12.PREPARATION & PROPERTIES OF ACIDS

SOLUTIONS

TEACHING TASK

JEE MAIN LEVEL

Single Answer Type

1. Which of the following is a weak acid?

1) H_3PO_4 2) H_2CO_3 3) HNO_2 4) All of these

Answer:4

Solution:H_3PO_4 – weak acid
H_2CO_3 – weak acid
HNO_2 – weak acid
All are weak acids.

2. $NaHCO_3 + HCl \rightarrow .....+ CO_2 + H_2O$.

1)NaOH 2)NaO 3)NaCl 4) Na

Answer:3

Solution: Reaction: $NaHCO_3 + HCl \rightarrow NaCl + CO_2 + H_2O$

3. Which acid do not change into their vapours, even on strong heating also.

1) H_2SO_4 2)HCl 3) CH_3COOH 4) HNO_3

Answer:1

Solution:H_2SO_4 – high boiling point, nonvolatile

HCl – volatile

CH_3COOH – volatile

HNO_3 – volatile

4. $Al(OH)_3 + H_2SO_4 \rightarrow .....+.....$.

1) AlH, H_2O 2) $AlSO_4, SO_2$ 3) $Al_2(SO_4)_3, H_2O$ 4) none

Answer:3

Solution:Neutralization: $2Al(OH)_3 + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + 6H_2O$

5. Nitrogen pentoxide + water $\rightarrow$

1) Nitric acid 2) Nitrous acid

3) Sulphurous acid 4) Swaphuric acid

Answer:1

Solution: $N_2O_5 + H_2O \rightarrow 2HNO_3$

6. $H_2 + ... ? \xrightarrow{Boiling} H_2S$

1) Cl 2) SO_4 3) SO_3 4) S

Answer:4

Solution:Direct synthesis: $H_2 + S \xrightarrow{\Delta} H_2S$

7. Metals displace hydrogen from the acids. They release.

1) H_2Gas 2) O_2Gas 3) SO_2Gas 4) CO_2Gas

Answer:1

Solution:Chemical Reaction Principle:

Metals that are more reactive than hydrogen (located above hydrogen in the reactivity series) can displace hydrogen from acids. The general chemical reaction is:

Metal + acid $\rightarrow$ salt + H_2 gas

Examples:

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2 \uparrow$$

$$Mg + H_2SO_4 \rightarrow MgSO_4 + H_2 \uparrow$$

Why Hydrogen Gas is Released:

Acids like HCl, H_2SO_4 (dilute) contain H^+ ions in aqueous solution. When a reactive metal comes in contact with the acid, it donates electrons to the H+ ions, reducing them to hydrogen gas: $2H^+ + 2e^- \rightarrow H_2 \uparrow$

The metal gets oxidized to metal ions, forming the corresponding salt.

8. H_3BO_3 is in

1) Solid state 2) Liquid state 3) Gaseous state 4) None

Answer:1

Solution:Boric acid is solid at room temperature.

9. $ZnO + 2HCl \xrightarrow{?} + H_2O$

1) $ZnCl_2$ 2) ZnO 3) Zn 4) ZnCl

Answer:1

Solution:Metal oxide + acid $\rightarrow$ salt + water

$$ZnO + 2HCl \rightarrow ZnCl_2 + H_2O$$

10. Which of the following acid is present in soft drinks ?

1) H_2SO_4 2) H_2NO_3 3) H_2CO_3 4) HNO_3

Answer:3

Solution:Carbonic acid (H_2CO_3) from dissolved CO_2.

Multi Correct Choice Type:

11. Which of the following is true about acids ?

1) Acids are corrosire 2) Acids taste sour

3) Soluble in water 4) Turn Red to Blue

Answer:1,2,3

Solution:

A) Acids are corrosive → True (strong acids can damage skin, materials)
B) Acids taste sour → True (e.g., citric acid in lemons)
C) Soluble in water → True (acids like HCl, H_2SO_4, CH_3COOH dissolve in water to give H^+ ions)
D) Turn Red to Blue → False (acids turn blue litmus red, not red to blue; bases turn red litmus blue)

12. Which of the following acids are volatile ?

1) H_2SO_4 2) HCl 3) HNO_3 4) H_2SO_3

Answer:2,3,4

Solution:

A) H_2SO_4 →Nonvolatile (high boiling point)
B) HCl → Volatile (easily vaporizes at room temperature)
C) HNO_3 → Volatile (boiling point 83°C, can vaporize)
D) H_2SO_3 → Volatile (sulfurous acid decomposes to SO_2 gas, which is volatile)

Statement Type :

13. **Statement-I :** Phosporous acid is a weak acid

Statement-II : They produces less concentration of H^+ ions in water.

Answer:A

Solution:

Statement I: Phosphorous acid is a weak acid →True (H_3PO_3 is weak, though stronger than H_3PO_4; pKa ~1.3 for first H, but still partially dissociates).
Statement II: They produce less concentration of H^+ ions in water → True (definition of weak acid).
Statement II correctly explains Statement I.

14. **Statement-I :** HNO_3 is a strong acid

Statement-II : H_2CO_3 is a strong acid

Answer:C

Solution:Statement I: HNO_3 is a strong acid → True (fully dissociates in water).
Statement II: H_2CO_3 is a strong acid → False (H_2CO_3 is weak, partial dissociation).

Comprehension type

An acid which contains hydrogen and a non-metallic element, other than oxygen is called Hydroacid.

15. Which of the following acid is Hydro acid

1) HCN 2) HNO_2 3) H_2SO_4 4) H_2CO_3

Answer:1

Solution:Hydro acids are binary acids composed of hydrogen + a nonmetal, no oxygen.
A) HCN → Hydrogen + Carbon + Nitrogen →Not purely binary; contains C and N (cyanide), but often classified as a hydro acid (binary acid of a pseudo-halogen).
B) HNO_2 → Contains O → oxyacid
C) H_2SO_4 → Contains O → oxyacid
D) H_2CO_3 → Contains O → oxyacid

16. An acid which contain hydrogen and non-metalic element other than oxygen .....

1) Volatile acid 2) Non volatile acid 3) Hydro acid 4) Oxy acid

Answer:3

Solution:An acid which contains hydrogen and a non-metal element other than oxygen is called a Hydro acid.

Integer Type :

17. Volatile acids easily charges into their vapours either at room temperature or heating below .....

Answer:100

Solution:Volatile acids vaporize at relatively low temperatures — often below 100°C (since water boils at 100°C, volatile acids usually vaporize below that).

18. Hydro acids contain _____ type of elements.

Answer:2

Solution:Hydro acids are binary acids: contain hydrogen and one other nonmetal (e.g., HCl, HBr, H_2S, HCN).
So number of types of elements = 2.

19. Hydrochloric acid, Nitric acid, Sulphuric acid, Phosphoric acid - How many are used for fertilizers?

Answer:3

Solution:Hydrochloric acid → Not used in fertilizers
Nitric acid → Used to make ammonium nitrate (fertilizer)
Sulphuric acid → Used to make superphosphate and ammonium sulfate
Phosphoric acid → Used to make phosphate fertilizers

Matrix Matching Type :

20.

1) $N_2O_5 + H_2O$	( )	$A) H_3PO_3$
2) $N_2O_3 + H_2O$	( )	$B) HNO_3$
3) $P_2O_3 + H_2O$	( )	$C) H_3PO_4$
4) $P_2O_5 + H_2O$	( )	$D) HNO_2$

Answer: 1-B,2-D,3-A,4-C

Solution:

1) $N_2O_5 + H_2O \rightarrow 2HNO_3 \rightarrow$ Nitric acid $\rightarrow$ B) HNO_3
2) $N_2O_3 + H_2O \rightarrow 2HNO_2 \rightarrow$ Nitrous acid $\rightarrow$ D) HNO_2
3) $P_2O_3 + 3H_2O \rightarrow 2H_3PO_3 \rightarrow$ Phosphorous acid $\rightarrow$ A) H_3PO_3
4) $P_2O_5 + 3H_2O \rightarrow 2H_3PO_4 \rightarrow$ Phosphoric acid $\rightarrow$ C) H_3PO_4

LEARNERS TASK

Conceptual Understanding Questions

1. The acid which kills most of the germs then we swallow with food.

1) H_2SO_4 2) HCl 3) HNO_3 4) H_2CO_3

Answer:2

Solution: HCl (Hydrochloric acid) Secreted in the stomach (pH ~1.5–3.5) to sterilize food and aid digestion.

2. $SO_2 + H_2O \rightarrow$

1) H_2SO_4 2) H_2SO_3 3) HSO_3 4) None

Answer:2

Solution: $SO_2 + H_2O \rightarrow H_2SO_3$

3. H_2SO_4 is example for

1) strong acid 2) Dibasic acid 3) Non-volatile acid 4) All the above

Answer:4

Solution: Strong acid: Fully dissociates in water.
Dibasic acid: Releases 2 H^+ ions.
Non-volatile: High boiling point (~337°C).

4. The acids in which more than 30% of the molecules of it ionise in water to furnish H^+ ions, are called_____.

1) Weak acids 2) Strong acids

3) Neutral acids 4) Inorganic acids

Answer:2

Solution:. Acids with >30% ionization in water are called Strong acids
Examples: HCl, HNO_3, H_2SO_4 (near 100% dissociation).

5. Which of the following is a Hydro acid

1) HCl 2) HNO_3 3) H_2SO_4 4) H_2CO_3

Answer:1

Solution:. Hydro acid (hydrogen + non-metal, no oxygen): A) HCl (Hydrochloric acid)
Others contain oxygen (Oxyacids).

6. The acids which easily charges into their vapours is called

1) Volatile acids 2) Non volatile acids

3) Strong acids 4) Weak acids

Answer:1

Solution: Acids that easily vaporize are called Volatile acids

7. Color of HCl is

1) Colourless 2) Brown 3) Red 4) Pink

Answer:1

Solution:Gaseous HCl is colorless; solutions are clear.

8. $H_2 + Cl_2 \xrightarrow{?} 2HCl$

1) Heat 2) Sunlight 3) Catalyst 4) None

Answer:2

Solution:Photochemical reaction (forms explosive mix in direct sunlight)

9. $SO_3 + H_2O \longrightarrow$

1) H_2SO_3 2) H_2SO_4 3) H_2S 4) H_2CO_3

Answer:2

Solution:$SO_3 + H_2O \rightarrow H_2SO_4$

10. Which of the following acid is heavier than water ?

1) Sulphuric acid 2) Hydrochloric acid

3) Sulphurous acid 4) Carbonic acid

Answer:1

Solution:A) Sulphuric acid (H2SO4)
Density: ~1.84 g/cm³ (water = 1 g/cm³).

JEE MAIN LEVEL QUESTIONS

1. $Ca(OH)_2+H_2SO_4 \rightarrow$

1) $CaSO_4$ 2) H_2O 3) Both 1 and 2 4) CaO

Answer:3

Solution:Balanced Reaction:$Ca(OH)_2+H_2SO_4 \rightarrow CaSO_4 + H_2O$
Neutralization reaction producing calcium sulfate (gypsum) and water.

2. Acid which is Brown due to impurities

1) H_2SO_4 2) HCl 3) H_2CO_3 4) HNO_3

Answer:4

Solution:Concentrated HNO_3 turns yellow-brown due to dissolved NO_2 gas (decomposition product).

3. Hydrogen gas is not evolved when ..... is mixed with Zinc.

1) Dil HNO_3 2) Conc HNO_3 3) Dil H_2SO_4 4) Conc H_2SO_4

Answer:1

Solution:HNO_3 (even dilute) is an oxidizing acid. With Zn, it produces NO/ N_2O/NO_2 instead of H_2: $4Zn+10HNO_3 \rightarrow 4Zn(NO_3)_2 + NH_4NO_3 + 3H_2O$

4. The acids which undergoes complete ionisation when dissolved in water and furnish large conc of H^+ ions are called.

1) Strong acids 2) weak acids 3) Volatile acids 4) Non - Volatile acids

Answer:1

Solution:Acids with complete ionization in water (high H^+ concentration): Strong acids

5. Hydro chloric acid is also known as

1) muriatic acid 2) Organic acid 3) Non volatilve acid 4) Weak acid

Answer:1

Solution:. Hydrochloric acid is also known as Muriatic acid
Common name used in industrial/cleaning contexts.

6. Chloric acid is a

1) Strong acid 2) weak acid 3) Non volatile acid 4) Organic acid

Answer:1

Solution:Chloric acid ($HClO_3$) is a Strong acid
Fully dissociates in water: $HClO_3 \rightarrow H^+ + ClO_3^-$

7. Which of the following acid is a Hygroscopic in nature ?

1) H_2SO_4 2) HCl 3) HNO_3 4) H_2CO_3

Answer:1

Solution:Hygroscopic acid (absorbs moisture from air): H_2SO_4 (Sulfuric acid)
Used as a drying agent due to its strong affinity for water.

8. Which of the following highly corrosive mineral acid ?

1) H_2SO_4 2) HCl 3) HNO_3 4) H_2CO_3

Answer:1
Solution: H_2SO_4 causes severe tissue damage (charring).

9. Another name of formic acid is

1) Ethanoic acid 2) Methanoic acid 3) Nitrous acid 4) Oxalic acid

Answer:2
Solution: Another name for formic acid is Methanoic acid (HCOOH)

10. A metals will not react with dilute acids ?

1) Copper 2) Silver 3) Both 1 and 2 4) Zinc

Answer:3
Solution: Cu and Ag lie below hydrogen in the reactivity series. They cannot displace H^+ from acids.
Exception: They react with oxidizing acids (e.g., HNO_3).

ADVANCED LEVEL QUESTIONS

Multi Correct Answer Type

11. Which of the following are strong acids ?

1) Chloric acid 2) Per chloric acid
3) Hydronic acid 4) Hydro iodic acid

Answer:1,2,4
Solution:Strong acids fully dissociate in water:
$HClO_3$ (Chloric acid): $HClO_3 \rightarrow H^+ + ClO_3^-$
$HClO_4$ (Perchloric acid): One of the strongest known acids.
HI (Hydroiodic acid): Fully ionizes in water.
C) Hydronic acid: Not a standard acid (likely a distractor).

12. Which of the following are weak acids ?

1) Oxalic acid 2) Formic acid 3) Benzoic acid 4) Hydroic acid

Answer:1,2,3
Solution:Weak acids partially dissociate in water:Oxalic acid,Formic acid,Benzoic acid.

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 :** $2HCl + CuCO_3 \rightarrow CuCl_2 + H_2O + CO_2$

Statement -II : Green solid dissolves with efferve scence to form blue solution.

Answer:A

Solution:The reaction between hydrochloric acid (HCl) and copper carbonate ($CuCO_3$) produces:
Copper chloride ($CuCl_2$, blue solution)
Water (H_2O)
Carbon dioxide (CO2, effervescence)
Balanced equation:$2HCl + CuCO_3 \rightarrow CuCl_2 + H_2O + CO_2$
Statement-II (True & Explanatory)
Green solid ($CuCO_3$) dissolves in HCl.
Effervescence (CO_2 gas bubbles) occurs.
Blue solution ($CuCl_2$) forms.
This matches the products described in Statement-I.

14. **Statement -I :** Acids reacts with bases to form salts and water.

Statement -II : When Hydrochloric acid reacts with Iron (III) oxide forms Reddish - Brown Crystals.

Answer:B

Solution:
Statement I is correct (neutralization).

Statement II: $Fe_2O_3 + 6HCl \rightarrow 2FeCl_3 + 3H_2O$;
$FeCl_3$ is yellow/brown, not always reddish-brown crystals. But FeCl3 solution is yellow/brown; solid is reddish-brown.
Both correct, but II is not an explanation of I, it's an example.

Comprehension type

An acid which contains oxygen, along with hydrogen and one more element is called oxyacids.

15. Which of the following acid is oxy acid ?

1) HCN 2) HI 3) HF 4) HCOOH

Answer:4

Solution:Oxyacids contain hydrogen (H) + oxygen (O) + another element (usually a non-metal).

HCOOH: Structure is H-C(=O)-OH (contains C, H, and O).

Other options:

A) HCN (Hydrocyanic acid): No oxygen $\rightarrow$ Hydroacid.

B) HI (Hydroiodic acid): No oxygen $\rightarrow$ Hydroacid.

C) HF (Hydrofluoric acid): No oxygen $\rightarrow$ Hydroacid.

16. Oxalic acid is a

1) Oxy acid 2) Solid state acid 3) Volatile acid 4) All of the above

Answer:1,2

Solution:A) Oxyacid: Contains C, H, and O (structure: HOOC-COOH).

B) Solid state: Exists as white crystalline solid at room temperature.

C) Volatile acid: Incorrect. Oxalic acid is non-volatile (high melting point).

D) All of the above: False (since it's not volatile).

Integer Type :

17. Acid solutions have a PH value .....

Answer:0 TO 7

Solution:he pH scale ranges from 0 to 14:

Acidic solutions: pH < 7 (e.g., HCl pH ~1, vinegar pH ~3).

Neutral solutions: pH = 7 (pure water).

Basic solutions: pH > 7 (e.g., NaOH pH ~14).

18. Phosphoric acid contains ..... number of phosphorous atoms.

Answer:1

Solution:Molecular formula of phosphoric acid: H_3PO_4.

Contains 1 phosphorus (P) atom, 4 oxygen (O) atoms, and 3 hydrogen (H) atoms.

Matrix Matching Type :

19.

Column-I		**Column-I**
1) $NaOH + H_2SO_4$	( )	$A) ZnCl_2 + H_2O$
2) $ZnO + HCl$	( )	$B) ZnCl_2 + CO_2 + H_2O$
3) $ZnCO_3 + HCl$	( )	$C) Na_2SO_4 + 2H_2O$
4) $Zn + HCl$	( )	$D) ZnCl_2 + H_2$

Answer:1-C,2-A,3-B,4-D

Solution:

Column-I	Column-I
1) $NaOH + H_2SO_4$	C)$Na_2SO_4 + 2H_2O$
2) $ZnO + HCl$	A)$ZnCl_2 + H_2O$
3) $ZnCO_3 + HCl$	B)$ZnCl_2 + CO_2 + H_2O$

4) Zn +HCl D)$ZnCl_2+H_2$

20.

Column-I	**Column-I**
1) Acetic acid	A) Ink stain remover
2) Carbonic acid	B) Washing eyes
3) Oxalic acid	C) Softdrinks
4) Boric acid	D) Cooking

Answer: 1-D,2-C,3-A,4-B

Solution:

Column-I	Column-I
1) Acetic acid	D) Cooking
2) Carbonic acid	C) Softdrinks
3) Oxalic acid	A) Ink stain remover
4) Boric acid	B) Washing eyes

KEY

			TEACHING TASK						
			JEE MAINS LEVEL QUESTIONS						
1	2	3	4	5	6	7	8	9	10
4	3	1	3	1	4	1	1	1	3
			JEE ADVANCED LEVEL QUESTIONS						
11	12	13	14	15	16	17	18	19	
1,2,3	2,3,4	A	C	1	3	100	2	3	
20	20		LEARNER'S TASK						
1-B,2-D,3-A,4-C			CONCEPTUAL UNDERSTANDING QUESTIONS						
1	2	3	4	5	6	7	8	9	10
2	2	4	2	1	1	1	2	2	1
			JEE MAINS LEVEL QUESTIONS						
1	2	3	4	5	6	7	8	9	10
3	4	1	1	1	1	1	1	2	3
			JEE ADVANCED LEVEL QUESTIONS						
11	12	13	14	15	16	17	18	19	
1,2,4	1,2,3	A	B	4	1,2	0 TO 7	1	1-C,2-A,3-B,4-D	
20	20								
1-D,2-C,3-A,4-B									