⓑ $HClO_4$ ⓒ H_2SO_4 ⓓ HCl

21. Which is the most essential acid in a fertilizer factory?
ⓐ HCl ⓑ H_2SO_4 ⓒ HNO_3 ⓓ H_3PO_4

22. Which one is used as insecticide?
ⓐ NH_4OH ⓑ NaOH ⓒ $Mg(OH)_2$ ⓓ $Ca(OH)_2$

23. Particular amount of what is useful for body?
ⓐ HCl ⓑ H_2SO_4
ⓒ HOOC – COOH ⓓ HNO_3

24. Which of the following has citric acid?
ⓐ Orange ⓑ Tamarind ⓒ Tomato ⓓ Apple

25. Which one is base?
ⓐ NaOH ⓑ NH_4OH
ⓒ $Ca(OH)_2$ ⓓ m $AI(OH)_3$

26. Edible acids —.
i. CH_3COOH
ii. HOOC – COOH
iii. $HClO_4$
Which one of the following is correct?
ⓐ i & ii ⓑ i & iii ⓒ ii & iii ⓓ i, ii & iii

27. Characteristics of alkali is —.
i. they are slippery and bitter taste
ii. they turn blue litmus paper to red in colour
iii. they give OH^- ion in water
Which one is correct?
ⓐ i & ii ⓑ i & iii ⓒ ii & iii ⓓ i, ii & iii

Look at the reactions below and answer the question numbers 28 and 29 :

$Ca(OH)_2 + H_3PO_4 \rightarrow Ca_3(PO_4)_2 + H_2O$

$Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$

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

28. What is the nature of these reactions?
ⓐ Base-forming ⓑ Alkali forming
ⓒ Acid forming ⓓ Salt forming

29. $Ca(OH)_2$ —.
i. releases H^+ in solution
ii. is a base
iii. is an alkali
Which one of the following is correct?
ⓐ i & ii ⓑ ii & iii ⓒ i & iii ⓓ i, ii & iii

30. In case of acid–
i. it produces H+ in water
ii. it converts red litmus paper into blue
iii. it produce H_2 when reacts with metal
Which one is correct?
ⓐ i & ii ⓑ i & iii ⓒ ii & iii ⓓ i, ii & iii

Answer Sheet ▸ Multiple Choice Questions

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

Short-Answer Question (Each question carries 2 marks)

Answer any 10 of the following questions : $2 \times 10 = 20$

1. How is litmus paper made?
2. Why does lemon juice not change the color of red litmus paper?
3. Why are grapes sour in taste?
4. Write two uses of sodium hydroxide.
5. Why is litmus paper called an indicator?
6. Why is HCl called an acid?
7. Why is NaOH called a base?
8. Explain why $Al(OH)_3$ is a base but not an alkali.
9. Write two differences between acid and base.
10. What is meant by antacid?
11. Mention the negative impacts of acid throwing.
12. Why should people be made aware of the use of acid?
13. Mention the uses of sulfuric acid in industries.
14. What is nitric acid used for?
15. How would you identify whether an aqueous solution of H_2SO_4 is a base or an acid?

Creative Question (Each question carries 10 marks)

Answer any 5 of the following questions : $10 \times 5 = 50$

1. $CaO + H_2SO_4 \longrightarrow CaSO_4 + H_2O$
   (A) (B) (D)
   a. What is formula? 1
   b. What is meant by the atomic number of Nitrogen is 7? 2
   c. Hydrogen ion is produced from the compound 'B'.—Explain with equation. 3
   d. What will happen in case of the change of the colour of litmus paper, if CO2 gas passes through the mixture of A and D? Give logic in favour of your answer. 4
2. Arpa observed that bubbles is produced in the two test tubes where HNO3 is added with Δ limestone and audible soda which are kept separately in the two test tubes in the laboratory of her school.
   a. What is indicator? 1
   b. Is methane an acid? Explain it. 2
   c. How can you identify the substance that is mixed in the stem, either acid or base? Explain it. 3
   d. Analyze the reasons for which Arpa observed the bubbles in both the text tubes with equation. 4
3.

H_2SO_4	$Ca(OH)_2$	NaCl
1st	2nd	3rd

   a. What is indicator? 1
   b. "All alkali are bases, but all bases are not alkali."— Explain it. 2
   c. What type of changes of colour is ocurred when litmus paper is added with the aqueous solution of the above stem's compound? Describe it. 3
   d. "A compound is as like the third compound is produced when the first and second compound is reacted with each other."— Analyze is with equation. 4
4. $MgCO_3 + HCl \rightarrow MgCl_2 + H_2O + Y\uparrow$
   (x) (z)
   a. What is formula? 1
   b. What type of reaction is occurred when $NaClO_3$ is heated? Explain it. 2
   c. Explain die characteristics of the compound-Y. 3
   d. Compare the properties of the compounds X and Z of the stimulate reaction with discussion. 4
5. $HCl \xrightarrow{H_2O} H^+ + Cl^-$
   a. What kind of acid is there in lemon? 1
   b. What do you mean by indicator? 2
   c. Explain the characteristics of the compound in the above reaction. 3
   d. Discuss the uses of the mentioned compound. 4
6. The science teacher was teaching the following reaction — $Mg(OH)_2 + H_2SO_4 \longrightarrow MgSO_4 + 2H_2O$. He noticed that Ratan sat holding his belly tightly. While he was asked he answered that last night he ate birani and he could not sleep at night. The teacher told him that the solution of your problem was in the reaction.
   a. What is meant by indicator? 1
   b. We cannot survive without NaCl. Why? 2
   c. How the problem of Ratan can be solved by the reaction of the stem? Explain. 3
   d. Though the reactants of the two reaction of the stem are different yet they have importance in the field of industry.— Analyze. 4
7. (i) $A + ZnO \rightarrow ZnSO_4 + H_2O$
   (ii) $A + KOH \rightarrow K_2SO_4 + H_2O$
   a. What is called base? 1
   b. Why methane is not an acid? 2
   c. Explain the uses of the 'A' marked compound. 3
   d. Explain the comparative analysis in between the reactants of the reaction (ii). 4
8. (i) $CaCO_3 + HCl \rightarrow$
   (ii) $Na + H_2SO_4 \rightarrow$
   (iii) $CaO + CH_3COOH \rightarrow$
   a. What is litmus paper? 1
   b. The valency of oxygen is 2; what does it mean? 2
   c. Complete the above mentioned equations i, ii & iii and balance them. 3
   d. "Different acids and bases are used in different fields."– Analyze this statement by taking the acid and base mentioned in the stem. 4

Answering Reference ▸ Short-Answer Questions

1 ▸ See this Chapter, Ques. 1	5 ▸ See this Chapter, Ques. 8	9 ▸ See this Chapter, Ques. 16	13 ▸ See this Chapter, Ques. 24
2 ▸ See this Chapter, Ques. 3	6 ▸ See this Chapter, Ques. 9	10 ▸ See this Chapter, Ques. 18	14 ▸ See this Chapter, Ques. 26
3 ▸ See this Chapter, Ques. 4	7 ▸ See this Chapter, Ques. 11	11 ▸ See this Chapter, Ques. 20	15 ▸ See this Chapter, Ques. 33
4 ▸ See this Chapter, Ques. 7	8 ▸ See this Chapter, Ques. 14	12 ▸ See this Chapter, Ques. 22	

Answering Reference ▸ Creative Questions

1 ▸ See this Chapter, Ques. 1	3 ▸ See this Chapter, Ques. 5	5 ▸ See this Chapter, Ques. 8	7 ▸ See this Chapter, Ques. 11
2 ▸ See this Chapter, Ques. 3	4 ▸ See this Chapter, Ques. 6	6 ▸ See this Chapter, Ques. 9	8 ▸ See this Chapter, Ques. 12