

# General Science Chemistry Notes PDF

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Basic Chemistry up to Class X level is asked in Competitive Exams such as Indian Railways –ALP and Group D exams and SSC exams. Cracku brings to you the capsule – One Liners covering exam specific topics in Chemistry.

## Matter and its Nature

- ☞ Matter exists in three different states in Physical Form
- Solids - Molecules are closely packed. It is structural rigidity to changes of shape or volume
  - Liquids – Molecular Bonds in a liquid are weaker than those in a solid but stronger than those in gases
  - Gases - Molecular Bonds in a gas are loosely held and weaker than those in solids and liquids

❖ Boiling Point	The boiling point of a substance is the temperature at which the vapor pressure of the liquid equals the Atmospheric Pressure
❖ Melting Point	The temperature at which the solid exists in equilibrium with its liquid under an external pressure of one atmosphere.
❖ Evaporation	Evaporation is the process of a substance in a liquid state changing to a gaseous state due to an increase in temperature and/or pressure
❖ Freezing Point	Freezing point is the temperature at which a liquid becomes a solid at normal atmospheric pressure
❖ Surface Tension	Surface tension is the elastic tendency of a fluid surface which makes it acquire the least surface area possible
❖ Decantation	Is a process to separate mixtures by removing a liquid layer that is free of a precipitate. The purpose may be to obtain the liquid free from particulates or to recover the precipitate
❖ Specific Gravity	The ratio of the mass of a substance to the mass of a

	reference substance for the same given volume
❖ Filtration	Filtration is process that separate solids from fluids by adding a medium through which only the fluid can pass through
❖ Sublimation	Sublimation is the transition of a substance directly from the solid to the gas phase without passing through the intermediate liquid phase.
❖ Diffusion	Diffusion is defined as the movement of Gas into open space or diffusion into another gas
❖ Effusion	Movement of gas through a tiny hole is defined as effusion
❖ Emulsion	A fine dispersion of minute droplets of one liquid into another in which it is not soluble or miscible
❖ Viscosity	The state of being thick, sticky, and semi-fluid in consistency, due to internal friction

⊖ Liquids at high altitudes boil at lower temperature due to low atmospheric pressure at high altitudes

⊖ Evaporation takes place only on the surface of Liquids

⊖ The melting point of Ice decreases with Increase in Pressure

⊖ Pure water has a maximum density of  $1 \text{ gm/cm}^3$  at 4 Degrees Celsius

⊖ Surface Tension decreases with Increase in temperature

⊖ Spherical Shape of Liquid Droplets is due to the property of Surface Tension in Liquids

⊖ Boiling Point and Evaporation of a liquid differ in a basic point that Evaporation occurs at all temperatures whereas Boiling Point of a liquid occurs at specific Temperature

- All matter is made up of Atoms which is the smallest particle of the element that consists of three fundamental units – Protons, electrons and neutrons.

❖ Discovery of Atomic Nucleus	❖ Ernest Rutherford based on Geiger–Marsden Gold Foil Experiment
❖ Discovery of Protons	❖ E Goldstein
❖ Discovery of Electrons	❖ J J Thomson
❖ Discovery of Neutrons	❖ James Chadwick

- Nucleus is the center of the Atom contains the neutral charges Neutrons and Positively charged Protons, the electrons revolve around the nucleus of an atom
- Protons, electrons and Neutrons are called sub-atomic particle.
- Each sub-atomic particle has an anti-particle with an opposite electric Charge
- “Positron” is not a sub-atomic particle but an anti-particle of electron which has same mass as electron –  $9.10 \times 10^{-31}$  Kg with opposite charge, whereas Proton is a sub atomic particle with mass  $1.6726219 \times 10^{-27}$  Kg and positive Charge
- Atoms combine with each other to form compound atoms called Molecules
- John Dalton was the first scientist to use symbols for elements in a very specific sense.
- The most commonly used measurement for atomic radius is Nanometer -  $1.0 \times 10^{-9}$  Metre and Angstrom A -  $1.0 \times 10^{-10}$  Metre
- The relative Atomic Masses of all units have been measured w.r.t an atom of Carbon-12 which is equal to  $1.66 \times 10^{-24}$  g
- Hydrogen has the smallest atom and is considered to have an atomic mass – 1

☞ Molecules are defined as group of two or more atoms chemically bonded together, Atoms of same element or different elements group together to form a compound molecule

☞ Compound formed between Atoms of Metals and Non-Metals have charged ions

❖ Charge on the Ion – Negative	❖ Anion
❖ Charged on the Ion – Positive	❖ Cation

☞ The combining capacity of an atom of an element with atoms of same element or different elements is called Valency of the element

❖ Atomic Number	❖ Sum total of all protons present in the nucleus of an atom
❖ Atomic Mass	❖ Sum total of Protons and neutrons present in the nucleus of an Atom

☞ The electrons present in the outermost shell of an atom are known as its valence electrons.

☞ Isotopes are atoms of same element having same Atomic Number but different Mass Numbers – (Hydrogen element has three Isotopes 1H1-Hydrogen, 2H1-Deuterium, 3H1 – Tritium)

☞ Atoms of different elements with different Atomic Number but Same Mass Numbers are called Isobars. (Arson. Potassium, Calcium all have same Mass Numbers but different Atomic Number)

☞ Atoms of different elements, which have same number of neutrons but different atomic numbers, are called isotones.

☞ Avagadro Number: The number of Atoms present in 12g of Carbon of C-12 Isotope is  $6.023 \times 10^{23}$  Atoms

- ⊖ 1 Mole of any substance will contain Avagadro number of Molecules or  $6.023 \times 10^{23}$  Atoms
- ⊖ One Mole of any Gas at standard Atmospheric Pressure (STP) will have a volume of 22.4 Litres
- ⊖ The electric neutrality of the atom is due to the presence of Equal number of Electrons and Protons in the atom
- ⊖ The Spontaneous emission of radiation from the nucleus of an atom is a nuclear Phenomenon termed as Radioactivity
- ⊖ Henry Becquerel first discovered radioactivity in 1896. The SI units to measure Radioactivity is Becquerel and unit of Becquerel is  $\text{Second}^{-1}$  (Second Inverse)
- ⊖ The radiation dose absorbed by the human body is measured using the SI unit Gray or conventional unit RAD
- ⊖ Carbon dating is a method for determining the age of an object containing organic material by using the properties of radiocarbon, a radioactive isotope of carbon.
- ⊖ The most essential particle to continue the chain reaction in the fission of Uranium is Neutron

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## PERIODIC CLASSIFICATION OF ELEMENTS

Elements, the purest form of substance can also be classified as

❖ Metal – 91/118 in the Periodic Table	❖ A material that is typically hard when in solid state, opaque, shiny, and has good electrical and thermal conductivity
❖ Non- Metals – 17/118 in the Periodic Table	❖ Is a chemical element that tend to be highly volatile, have low elasticity, and are good insulators of heat and electricity
❖ Metalloids – 10/118 in the Periodic Table	❖ A metalloid is any chemical element which has properties in between those of metals and nonmetals

Eminent scientist suggested the classification of elements as Mendeleev's Periodic Law which states that the Chemical and Physical Properties of elements are the periodic functions of their atomic weights.

Important points to remember for competitive exams

❖ Most Abundant element in the earth's crust	❖ Oxygen
❖ Lightest element in the Universe	❖ Hydrogen
❖ The Only Liquid metallic Element	❖ Mercury
❖ Element which is the best conductor of Electricity	❖ Silver
❖ Highest electro-Negative Element	❖ Fluorine

❖ Most Malleable Element	❖ Gold
❖ The Most abundantly found element in the Human Body	❖ Oxygen

## ACIDS BASES AND SALTS

### ACIDS

### BASES

Acids are compounds that form hydrogen ions when dissolved in water, and whose aqueous solutions react with bases and certain metals to form salts

Bases are compounds that, in aqueous solution, are slippery to the touch, taste astringent and react with acids to form salts

Acid is a Proton Donor

Base is a Proton Acceptor

#### **Types of Acids:**

**Strong Acid:** An acid, which dissociates completely or almost completely in water.

**Weak Acid:** An acid that dissociates only partially when dissolved in water.

#### **Types of Bases:**

**Strong Base:** A base that dissociates completely or almost completely in water

**Weak Base:** A base that dissociates partially when dissolved in water

Acids are sour to taste

Bases are bitter to taste

The acidic property of an acid is due to the presence of hydrogen ions (H<sup>+</sup>)

Property of Base is due to the presence of hydroxyl (OH<sup>-</sup>) ions

A Salt results when an acid reacts with a base

**A scale for measuring Hydrogen ion concentration in a solution is called pH scale**

The P in pH stands for "Potenz" –meaning - Power

## CHEMICAL BONDING, REACTIONS AND EQUATIONS

⊞ The binding force of the constituent atoms of a molecule to maintain a mutual atomic order and definite shape is called Chemical Bonding

❖ There are three types of Chemical Bonding

Electrovalent Bond	Covalent Bond	Metallic Bond
Chemical bond formed between two atoms due to transfer of electron(s) from one atom to the other.	A covalent bond, also called a molecular bond, is a chemical bond that involves the sharing of electron pairs between atoms.	Metallic bonding is a type of chemical bonding that arises from the electrostatic attractive force between conduction electrons and positively charged metal ions.

⊞ **Redox Reaction:** Any reaction involves both a reduction process and a complementary oxidation process the two key reactions involved with electron transfer processes is called redox reaction

⊞ An oxidation- reduction involves many parameters

Oxidation Reaction	Reduction Reaction
Addition of Oxygen	Addition of Hydrogen
Removal of Hydrogen	Removal of Oxygen
Loss of electron	Gain of Electron
Increase in Valency	Decrease in Valency

## ORGANIC CHEMISTRY

- Organic chemistry is the chemistry of carbon compounds, carbon which is an essential constituent of all Organic Compounds discovered till today.
- The Simplest of all organic compounds are Hydrocarbons which contain only Hydrogen and Carbon
- CARBON – HYDROGEN – ORGANIC COMPOUNDS**  
The three types of Hydro Carbons are Alkanes- $\text{CH}_4$  (Methane), Alkenes- $\text{C}_2\text{H}_4$  (Ethene) and Alkynes-  $\text{C}_3\text{H}_4$ (Propyne)
- CARBON-HYDROGEN-OXYGEN**  
Alcohols have (OH) Hydroxyl groups – Methanol ( $\text{CH}_3\text{OH}$ )  
Most common compounds containing Carbon, Hydrogen and Oxygen is “Carbohydrates” ( $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ )  
Some other examples are: Ketones, Aldehydes, Fatty Acids
- CARBON-NITROGEN-HYDROGEN**  
Many important Organic Compounds are obtained in this combination Amines –  $\text{NH}_3$  Cyanides etc...

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## IMPORTANT SCIENTISTS ASSOCIATED WITH CHEMISTRY

❖ The first person to discover the evidence of Radio- Activity, The SI unit of Radio-activity is named after him. He is often considered as the Father of Radio-Activity	Antoine Henri Becquerel
❖ Scientist who did Pioneering research in the field of Radio-Activity Discovered important radio-active elements Radium and Polonium Won the Nobel Prize in chemistry in 1911 and Nobel Prize in Physics 1903 along with Antoine Henri Becquerel, Pierre Curie	Marie Curie
❖ A Swedish chemist, engineer, inventor, businessman, and philanthropist. Known for inventing dynamite and the founder of Nobel Prize instituted in 1895	Alfred Nobel
❖ A Russian chemist and inventor who has formulated the Periodic Law, created a farsighted version of the periodic table of elements.	Dmitri Ivanovich Mendeleev
❖ A noted Scottish physician and chemist, known for his discoveries of Magnesium, latent heat, specific heat, and carbon dioxide	Joseph Black
❖ A Scottish physician, chemist and botanist who is credited with the discovery of nitrogen in 1772	Daniel Rutherford
❖ A Cornish chemist and inventor, who is best remembered today for the discovery of multiple important elements essential for Humans – Pottasium, Calicium, Barium, Boron, Sodium	Sir Humphry Davy
❖ A British chemist who received the Nobel Prize in Chemistry in 1904 for the discovery of noble gases.	Sir William Ramsay
❖ English chemist and meteorologist who pioneered studies of Atomic Theory and who is credited with the discovery of color Blindness and is often considered as one of the founders of Modern Chemistry	John Dalton

❖ A Swedish chemist often considered as the founders of Modern Chemistry and is known for discovery of important elements – Silicon, Thorium	Baron Jons Jacob Berzelius
❖ A German Chemist considered as the father of Nuclear Chemistry and winner of Noble Prize in Chemistry in 1944 for discovery of Nuclear Fission	Otto Hann
❖ A Jewish chemist who received the Nobel Prize in Chemistry in 1918 for his invention of the Haber–Bosch process.	Fritz Haber
❖ The Most important element to Humans - Discovery of Oxygen is often credit with an English Scientist	Joseph Priestley
❖ A French physicist - a pioneer in magnetism, piezoelectricity and radioactivity, recipient of Nobel Prize in Physics for joint research on radiation Phenomenon	Pierre Curie
❖ A Mexican chemist known for his pivotal role in the discovery of the Antarctic ozone hole and Noble Prize winner for discovery of theory developed on depletion of Ozone due to CFCs	Mario Jose Molina
❖ A British biochemist one of only two people to have won twice the Nobel Prize in Chemistry for discovery of Amino acid sequence of insulin	Frederick Sanger
❖ An Italian scientist, most noted for his contribution to molecular theory now known as Avogadro's law	Lorenzo Romano Amedeo Carlo Avogadro
❖ British Chemist known for development of Protein crystallography; determining the structure of Insulin	Dorothy Hodgkin
❖ Scientist credited with the discovery of the covalent bond	Gilbert N. Lewis
❖ Scientist credited with the discovery of 3 <sup>rd</sup> law of Thermodynamics	Walther Nernst
❖ Dutch Scientist and The first recipient of the Nobel Prize in	Jacobus

Chemistry	Henricus van 't Hoff
❖ Scientist credited with the discovery of Fluorine	Henri Moissan
❖ Current President of the Royal Society and recipient of Nobel Prize in Chemistry in 2009 for studying the structure of Ribosome	V Ramakrishnan
❖ A British scientist, and an important experimental and theoretical chemist noted for his discovery of hydrogen	James Chadwick

## IMPORTANT CHEMICALS AND COMPOUNDS

Name of the Compound	Application
Hydrogen Chloride (HCL)	Found in stomach as Gastric Juice for Digestion of food
Sulphuric Acid	Often referred to as the "King of Chemicals", has applications mainly in Car Batteries, Detergents, Fertilizers
Acetic Acid ( CH <sub>3</sub> COOH)	Chemical name of Vinegar
Citric Acid	Present in Lemons and Citrus fruit
Sodium Chloride	Chemical Name of Common Salt
Benzoic Acid	Mainly used as a preservative for Food
Sodium Carbonate	Chemical Name of Washing Soda
Nitric Acid	Commonly used in Manufacturing of Fertilizers like Ammonium Nitrate
Sodium Hydrogen	Chemical name of Baking Soda

Carbonate	
Formic Acid	Used as Food Preservative, found mainly in ants, low concentration is useful to Humans. High Concentration is dangerous
Potassium Hydroxide	Chemical name of Caustic Pottash
Calcium Hydroxide	Chemical name of Lime Water
Boric Acid – Hydrogen Borate	Commonly used antiseptic, Flame retardant
Magnesium Hydroxide	Chemical name of Milk of Magnesia, commonly used an antacid
Aluminum Hydroxide	Most commonly used foaming agent in Fire Extinguishers
Potassium Nitrate	Commonly used in manufacturing of Match Sticks and Gunpowder
Calcium Carbonate	Very Important Compound in Cement Industry
Calcium Sulphate	Chemical name of Plaster of Paris
Calcium Hypochlorite	Chemical name of Bleaching Powder
2-Acetoxybenzoic acid	Chemical name of Aspirin
Ethanol	Chemical name of Alcohol
Copper Sulphate	Chemical name of Blue Vitriol – Hydrated Salt
Ferrous Sulphate	Chemical name of Green Vitriol - Hydrated Salt
Magnesium Sulphate	Chemical name of Epsom Salt - Hydrated Salt
Borax	Chemical name of Sodium Borate - Hydrated Salt
Trichloromethane	Chemical name of Chloroform
Carbon Dioxide	Chemical Name of Dry Ice, primarily used as a cooling agent

Detergents are generally ammonium or sulphonate salts of long chain carboxylic acids Soaps are sodium or potassium salts of long chain carboxylic acids	
Composed of about 75% saturated hydrocarbons and 25% aromatic hydrocarbons	Diesel – Derived from Petroleum
Organic compound generally derived from a carboxylic acid and an alcohol	<b>Esters</b> with characteristic odors are commonly used in synthetic flavors, perfumes, and cosmetics.
Second Isotope of Hydrogen –Water	Often called as Deuterium Oxide or Heavy Water, used in the nuclear reactor to slow down the speed of neutrons
Hydrated Iron Oxides	Rust – Red Oxide
Dinitrogen Monoxide	Chemical name of Laughing Gas
Hydroxy Propanoic Acid	Chemical name of Lactic Acid, a commonly used food preservative
Calcium Carbonate	Chemical name of Marble
Fuming Sulphuric Acid	Chemical name of Oleum, which is commonly used in Oil refining process
Ethanedioic Acid	Chemical name of Oxalic Acid- commonly used as a bleach for wood and
Trinitrophenol	Chemical name of Picric acid which is more acidic than phenol and is commonly used in military explosives, as a yellow dye.
Calcium Oxide	Chemical name of Quicklime
Chlorobenzalmalononitrile	Chemical name of Tear Gas
Zinc Sulphate	Chemical name of White Vitriol

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Carbon Monoxide	Chemical name of Water Gas
Aluminum Hydroxide	Chemical name for Window Cleaner, has its application in the cleaning of windows
Silver Nitrate solution is poured into a solution of Sodium Chloride	White Precipitate
Potassium Iodide solution reacts with Lead Nitrate solution	Yellow Precipitate of Lead Iodide
Lead sulphide mineral	"Galena" primarily found ore of lead and is mined from large number of deposits from many countries

### MAIN ORES OF IMPORTANT ELEMENTS

Main ore of Iron	Hematite
Main ore of Aluminum	Bauxite
Main ore of Copper	Chalcopyrite
Main ore of Zinc	Sphalerite
Main ore of Lead	Galena
Main ore of Mercury	Cinnabar
Main source of Sodium	Rock Salt
Main ore of Tin	Cassiterite
Main Ore of Magnesium	Dolomite
Main ore of Phosphorous	Fluorapatite

**IMPORTANT DEFINITIONS, ABBREVIATIONS AND  
POINTS TO REMEMBER  
IN CHEMISTRY**

Element that is common to all acids	Hydrogen
Most Abundant element in the earth's crust	Aluminum
First scientist to use symbols for elements in a very specific sense	John Dalton
Oxides of metals which show characteristics of both acidic and basic nature	Aluminum Oxide and Zinc Oxide – known as atmospheric oxides
Metals kept in kerosene to avoid combustion in open air due to their high reactivity	Potassium and Sodium
The relation of two or more compound that are composed of the same kind and number of atoms but differ from each other in structural arrangement	Isomers - Phenomenon is called Isomerism
The temperature at which a given mass of gas does not occupy any volume or does not exert pressure	Absolute Zero temperature
Celsius Scale Kelvin Scale Fahrenheit Scale	Three scales to measure Temperature
Diamond Graphite Amorphous	Three states of Carbon
Substance that can exist in all the three states of matter – Solids, Liquids and Gases	Water
Acid that decomposes at ordinary room temperature	Nitric Acid
Strongest Oxidizing Agent	Fluorine
Strongest Reducing Agent	Lithium

Element found in maximum percentage in Human Body	Oxygen
The purest form of coal	Anthracite
Main element used in the conversion of Solar Energy	Silicon
PH values of important compounds: Hydrochloric Acid Vinegar Tomatoes Milk Pure Water Human Blood Milk of Magnesia Sodium Hydroxide	0 2.2 4.5 6.6 7.0 7.4 10.5 14
Element which has highest Melting Point	Tungsten
Element which has highest electron affinity	Chlorine
Element with highest Boiling Point	Tungsten
Element with lowest Boiling Point	Helium
Element which has the highest Density	Osmium
Element with the lowest Boiling Point	Helium
Element with the lowest Density	Hydrogen
Most commonly used chemical in photography	Silver Bromide
Most commonly used chemical for artificial rain or cloud seeding	Silver Iodide
Most common chemical used in toothpaste	Fluoride
Most common chemical used Voting Ink	Silver Nitrate
Chemical commonly used in Artificial ripening of Fruits	Calcium Carbide
Commonly used chemical used in Airbag	Sodium Azide

Commonly used chemical in Blood Bank	CPD : Citrate-Phosphate- Dextrose
Commonly used Chemical in Mouth Wash	Hydrogen peroxide
Most commonly used semiconductors	Germanium and Silicon

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## Chemistry 20 Important One Liners

Element that doesn't occur in nature but is produced artificially	Plutonium
Popular <b>Allotrope</b> of Oxygen which is highly reactive in nature	Ozone
World's Biggest and most Powerful Nuclear Powered Ship	SIBIR launched in Russia recently
World's first Molecular Robot (Millionth of Millimeter in Size)	Created by Scientists from University of Manchester (Made from elements of Carbon, Hydrogen, Oxygen and Nitrogen)
Scientist credited with the Discovery of Electrons	J J Thomson
Organization which developed new technique to produce bioethanol from discarded Cotton Stalks	CSIR- National Institute for Interdisciplinary Science and Technology
Name of the World's first Wind Farm built across coast of Scotland Country	Hywind

India's first Bio-CNG(Bio-methane) Bus developed recently by	Tata Motors
Atoms of same element having same Atomic Number but different Mass Numbers	Isotopes
A Mexican chemist and Noble Prize winner for discovery of theory developed on depletion of Ozone due to CFCs	Mario Jose Molina
Scientist credited with the discovery of the covalent bond	Gilbert N. Lewis
Chemical mainly used as Preservative in Food	Benzoic Acid
Scientist credited with the discovery of Fluorine	Henri Moissan
Substance used to retard the setting of the Cement	Gypsum
Most commonly used foaming agent in Fire Extinguishers	Aluminum Hydroxide
Chemical with characteristic odors are commonly used in synthetic flavors, perfumes, and cosmetics	Esters
Main Ore of Mercury	Cinnabar
Chemical name of Green Vitriol - Hydrated Salt	Ferrous Sulphate
Metals kept in kerosene to avoid combustion in open air due to their high reactivity	Potassium and Sodium

Chemical name of Lime Water	Calcium Hydroxide
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