AFCAT SCIENCE
ACIDS, BASES & SALTS

1. Common Acids Found in Nature

Acid Name	Chemical Formula	Where Found Naturally
Acetic acid	CH_3COOH	Vinegar
Formic acid	$HCOOH$	Ant sting, nettle leaves
Citric acid	$C_6H_8O_7$	Lemon, orange, citrus fruits
Tartaric acid	$C_4H_6O_6$	Tamarind, grapes, bananas
Lactic acid	$C_3H_6O_3$	Sour milk, curd
Ascorbic acid	$C_6H_8O_6$	Vitamin C – amla, lemon
Oxalic acid	$H_2C_2O_4$	Tomato, spinach
Butyric acid	$C_4H_8O_2$	Rancid butter
Carbonic acid	H_2CO_3	Carbonated drinks
Sulphuric acid	H_2SO_4	Battery acid (industrial)

2. List of Strong and Weak Acids

Strong Acids (completely ionized)	Weak Acids (partially ionized)
Hydrochloric acid (HCl)	Acetic acid (CH_3COOH)
Nitric acid (HNO_3)	Carbonic acid (H_2CO_3)
Sulphuric acid (H_2SO_4)	Formic acid ($HCOOH$)
Hydrobromic acid (HBr)	Phosphoric acid (H_3PO_4)
Hydroiodic acid (HI)	Oxalic acid ($H_2C_2O_4$)
Perchloric acid ($HClO_4$)	Boric acid (H_3BO_3)

3. List of Strong and Weak Bases

Strong Bases (completely ionized)	Weak Bases (partially ionized)
Sodium hydroxide ($NaOH$)	Ammonium hydroxide (NH_4OH)
Potassium hydroxide (KOH)	Magnesium hydroxide [$Mg(OH)_2$]
Calcium hydroxide ($Ca(OH)_2$)	Aluminium hydroxide [$Al(OH)_3$]
Barium hydroxide ($Ba(OH)_2$)	Zinc hydroxide [$Zn(OH)_2$]
Strontium hydroxide ($Sr(OH)_2$)	Copper hydroxide [$Cu(OH)_2$]

4. Common Salts and Their Chemical Names

Common Name	Chemical Name / Formula	Use / Importance
Common salt	Sodium chloride (NaCl)	Food seasoning, saline water
Baking soda	Sodium bicarbonate ($NaHCO_3$)	Baking, antacid, fire extinguisher
Washing soda	Sodium carbonate decahydrate ($Na_2CO_3 \cdot 10H_2O$)	Softens hard water, detergent
Bleaching powder	Calcium oxychloride ($CaOCl_2$)	Disinfectant, bleaching fabrics
Plaster of Paris	Calcium sulphate hemihydrate ($CaSO_4 \cdot \frac{1}{2}H_2O$)	Plastering, casts
Gypsum	Calcium sulphate dihydrate ($CaSO_4 \cdot 2H_2O$)	Cement, fertilizers
Blue vitriol	Copper(II) sulphate pentahydrate ($CuSO_4 \cdot 5H_2O$)	Fungicide, test for water
Epsom salt	Magnesium sulphate heptahydrate ($MgSO_4 \cdot 7H_2O$)	Medicine, agriculture
Baking powder	$NaHCO_3$ + Tartaric acid	Baking (CO_2 release)
Quicklime	Calcium oxide (CaO)	Cement, whitewash
Slaked lime	Calcium hydroxide ($Ca(OH)_2$)	Neutralizes acidity
Potash alum (Fitkari)	$KAl(SO_4)_2 \cdot 12H_2O$	Water purification, aftershave
Green vitriol	Ferrous sulphate ($FeSO_4 \cdot 7H_2O$)	Dyeing, fertilizers
Mohr's salt	Ferrous ammonium sulphate [$FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$]	Analytical chemistry
Cream of tartar	Potassium bitartrate ($KHC_4H_4O_6$)	Baking stabilizer
Hypo	Sodium thiosulphate ($Na_2S_2O_3 \cdot 5H_2O$)	Fixing agent in photography
Saltpetre	Potassium nitrate (KNO_3)	Gunpowder, fireworks
Borax	Sodium tetraborate decahydrate ($Na_2B_4O_7 \cdot 10H_2O$)	Glass, soap, antiseptic

5. Uses of Some Important Salts

Salt Name	Uses
Sodium chloride (NaCl)	Essential for body, food preservation, raw material for chemicals
Sodium bicarbonate ($NaHCO_3$)	Baking, antacid, neutralizing acid, fire extinguishers
Sodium carbonate (Na_2CO_3)	Glass manufacture, water softener, soap industry
Calcium carbonate ($CaCO_3$)	Marble, chalk, building material
Calcium sulphate ($CaSO_4$)	Making cement and plaster of Paris
Calcium oxychloride ($CaOCl_2$)	Disinfection, bleaching, water purification
Copper sulphate ($CuSO_4$)	Fungicide, laboratory reagent
Potash alum ($KAl(SO_4)_2 \cdot 12H_2O$)	Water purification, antiseptic
Magnesium sulphate ($MgSO_4$)	Medicine and fertilizer
Ferrous sulphate ($FeSO_4$)	Iron supplement, dyeing agent
Potassium nitrate (KNO_3)	Fertilizer, fireworks, gunpowder
Ammonium nitrate (NH_4NO_3)	Fertilizer and explosive component
Sodium nitrate ($NaNO_3$)	Fertilizer, glass manufacturing
Sodium thiosulphate ($Na_2S_2O_3$)	Photographic fixer
Boric acid (H_3BO_3)	Antiseptic, eyewash, glass industry

6. pH and Its Importance

pH Range	Nature of Solution	Example
0 – 3	Strong acid	HCl, H_2SO_4
4 – 6	Weak acid	Vinegar, carbonated drink
7	Neutral	Distilled water
8 – 10	Weak base	Soap, blood (7.4)
11 – 14	Strong base	NaOH, KOH

ACIDS AND BASES (ONE LINE APPROACH)

Concept / Question	One-line Explanation / Answer	Example / Extra Info
Acid	Substance that produces hydrogen ions (H^+) in aqueous solution.	$HCl \rightarrow H^+ + Cl^-$
Base	Substance that produces hydroxide ions (OH^-) in aqueous solution.	$NaOH \rightarrow Na^+ + OH^-$
Alkali	Water-soluble base.	NaOH, KOH
Arrhenius Theory	Acids produce H^+; bases produce OH^- in water.	HCl, NaOH
Bronsted-Lowry Theory	Acid = proton donor; Base = proton acceptor.	$NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$
Lewis Theory	Acid = electron pair acceptor; Base = electron pair donor.	BF_3 (acid), NH_3 (base)
Strong Acid	Completely ionizes in water.	HCl, H_2SO_4
Weak Acid	Partially ionizes in water.	CH_3COOH
Strong Base	Completely dissociates in water.	NaOH, KOH
Weak Base	Partially dissociates in water.	NH_4OH
pH Scale	Negative logarithm of hydrogen ion concentration.	$pH = -\log[H^+]$
pH Range	0 (acidic) to 14 (basic); 7 = neutral.	Water has pH 7
Acidic Solution	$pH < 7$	Lemon juice ($pH \approx 2$)
Basic Solution	$pH > 7$	Soap solution ($pH \approx 9$)
Neutral Solution	Equal $[H^+]$ and $[OH^-]$ ions.	Pure water
Indicators	Substances that change color in acids/bases.	Litmus, Phenolphthalein, Methyl orange
Litmus Test	Acid turns blue litmus → red; Base turns red litmus → blue.	-
Phenolphthalein	Colorless in acid, pink in base.	-
Methyl Orange	Red in acid, yellow in base.	-
Universal Indicator	Shows full pH range with color changes.	pH paper
Neutralization Reaction	Acid + Base → Salt + Water.	$HCl + NaOH \rightarrow NaCl + H_2O$

Salt	Product formed by neutralization.	NaCl, KNO_3
Amphoteric Substance	Acts as both acid and base.	Water, Al_2O_3, ZnO
Hydronium Ion (H_3O^+)	Formed when H^+ combines with water.	$H^+ + H_2O \rightarrow H_3O^+$
Acid Anhydride	Non-metal oxide forming acid with water.	$CO_2 + H_2O \rightarrow H_2CO_3$
Basic Anhydride	Metal oxide forming base with water.	$CaO + H_2O \rightarrow Ca(OH)_2$
Buffer Solution	Resists change in pH on adding acid/base.	Blood acts as buffer
Conjugate Acid-Base Pair	Differ by one proton (H^+).	HCl / Cl^-, NH_4^+ / NH_3
Acidic Oxide	Oxide of non-metal forming acid in water.	SO_2, CO_2
Basic Oxide	Oxide of metal forming base in water.	CaO, Na_2O
Amphoteric Oxide	Can act as both acid and base.	Al_2O_3, ZnO
Strength of Acid/Base	Depends on degree of ionization.	Strong = 100% ionized
Concentration of Acid/Base	Amount of acid/base dissolved per liter.	Molarity (mol/L)
Dilution	Mixing acid/base with water to reduce concentration.	$H_2SO_4 + H_2O \rightarrow$ diluted acid
Precaution in Diluting Acid	Always add acid to water, not vice versa.	Prevents splashing/explosion
Common Acids	Found in daily life substances.	Citric acid (lemon), Acetic acid (vinegar)
Common Bases	Used in household and industry.	$Ca(OH)_2$, Na_2CO_3, NH_4OH
pH of Human Blood	Approximately 7.4 (slightly basic).	Vital for homeostasis
pH of Stomach Acid	Around 1.5 to 3.5.	Contains HCl
Antacids	Substances neutralizing excess stomach acid.	$Mg(OH)_2$, $Al(OH)_3$
Acid Rain	Rainwater with pH < 5.6 due to SO_2/NO_2 gases.	Damages monuments and crops
Industrial Acid	Sulphuric acid (H_2SO_4) – called king of chemicals.	Used in fertilizers, paints, batteries
Vinegar	5–8% acetic acid in water.	CH_3COOH

Baking Soda	Sodium bicarbonate, mild base.	$NaHCO_3$
Washing Soda	Sodium carbonate decahydrate.	$Na_2CO_3 \cdot 10H_2O$
Bleaching Powder	Calcium oxychloride used for disinfection.	$CaOCl_2$
Plaster of Paris	Partially hydrated calcium sulphate.	$CaSO_4 \cdot ½H_2O$
Milk of Magnesia	Suspension of magnesium hydroxide.	Used as antacid
pH Paper	Paper impregnated with universal indicator.	Color changes show pH value
Alkalinity of Soil	Measured by pH; affects crop growth.	Acidic soil treated with lime
Titration	Analytical method to determine concentration of acid/base.	Neutralization titration
End Point (Titration)	Point where reaction just completes; indicated by color change.	-
pKa	Negative log of acid dissociation constant.	pKa = –log Ka
pKb	Negative log of base dissociation constant.	pKb = –log Kb
Relationship between pH and pOH	pH + pOH = 14 (at 25°C).	Water equilibrium constant
Kw (Ionic Product of Water)	Product of $[H^+]$ and $[OH^-]$ at 25°C.	1×10^{-14}
Neutral Water Condition	$[H^+] = [OH^-] = 10^{-7}$ M	pH = 7

ACIDS, BASES AND SALTS (ONE LINE APPROACH)

Question / Concept	**One-line Answer**
Substance which donates proton is a/an	Acid
Base is a substance which	Accepts proton
Which acid is used in lead storage battery?	Sulphuric acid
Number of H^+ ions given by one molecule of the acid is called	Acidity
Acids or bases which get dissociated completely even in concentrated solutions are	Strong acids or bases
According to Lewis theory, base is a/an	Electron donor
According to Arrhenius theory, what an acid yields in aqueous solution?	H^+ or hydronium ions

What a base yields in aqueous solution, according to Arrhenius theory?	OH^- ions
5% acetic acid in water is	Vinegar
Acid present in ant sting	Formic acid (HCOOH)
Which acid is used in oil and sugar refining?	Sulphuric acid
Acid used in manufacture of glue and gelatine	Hydrochloric acid
Which acid is used in making refrigerants?	Hydrofluoric acid
Acid produced in stomach which helps in digestion	Hydrochloric acid
NO_2 is responsible for the yellow colour of which acid?	Nitric acid
Chemical used for cleaning gold ornaments	Aqua regia
What does aqua regia contain?	Conc. HNO_3 + Conc. HCl (1:3)
The nature of taste of acid is	Acidic / Sour
Base used in rayon, soap, and paper industries	Sodium hydroxide (NaOH)
Substance changing colour of litmus paper from red to blue is	Base
When an acid and a base combine, they form	Salt and water
Equilibrium constant of hydrolysis reaction is called	Hydrolysis constant
The fraction of total salt that gets hydrolyzed at equilibrium is known as	Degree of hydrolysis
What is Epsom salt?	Magnesium sulphate ($MgSO_4 \cdot 7H_2O$)
$CaSO_4 \cdot 2H_2O$ is the chemical formula of	Gypsum
Monopotassium tartrate ($KHC_4H_4O_6$) is commonly called	Cream of tartar
What is used as a fixing agent in photography?	Hypo (Sodium thiosulphate)
Salt of potassium used in the production of gunpowder	Potassium nitrate (KNO_3)
The negative logarithm of H^+ ion concentration is called	pH
Value of pH for acids	pH < 7
Substance having pH > 7 is generally called	Base
Methyl orange is red in acidic solution while in basic solution it is	Yellow colour
Which colour appears on adding two drops of phenolphthalein in acidic solution?	Colourless

pH of milk of magnesia	Around 10
Chemical whose formula is commonly known as bleaching powder	$CaOCl_2$ (Calcium oxychloride)
Which acid is added in baking soda making or baking powder?	Tartaric acid
Salt used to test the presence of water	Blue vitriol ($CuSO_4 \cdot 5H_2O$)