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# Chemistry (I) Charts, School Education

## Product Image



## Description

**Standard Size:** 58x90cms

**Language:** English

Laminated Paper Charts with Plastic Rollers. These charts have technically accurate and detailed description in vivid colours.

**Note:** Based on minimum order quantity conditions, Charts can be customized to your requirements in terms of CONTENT, LANGUAGE, SIZE, etc. Please write back to us for discussion.

A . Charts, Composition of Water by Weight      B. Charts, Chemical Reactivity of An Element



C. Charts, Occurrence, and Forms of Carbon      D. Charts, Carbon Dioxide & Carbon Monoxide



## Occurrence and Forms of Carbon

### Occurrence of Carbon

**In Free State**  
Carbon in its free state is found in nature as diamond, graphite and coal.

**In Fossil Fuels**  
In fossil fuels carbon is found in coal, petroleum and natural gas.

**In Combined Form**  
In the combined form carbon occurs as carbonate salts, mainly and limestone in the form of calcium carbonate ( $\text{CaCO}_3$ ).

**In Atmosphere**  
In the atmosphere carbon is found as carbon dioxide.

### Different Forms of Carbon

**CRYSTALLINE AND AMORPHOUS FORMS OF CARBON**

**CRYSTALLINE FORMS**  
Diamond, Graphite, Fullerene

**AMORPHOUS FORMS**  
Charcoal, Lampblack, Coke, Graphite, Carbon Black

**Properties of Carbon**  
1. It is a non-metallic element.  
2. It is found in the form of diamond, graphite and amorphous carbon.  
3. It is a good conductor of electricity.  
4. It is a good reducing agent.

## Carbon Dioxide and Carbon Monoxide

### CARBON DIOXIDE ( $\text{CO}_2$ )

**Preparation of  $\text{CO}_2$  in Atmosphere**

- Respiration by living beings.
- Burning of fossil fuels.
- Decomposition of animal and plant wastes.
- Volcanic eruptions.
- Acid rain falling on water bodies and rocks.

**Properties of  $\text{CO}_2$**

- Colorless and odorless gas.
- Slightly soluble in water.
- Turns limewater (saturated lime water) milky by forming calcium carbonate. This reaction is used as a test for the presence of  $\text{CO}_2$ .
- It is a weakly acidic oxide.

**Laboratory Preparation of  $\text{CO}_2$**   
In the laboratory carbon dioxide is prepared by the reaction of dilute hydrochloric acid and calcium carbonate.

$$\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$$

**Uses of  $\text{CO}_2$**   
Carbon dioxide is used in the manufacture of soda water, fire extinguishers, and in the production of carbonates.

### CARBON MONOXIDE ( $\text{CO}$ )

Carbon monoxide is a poisonous gas, which is formed when carbon is oxidized in a limited supply of air.

$$2\text{C} + \text{O}_2 \rightarrow 2\text{CO}$$

**Use of  $\text{CO}$**   
Carbon monoxide is used in the extraction of iron from its ores. This is because it is a good reducing agent.

**Laboratory Preparation of  $\text{CO}$**   
In the laboratory carbon monoxide is prepared by the reaction of formic acid and concentrated sulphuric acid.

$$\text{HCOOH} + \text{H}_2\text{SO}_4 \rightarrow \text{CO} + \text{H}_2\text{O} + \text{H}_2\text{SO}_4$$

**Properties of  $\text{CO}$**

- $\text{CO}$  is a colorless, odorless, and tasteless gas.
- $\text{CO}$  is a weakly acidic oxide.
- $\text{CO}$  is a good reducing agent.
- $\text{CO}$  is a poisonous gas.

## E. Charts, Carbonates & Bicarbonates

## Carbonates & Bicarbonates

Carbonates and bicarbonates are the salts of carbonic acid.

### CARBONATES

**Sodium Carbonate ( $\text{Na}_2\text{CO}_3$ )**  
Sodium carbonate is commonly known as soda ash. It is a white, crystalline solid. It is used in the manufacture of glass, paper, and soap.

**Calcium Carbonate ( $\text{CaCO}_3$ )**  
Calcium carbonate is found in nature as limestone, marble, and chalk. It is used in the manufacture of cement and as a building material.

### BICARBONATES

**Sodium Bicarbonate ( $\text{NaHCO}_3$ )**  
Sodium bicarbonate is commonly known as baking soda. It is a white, crystalline solid. It is used in the manufacture of glass, paper, and soap.

**Calcium Bicarbonate ( $\text{CaHCO}_3$ )**  
Calcium bicarbonate is found in nature as limestone, marble, and chalk. It is used in the manufacture of cement and as a building material.

## Valencies of Elements

**Valency** :- Capacity of a single atom or radical to combine with other atoms or radicals to form a stable molecule. Valency of an element depends on the number of valence electrons.

**Valency of Elements**

Element	Sym.	Valency
Hydrogen	H	+1, -1
Helium	He	0
Lithium	Li	+1
Beryllium	Be	+2
Boron	B	+3, -3
Carbon	C	+2, +4
Nitrogen	N	+3, +5, -3, -4, -5
Oxygen	O	-2
Fluorine	F	-1, +1
Neon	Ne	0
Sodium	Na	+1
Magnesium	Mg	+2
Aluminum	Al	+3
Silicon	Si	+4
Phosphorus	P	+3, +5
Sulphur	S	+2, +4, +6
Chlorine	Cl	+1, +3, +5, +7
Argon	Ar	0
Potassium	K	+1
Calcium	Ca	+2
Scandium	Sc	+3
Titanium	Ti	+2, +3, +4
Vanadium	V	+2, +3, +4, +5
Chromium	Cr	+2, +3, +6
Manganese	Mn	+2, +3, +4, +6, +7
Iron	Fe	+2, +3
Cobalt	Co	+2, +3
Nickel	Ni	+2, +3
Copper	Cu	+1, +2
Zinc	Zn	+2
Gallium	Ga	+3
Germanium	Ge	+4
Arsenic	As	+3, +5
Selenium	Se	+2, +4, +6
Bromine	Br	+1, +3, +5
Krypton	Kr	0
Rubidium	Rb	+1
Strontium	Sr	+2
Yttrium	Y	+3
Zirconium	Zr	+2, +3, +4
Niobium	Nb	+2, +3, +4, +5
Molybdenum	Mo	+2, +3, +4, +5, +6
Technetium	Tc	+4
Ruthenium	Ru	+2, +3, +4, +5, +6, +7
Rhodium	Rh	+3, +4
Palladium	Pd	+2, +4
Silver	Ag	+1
Cadmium	Cd	+2
Indium	In	+3
Mercury	Hg	+1, +2
Thallium	Tl	+1, +3
Lead	Pb	+2, +4
Bismuth	Bi	+3, +5
Polonium	Po	+2, +4
Astatine	At	+1, +3, +5, +7
Radon	Rn	0
Francium	Fr	+1
Radium	Ra	+2
Actinium	Ac	+3
Thorium	Th	+4
Protactinium	Pa	+3, +4
Uranium	U	+3, +4, +5, +6

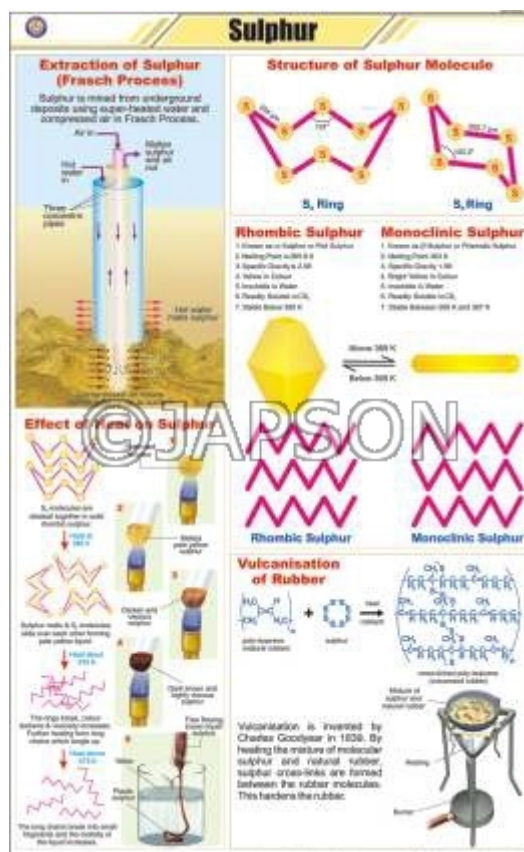
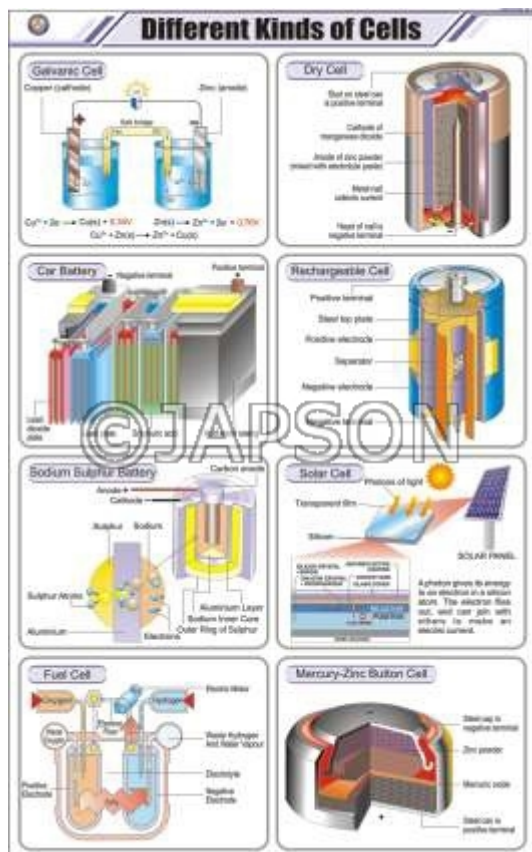
**Valency Mechanism**  
The way by which the elements combine with each other to attain a stable electronic configuration.

- By forming ionic bond.
- By forming covalent bond.
- By forming co-ordinate bond.

## G. Charts, Bivalent Kinds of Cells

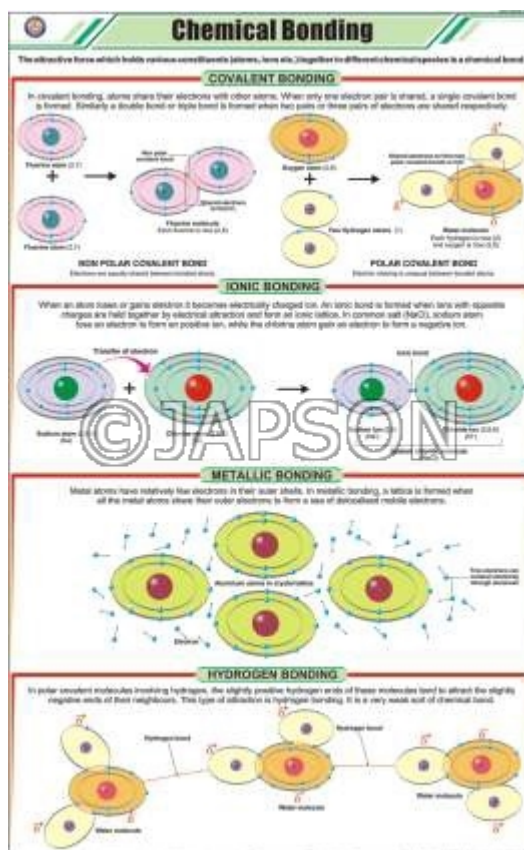
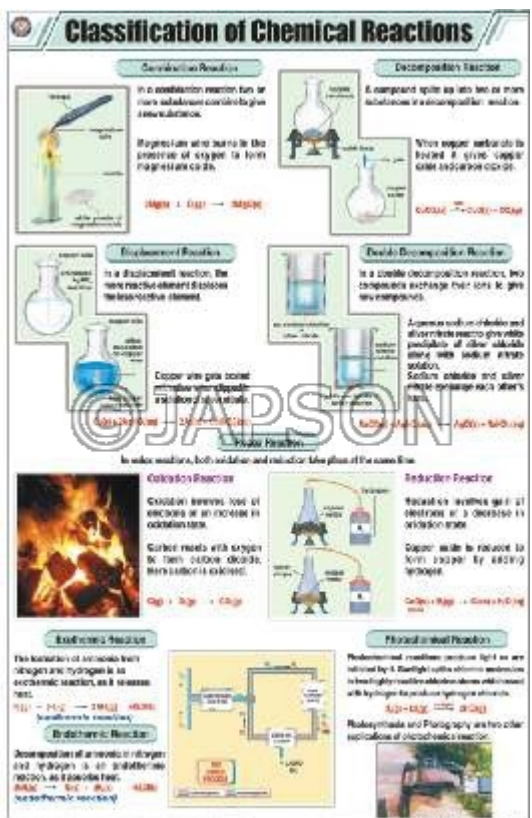
## H. Charts, Sulphur





## I. Charts, Classification of Chemical Reactions

## J. Charts, Chemical Bonding





## K. Charts, Separation of Substances      L. Charts, Atoms and Atomic Structure

### Separation of Substances

Separation of substances is required to get a pure and clean substance for our use. Substances can be purified through various means. Some of them have been discussed below:

#### Distillation

Difficult to separate a mixture of two volatile liquids from a solution.

#### Fractional Distillation

Two volatile liquids having different boiling points are separated by this.

#### Leaching

The process of extraction is accelerated by the presence of a solvent.

#### Filtration

We use the process of filtration when separating a solid from a liquid.

#### Evaporation and Crystallization

A solution is crystallized by heating it to dryness and then cooling it.

#### Sublimation

The process of sublimation is used to separate a solid from a liquid.

#### Magnetic Separation

A magnet is used to separate iron, nickel, or cobalt from a mixture.

#### Sedimentation and Decantation

A mixture of sand and water is separated by sedimentation and decantation.

#### Churning

In the process of churning, a mixture is used to separate a solid from a liquid.

#### Sieving

Sieving is used to separate a solid from a liquid.

#### Winnowing

Winnowing is used to separate a solid from a liquid.

#### Separating funnel

Two immiscible liquids are separated using a separating funnel.

#### Centrifugation

Two immiscible liquids are separated using a separating funnel.

### Atoms and Atomic Structure

Atoms are the building blocks of matter.

Dr. J.J. Thomson was the first to discover the presence of electrons in 1897. He performed the Cathode Ray Experiment.

Rutherford's Gold Foil Experiment led him to suggest the presence of positively charged nucleus deep inside the atom where probably the entire mass of atom is concentrated.

In 1932, James Chadwick discovered the presence of neutrons in an atom. Goldstein shows the existence of protons in an atom.

According to classical electromagnetic theory, electrons will lose energy continuously while revolving around the nucleus. This, however, does not happen.

Bohr's Atomic Model suggested that electrons revolve around the nucleus in different energy levels or orbits. Energy levels or shells are represented either by numbers 1, 2, 3, 4, 5 and 6 or by letters K, L, M, N, O and P. The electrons do not lose their energy as long as they keep moving in their energy levels.

The electrons orbiting the nucleus of an atom can absorb energy and move from a normal orbit to a higher one.

Mass number = protons + neutrons. It is represented by A.

Atomic mass is the average of mass number of naturally occurring isotopes of an atom.

In 1913, Moseley introduced atomic number. It is equal to the number of protons present inside the nucleus of an atom. It is represented by Z.

The mass number and atomic number are shown as superscript and subscript respectively on the left side of the symbol of that element.

Example:  $^{23}_{11}\text{Na}$

## M. Charts, Atmosphere and Composition of Air

### Atmosphere and Composition of Air

The atmosphere is a thick layer of air surrounding the Earth. It is made up of different gases.

#### 1. Troposphere

It extends up to about 11 km from the surface. It is the layer where most of the weather occurs.

#### 2. Stratosphere

It extends up to about 50 km from the surface. It is the layer where the ozone layer is located.

#### 3. Mesosphere

It extends up to about 85 km from the surface. It is the layer where meteors burn up.

#### 4. Thermosphere

It extends up to about 1000 km from the surface. It is the layer where the aurora occurs.

#### Composition of Air

Air is a mixture of different gases. The major components are:

- Nitrogen (78.1%)
- Oxygen (21%)
- Argon (0.93%)
- Carbon Dioxide (0.04%)
- Water Vapor (Variable)

Other gases include neon, helium, krypton, and xenon.

Trace gases include ozone, methane, and nitrous oxide.

Particulates include dust, pollen, and smoke.

## N. Charts, Chemical Reaction and its Characteristics

### Chemical Reaction and its Characteristics

A chemical reaction is a phenomenon of formation of new substances.

For the formation of a new substance, the reactants must combine in a certain way.

Example:  $\text{CuSO}_4 + \text{NaOH} \rightarrow \text{Cu(OH)}_2 + \text{Na}_2\text{SO}_4$

#### 1. Evolution of Gas

Sodium reacts with water vigorously to produce hydrogen gas.

#### 2. Change of Colour

Copper reacts with silver nitrate to form copper nitrate and silver metal.

#### 3. Formation of Precipitate

Silver nitrate reacts with sodium chloride to form silver chloride precipitate.

#### 4. Change of State

Ammonia reacts with hydrogen chloride to form ammonium chloride.

#### 5. Release of Heat

Combustion of a substance releases heat.

#### 6. Absorption of Heat

Decomposition of a substance absorbs heat.

## O. Charts, Mole Concept

### Mole Concept

The word 'mole' is derived from the latin word moles, which means pile, heap or mass.  
Every mole of any element has the same number of atoms in it.  
One mole is the amount of a substance that contains as many particles or entities as there are atoms in exactly 12 gm (or 0.012kg) of the  $^{12}\text{C}$  isotope. Mole of a substance always contain same number of entities no matter what the substance may be.

**AVOGADRO NUMBER:** Knowing that 1 mole of carbon weighs 12g, the number of atoms in it is equal to

$$= 6.0221415 \times 10^{23}$$

This number is known as Avogadro Constant and is denoted by **N**.

#### THE AVOGADRO NUMBER, N

$N = 6.0221415 \times 10^{23}$  or 602,214,150,000,000,000,000

To three significant figures  
 $N = 6.02 \times 10^{23}$

The number of units represented by the Avogadro Number, N, is  $6.02 \times 10^{23}$ .

ELEMENT	ATOMIC MASS (amu)	1 MOLE = 1 GRAM ATOM (masses $6.02 \times 10^{23}$ atoms)
Al	27.3	27.3 g
O	16.0	16.0 g
C	12.0	12.0 g
H	1.000	1.008 g

One mole of an element is a gram-atom of the element. It contains  $6.02 \times 10^{23}$  atoms.

#### 1 MOLE = MOLECULAR MASS (amu)

Gas	1 MOLE (Gram-molecular mass)	MOLECULAR MASS (amu)
$\text{H}_2$	2.016 g	2.016
$\text{O}_2$	32.0 g	32.0
$\text{CO}_2$	44.0 g	44.0

The determination of the mass of a molecule also serves to determine the gram-molecular mass of a substance.

#### AVOGADRO'S HYPOTHESIS

Equal volumes of all gases, under the same conditions of temperature and pressure, contain the same number of molecules.

#### MOLECULAR VOLUME OR GRAM-MOLECULAR VOLUME = 22.4 l AT S.T.P.

For all gases, the volume occupied by the Avogadro Number, N, of molecules is approximately 22.4 liters at S.T.P. (standard temperature and pressure).

#### CHARGE ON AN ELECTRON

$e = 9.62 \times 10^{18}$  electrons  $F = 96,500$  coulombs

Charge on one electron = 96,500 coulombs  
 $9.62 \times 10^{18}$  electrons  
 $= 1.60 \times 10^{19}$  coulombs

A mole of electrons is  $6.02 \times 10^{23}$  electrons and is called the Faraday (F). In electrical units one Faraday is equal to 96,500 coulombs of charge.

## P. Charts, Combustion

### Combustion

Combustion is the process of burning of a substance in the presence of oxygen to liberate energy in the form of heat and light. A substance which helps in burning of combustible substances is known as supporter of combustion. Oxygen is a supporter of combustion while nitrogen is a non-supporter.

Substances which burn in air to produce heat and light are called **Combustible Substances**.

Combustion of coke to yield carbon dioxide, heat and light.

$$\text{C} + \text{O}_2 \rightarrow \text{CO}_2 + \text{heat} + \text{light}$$

The chemical reaction of combustion of a substance containing carbon is as follows.

$$\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O} + \text{heat} + \text{light}$$

When magnesium burns in air, magnesium oxide is produced.

$$2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO} + \text{heat} + \text{light}$$

When hydrogen burns in air, water is produced.

$$2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{heat} + \text{light}$$

Substances that do not burn easily are called **Non Combustible Substances**.

#### Types of Combustion

- 1. Rapid Combustion**  
Combustion in which a large amount of heat and light are produced for a short time is called Rapid Combustion.
- 2. Slow Combustion**  
Combustion at a very slow rate and at a low temperature is called Slow Combustion.
- 3. Explosion**  
Combustion, in which a very large amount of energy is released in the form of heat, light and sound in a very short period of time is called an Explosion.
- 4. Complete Combustion**  
Combustion in the presence of excess oxygen to burn the highest state of the substance is called complete combustion. e.g. burning of carbon to form carbon dioxide.  
 $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$
- 5. Incomplete Combustion**  
Combustion in the presence of insufficient supply of oxygen is called incomplete combustion. e.g. incomplete combustion of carbon produces carbon monoxide.  
 $2\text{C} + \text{O}_2 \rightarrow 2\text{CO}$

#### Ignition Temperature

A combustible substance starts burning only when it is heated to a certain minimum temperature called the ignition temperature. Three requirements for ignition to take place are:

1. A combustible substance.
2. A supporter of combustion such as oxygen.
3. Heat to raise the temperature of the combustible substance to the ignition temperature.

Combustible Substances

Oxygen

Heat

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