13. ACIDS, BASES & SALTS -BASES &ALKALI PREPARATION& PROPERTIES

SOLUTIONS

TEACHING TASK

JEE MAINS LEVEL QUESTIONS

1. Chemical name of slaked lime is:
   A) CaO B) $Ca(OH)_2$ C) $CaCO_3$ D) $CaCl_2$

Answer:B

Solution:The chemical name of slaked lime is $Ca(OH)_2$

2. Which of the following is NOT a base? **(FA & SA- 3 Marks / 4 Marks)**
   A) NaOH B) KOH C) HCl D) $Ca(OH)_2$

Answer:C

Solution:HCl is an acid, not a base.

3. An alkali solution having high percentage of solute is called:
   A) Dilute alkali B) Concentrated alkali
   C) Weak alkali D) Strong alkali

Answer:B

Solution:High percentage of solute $\rightarrow$ concentrated alkali.

4. The ion responsible for basic properties in aqueous solution is:
   (FA & SA- 2 Marks)
   A) H^+ B) OH^- C) Cl^- D) Na^+

Answer:B

Solution:Bases provide OH^- ions in water.

5. What is formed when sodium oxide reacts with water?
   A) NaOH B) Na_2O C) NaCl D) Na_2CO_3

Answer:A

Solution: $Na_2O + H_2O \rightarrow 2NaOH$

6. Which of the following bases is insoluble in water?
   A) NaOH B) KOH C) $Ca(OH)_2$ D) $Cu(OH)_2$

Answer:D

Solution:NaOH, KOH, $Ca(OH)_2$ (slightly soluble); $Cu(OH)_2$ is insoluble.

7. The basicity of orthophosphoric acid (H_3PO_4) is:**(FA & SA- 5 Marks/ 8 Marks)**
   A) 1 B) 2 C) 3 D) 4

Answer:C

Solution:Basicity = number of replaceable H^+ ions = 3.

8. Which is the strongest base among the following?
   A) NH_4OH B) $Ca(OH)_2$ C) NaOH D) $Mg(OH)_2$

Answer:C

Solution:NaOH is a strong alkali; completely dissociates in water.

9. The acid used in car batteries is:
   A) Nitric acid B) Sulphuric acid
   C) Hydrochloric acid D) Carbonic acid

Answer:B

Solution:Sulphuric acid (H_2SO_4) is used in lead–acid batteries

10. Which acid is present in vinegar?
   A) Citric acid B) Acetic acid C) Formic acid D) Lactic acid

Answer:B

Solution:Vinegar contains about 5–8% acetic acid (CH_3COOH)

JEE ADVANCED LEVEL QUESTIONS

Multi Correct Choice Type:

11. Which of the following oxide(s) will produce a basic solution when dissolved in water?
   A) Potassium oxide (K_2O) B) Carbon dioxide (CO_2)
   C) Calcium oxide (CaO) D) Phosphorus pentoxide (P_4O_{10})

Answer:A,C

Solution:A) $K_2O \rightarrow$ metal oxide, basic
   B) $CO_2 \rightarrow$ non-metal oxide, acidic
   C) $CaO \rightarrow$ metal oxide, basic
   D) $P_4O_{10} \rightarrow$ non-metal oxide, acidic

12. Which of the following hydroxide(s) can exhibit amphoteric character?
   A) Beryllium hydroxide [$Be(OH)_2$] B) Sodium hydroxide [NaOH]
   C) Aluminium hydroxide [$Al(OH)_3$] D) Barium hydroxide [$Ba(OH)_2$]

Answer:A,C

Solution:A) $Be(OH)_2 \rightarrow$ amphoteric
   B) NaOH $\rightarrow$ strongly basic, not amphoteric
   C) $Al(OH)_3 \rightarrow$ amphoteric
   D) $Ba(OH)_2 \rightarrow$ strongly basic, not amphoteric

Statement Type :

Identify the correct statement.

A) Both the statements ar **TRUE** and **Statement** -II is the correct explanation of **STATEMENT** - I
B) Both the statements are **TRUE** and **Statement** -II is not the correct explantion of Statement -I
C) Statement -I is **TRUE** and Statement -II is **FALSE**

D) Statement -Iis **FALSE** and Statement -II is **TRUE**

13. **Statement I** : Sodium carbonate (Na_2CO_3) is a salt but its aqueous solution turns red litmus blue.
Statement II : Salts formed from the reaction of a strong base and weak acid undergo hydrolysis to produce a basic solution

Answer:A

Solution:Na_2CO_3 is formed from strong base (NaOH) + weak acid (H_2CO_3).
Its solution is basic because CO_3^{2-} hydrolyzes $\rightarrow$ turns red litmus blue.
Statement II correctly explains Statement I

14. **Statement I** : Ammonium hydroxide (NH_4OH) is classified as a weak base.
Statement II : The strength of a base depends on its molecular weight; higher molecular weight bases are always weaker.

Answer:C

Solution:NH_4OH is indeed a weak base $\rightarrow$ Statement I is true.
The strength of a base does not directly depend on molecular weight; it depends on degree of ionization in water. $\rightarrow$ Statement II is false.

Comprehension type

A base which is soluble in water is called as an alkali. The word alkali came from Arabic means ash. Long ago people burnt plants and used the ashes in making soaps and glass. The ashes contained the alkalis soda and potash.
Ex: Sodium hydroxide (NaOH), Potassium hydroxide (KOH)
All alkali can be bases but all bases are not alkalis. However as it dissolves in water to furnish OH^- ions, hence it is an alkali.

15. According to the passage, the key characteristic that defines an 'alkali' is:
A) Its ability to turn red litmus blue.
B) Its bitter taste and soapy touch.
C) Its solubility in water.
D) Its origin from plant ashes.

Answer:C

Solution:An alkali is specifically a base that is soluble in water.
Turning red litmus blue, bitter taste, and soapy touch are general properties of bases, not the defining feature of an alkali.

16. Based on the information, which of the following statements is correct?
A) All bases are alkalis.
B) The terms 'base' and 'alkali' can be used interchangeably.
C) Potassium hydroxide (KOH) is an example of an alkali.
D) Alkalis are insoluble in water.

Answer:C

Solution:KOH is a base soluble in water, so it is an alkali.
Not all bases are alkalis (e.g., $Ba(OH)_2$ is only slightly soluble), so option A is incorrect.
Bases and alkalis are not interchangeable terms.
Alkalis are soluble, not insoluble.

Integer Type :

17. The number of hydroxyl ions (OH^-) furnished by one molecule of Calcium HydroxideCa$(OH)_2$, on complete dissociation in water is _____.

Answer:2

Solution:Calcium hydroxide formula: $Ca(OH)_2$

Dissociation in water: $Ca(OH)_2 \rightarrow Ca^{2+} + 2OH^-$

One molecule of $Ca(OH)_2$ produces 2 OH^- ions

18. The number of water molecules produced when one molecule of Aluminium Hydroxide, $Al(OH)_3$, completely neutralizes Phosphoric Acid (H_3PO_4) is _____.

Answer:3

Solution: $Al(OH)_3 + H_3PO_4 \rightarrow AlPO_4 + 3H_2O$

1 molecule of $Al(OH)_3$ reacts with 1 molecule of H_3PO_4 to produce 3 molecules of water

Matrix Matching Type :

19.

Column-I	**Column-II**
a) LiOH	1) Weak base
b) $Ba(OH)_2$	2) Strong alkali
c) NH_3 (aqueous)	3) Diacidic base
d) H_2SO_4	4) Strong acid
e) $NaHCO_3$	5) Amphoteric substance

Answer:a–2, b–3, c–1, d–4, e–5

Solution:

a) LiOH	2) Strong alkali
b) $Ba(OH)_2$	3) Diacidic base
c) NH_3 (aqueous)	1) Weak base
d) H_2SO_4	4) Strong acid
e) $NaHCO_3$	5) Amphoteric substance

LEARNERS TASK

CONCEPTUAL UNDERSTANDING QUESTIONS

1. KOH is an example of:

A) Strong Base B) Diacidic alkali C) Weak acid D) 1 and 2 only

Answer:A

Solution:KOH completely dissociates in water → strong base

2. Which of the following is used in white washing?

A) Calcium hydroxide
B) Magnesium hydroxide
C) Sodium hydroxide
D) Potassium hydroxide

Answer:A

Solution:Whitewashing uses slaked lime ($Ca(OH)_2$

3. Formula of quicklime is:
   A) CaO B) $Ca(OH)_2$ C) $CaCO_3$ D) $CaCl_2$

Answer:A

Solution:Quicklime = CaO.

4. The number of H^+ ions required to neutralize one molecule of a base is called:
   A) Acidity of base B) Basicity of acid
   C) Atomicity D) Neutralization capacity

Answer:A

Solution:The number of H^+ ions (protons) that one molecule of a base can accept, or the number of replaceable hydroxyl OH^- ions it can produce in an aqueous solution, is called the acidity of the base

5. Which of the following statements about bases is CORRECT?
   A) All bases are soluble in water
   B) All bases turn phenolphthalein pink
   C) Bases react with acids to form salt and water
   D) Bases have pH less than 7

Answer:C

Solution:A) False — not all bases soluble.
   B) False — only soluble bases (alkalis) turn phenolphthalein pink.
   C) True — neutralization reaction.
   D) False — bases have pH > 7.

6. Choose the INCORRECT statement:
   A) NaOH is a strong alkali
   B) $Cu(OH)_2$ is insoluble in water
   C) NH_4OH is a strong base
   D) $Ca(OH)_2$ is used in manufacturing bleaching powder

Answer:C

Solution:A) True — NaOH strong alkali.
   B) True — $Cu(OH)_2$ insoluble.
   C) False — NH_4OH is a weak base.
   D) True — $Ca(OH)_2$ used in making bleaching powder.

7. The acid present in tamarind is:
   A) Tartaric acid B) Citric acid C) Oxalic acid D) Acetic acid

Answer:A

Solution:Tamarind contains tartaric acid.

8. $Ba(OH)_2$ is a:
   A) Monobasic base B) Dibasic base
   C) Tribasic base D) Tetrabasic base

Answer:B

Solution:Barium hydroxide has 2 OH^- ions per molecule $\rightarrow$ diacidic base

9. Which of the following is the WEAKEST alkali?
A) NaOH B) KOH C) $Ca(OH)_2$ D) NH_4OH

Answer:D

Solution:Alkali means water-soluble base. NH_4OH is weakest among these.

10. The oxide that is amphoteric in nature is:
A) Na_2O B) Al_2O_3 C) CaO D) MgO

Answer:B

Solution:Al_2O_3 (aluminium oxide) reacts with both acids and bases $\rightarrow$ amphoteric.

JEE MAINS LEVEL QUESTIONS

1. The acid used as a food preservative in pickles is: **(FA & SA- 2 Marks)**
A) Acetic acid B) Oxalic acid C) Boric acid D) Tartaric acid

Answer:A

Solution:Vinegar (CH_3COOH) is used to preserve pickles

2. Acid used in the manufacturing of fertilizers:
A) HCl B) HNO_3 C) CH_3COOH D) H_2CO_3

Answer:B

Solution:Nitric acid is used for making nitrate fertilizers.

3. An alkali solution having relatively low percentage of solute is called:
A) Concentrated alkali B) Dilute alkali
C) Strong alkali D) Weak alkali

Answer:B

Solution:Low solute $\rightarrow$ dilute; high solute $\rightarrow$ concentrated.

4. Which of the following is a Diacidic Base? **(FA & SA- 3 Marks/ 4 Marks)**
A) NaOH B) $Al(OH)_3$ C) $Ca(OH)_2$ D) H_3PO_4

Answer:C

Solution:Calcium hydroxide has 2 OH^- ions per molecule $\rightarrow$ Diacidic Base

5. Balanced equation for burning of magnesium in air:
A) $Mg + O_2 \rightarrow MgO$ B) $2Mg + O_2 \rightarrow 2MgO$
C) $Mg + O \rightarrow MgO$ D) $Mg + O_2 \rightarrow MgO_2$

Answer:B

Solution:$2Mg + O_2 \rightarrow 2MgO$

6. Phosphine gas dissolved in water produces:
A) Phosphoric acid B) Phosphorous acid
C) No reaction D) Phosphine hydroxide

Answer:C

Solution:PH_3 is a very weak base; it does not react with water.

7. Metal bicarbonates on mild heating produce: **(FA & SA- 5 Marks/ 8 Marks)**
A) CO_2 gas B) H_2 gas C) O_2 gas D) N_2 gas

Answer:A

Solution: $Ca(HCO_3)_2 \rightarrow CaCO_3 + CO_2 + H_2O$

8. When potassium reacts with water, the product formed is:
A) K_2O B) KOH C) KO_2 D) KH

Answer:B

Solution: $2K + 2H_2O \rightarrow 2KOH + H_2$

9. Which of the following metals does NOT produce hydrogen gas with steam?
A) Zinc B) Iron C) Aluminum D) Copper

Answer:D

Solution:Cu is below H in the reactivity series; does not react with water or steam.

10. All non-metal oxides are:
A) Basic oxides B) Acidic oxides C) Neutral oxides D) Amphoteric oxides

Answer:B

Solution: All non-metal oxides are →Acidic oxides (except a few neutral like CO, NO, N_2O)
But in general statement, they are mostly acidic.

JEE ADVANCED LEVEL QUESTIONS

Multi Correct Answer Type:

11. Which of the following is/are Triacidic Base(s)?
A) Aluminum Hydroxide [$Al(OH)_3$]
B) Ferric Hydroxide [$Fe(OH)_3$]
C) Calcium Hydroxide [$Ca(OH)_2$]
D) Phosphoric Acid [H_3PO_4]

Answer:A,B

Solution: Triacidic Base(s) → Base that can neutralize 3 H^+ ions (has 3 OH^- groups reacting in neutralization)
A) $Al(OH)_3$ → Triacidic
B) $Fe(OH)_3$ → Triacidic
C) $Ca(OH)_2$ → Diacidic
D) H_3PO_4 → Acid, not a base.

12. Which of the following is/are Monoacidic Base(s)?
A) Lithium Hydroxide (LiOH)
B) Sodium Hydroxide (NaOH)
C) Barium Hydroxide [$Ba(OH)_2$]
D) Ammonium Hydroxide (NH_4OH)

Answer:A,B,D

Solution: Monoacidic Base(s) → Base that can neutralize 1 H^+ ion (has 1 OH^- group reacting in neutralization)

A) LiOH $\rightarrow$ Monoacidic
B) NaOH $\rightarrow$Monoacidic
C) $Ba(OH)_2$ $\rightarrow$ Diacidic
D) NH_4OH $\rightarrow$ Monoacidic $\rightarrow$ (furnishes one OH^-)

Statement Type :

A) Both the statements ar **TRUE** and **Statement -II** is the correct explanation of **STATEMENT -** I
B) Both the statements are **TRUE** and **Statement -II** is not the correct explantion of Statement -I
C) Statement -I is **TRUE** and Statement -II is **FALSE**
D) Statement -Iis **FALSE** and Statement -II is **TRUE**

13. **Statement I** : Sodium hydroxide (NaOH) and potassium hydroxide (KOH) are strong alkalis.
Statement II : Group 1 metal hydroxides are highly soluble in water and completely dissociate to produce OH^- ions.

Answer:A

Solution:NaOH and KOH are strong bases $\rightarrow$ Statement I is true.
Group 1 hydroxides are soluble and completely dissociate $\rightarrow$ Statement II is true.
Statement II explains why Statement I is true

14. Statement I : Calcium oxide (CaO) is considered a base even though it is insoluble in water.
Statement II : A substance needs to be soluble in water and produce OH^- ions to be classified as a base.

Answer:C

Solution:CaO is a basic oxide, but it is not very soluble in water. It reacts with water to form $Ca(OH)_2$ $\rightarrow$Statement I is true.
Statement II is false, because solubility is not a strict requirement; reaction with water producing OH^- is sufficient.

Comprehension type :

i) Sodium hydroxide is used in the manufacture of soap, paper and a synthetic fibre called 'rayon'.
ii) Calcium hydroxide (slaked lime) is used in the manufacture of bleaching powder.
iii) Magnesium hydroxide is used an 'antacid' to neutralise excess acid in the stomach and cure indigestion.
iv) Sodium carbonate is used as washing soda and for softening hard water.
v) Sodium hydrogen carbonate is used as baking soda in cooking food, for makiing.

15. Sodium hydroxide (NaOH) is commercially important because it is used in the manufacture of:
A) Soap, paper, and rayon
B) Bleaching powder and glass
C) Antacids and fertilizers
D) Baking soda and washing soda

Answer:A

Solution:Sodium hydroxide (NaOH) is used in the manufacture of:
Soap (saponification)
Paper (pulping)
Rayon (viscose process)

16. Which compound is used as an 'antacid' to neutralize excess stomach acid and relieve indigestion?
A) Sodium carbonate B) Calcium hydroxide
C) Magnesium hydroxide D) Sodium hydrogen carbonate

Answer:C

Solution:Magnesium hydroxide is used an 'antacid' to neutralise excess acid in the stomach and cure indigestion.

Integer Type:

17. A monoacidic base contains _____ number of Hydroxyl ions to react with one molecule of a tribasic acid.

Answer:3

Solution:Tribasic acid has 3 replaceable H^+ ions .
Monoacidic base has 1 OH^- per molecule (e.g., NaOH).
To neutralize 1 molecule of H_3PO_4, you need 3 OH^- ions $\rightarrow$ 3 molecules of monoacidic base

18. _____ Al + _____ NaOH + _____ $H_2O \rightarrow$ _____ $NaAlO_2$ + _____ H_2

Answer:2,2,2,2,3

Solution: $2Al + 2NaOH + 2H_2O \rightarrow 2NaAlO_2 + 3H_2$

Matrix Matching Type :

19.

Column-I	**Column-I**
a) $2Ca + O_2 \rightarrow$	1. $Ca(OH)_2$
b) $CaO + H_2O \rightarrow$	2. $2KOH + H_2\uparrow$
c) $2K + 2H_2O \rightarrow$	3. 2CaO
d) $CaCO_3 \xrightarrow{heat}$	4. $CaO + CO_2\uparrow$
	5. $Ca(OH)_2 + H_2\uparrow$

Answer:a-3,b-1,c-2,d-4

Solution:

a) $2Ca + O_2 \rightarrow$	3. 2CaO
b) $CaO + H_2O \rightarrow$	1. $Ca(OH)_2$
c) $2K + 2H_2O \rightarrow$	2. $2KOH + H_2\uparrow$
d) $CaCO_3 \xrightarrow{heat}$	4. $CaO + CO_2\uparrow$

KEY

				TEACHING TASK					
			JEE MAINS LEVEL QUESTIONS						
1	2	3	4	5	6	7	8	9	10
B	C	B	B	A	D	C	C	B	B
			JEE ADVANCED LEVEL QUESTIONS						
11	12	13	14	15	16	17	18	19	
A,C	A,C	A	C	C	C	2	3	a–2, b–3, c–1, d–4, e–	
				LEARNERS TASK					
			CONCEPTUAL UNDERSTANDING QUESTIONS						
1	2	3	4	5	6	7	8	9	10
A	A	A	A	C	C	A	B	D	B
			JEE MAINS LEVEL QUESTIONS						
1	2	3	4	5	6	7	8	9	10
A	B	B	C	B	C	A	B	D	B
			JEE ADVANCED LEVEL QUESTIONS						
11	12	13	14	15	16	17	18	19	
A,B	A,B,D	A	C	A	C	3	2,2,2,2,3	a-3,b-1,c-2,d-4	