



Government of Tamilnadu

Department of Employment and Training

Course : TNPSC Group II Exam
Subject : Chemistry
Topic : **Carbon and its Compounds**

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**Commissioner,
Department of Employment and Training.**

CARBON AND ITS COMPOUNDS

Carbon is a non-metal

symbol	: C
Atomic Number	: 6
Atomic Mass	: 12
Valency	: 4

$1s^2 2s^2 2p^2$ ie $k=2, l=4$, k shell has 2 electrons, l shell has 4 electrons. Since it has four electrons in its outermost shell, its valency is four.

Allotropy

❖ The electronic configuration of carbon is $k=3, l=4$. It has four electrons in the valence shell and belongs to group IV A (group 14) of the periodic table. Other element in the 14th group is Silicon, Germanium, Tin, Lead.

❖ Allotropy is defined as the property by which an element can exist in more than one form that is physically different but chemically similar.

Allotropes of carbon

❖ Without carbon, no living thing could survive. Human beings are made of carbon compounds.

❖ Carbon compounds hold the key to plant and animal life on earth. Hence, carbon chemistry is called living chemistry.

❖ Carbon exists in three allotropic forms.

1. Crystalline form. Ex. Diamond, Graphite
2. Amorphous form. Ex. Coke, Charcoal
3. Fullerene.

❖ **Catenation-special property of carbon**

Diamond

Electronic configuration of carbon

❖ The atomic number of carbon is 6. The electronic configuration is

❖ Diamond is a allotropy of carbon. Polished Diamond is more shine.

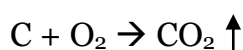
❖ In India diamonds are found in Panna mines in Madhya Pradesh,

Wajrakarur in Andhra Pradesh and Golkunda mines in Karnataka.

- ❖ In diamond each carbon atom is bonded to four other carbon atoms forming a rigid three dimensional structure, accounting for its hardness and rigidity .
- ❖ It is a Hexagonal cubic structure
- ❖ Kohinoor diamond is 105 Carat
- ❖ Kohinoor diamond is 21.68 g.

Characteristics of a diamond

1. It is a hardest naturally occurring substance
2. Colourless, transparent substance
3. It has a density of 3.5g/cm^3 .
4. It does not conduct electricity
5. It sublimates when heated to about 3500°C
6. Action of air
 - When heated to 800°C , it burns to give carbon dioxide.



Diamond uses

1. It is used in Jewellery.
2. Diamonds are used for cutting glass and even for drilling hard rocks.
3. It is used for making protective window in space crafts.

4. It is used in delicate eye surgeries as surgical tools.
5. High technology thermometers,
 $1 \text{ carat} = 200 \text{ mg}$

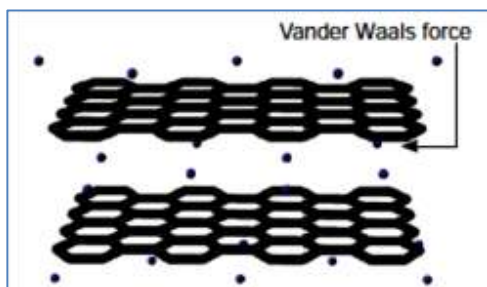
Graphite

- ❖ Graphite is an allotropy of carbon.
- ❖ Graphite exporting countries are China, India, Brazil, North Korea and Canada.
- ❖ In Graphite each carbon atom is bonded to three other Carbon atoms in the same plane giving hexagonal layers held together by weak vander waals forces accounting for softness.
- ❖ Graphite burns in air at 700°C to form CO_2 .
 1. Graphite is a good conductor of electricity
 2. Graphite is used to make pencils.

Graphite properties

- ❖ Graphite are generally greenish –black and opaque, melting point 3700°C , density 2.3 g / cm^3
- ❖ Graphite is soft and greasy to touch.

CARBON AND ITS COMPOUNDS



Uses of graphite

1. Graphite is used as a lubricant in machines.
2. Graphite is used as an electrode in dry cells.
3. It is used to make pencil lead.
4. It is used to make ink and paint.
5. Graphite is used as moderator in nuclear reactors.
6. It is used to make artificial diamonds.

Fullerene (C₆₀)

1. Fullerenes form another type of carbon allotropes.
2. It is identified to contain 60 carbon atoms in the shape of football.
3. It looks like the geodesic dome designed by the US architect Buckminster Fuller it is named as Buckminster Fullerene.
4. Discovered by Richard Smalley, Robert Curl and Harry Kroto.

Isomerism

- ❖ Isomerism, the phenomenon by which two (or) more compounds to have same molecular formula but different structural formula with difference in properties.

Examples

❖ molecular formula C₂H₆O

ethyl alcohol
(C₂H₅OH)

dimethyl ether
(CH₃OCH₃)

Hydrocarbons

- ❖ Organic compounds containing only carbon and hydrogen are called Hydrocarbons.

1. Saturated hydrocarbons

- Alkanes – General formula (C_nH_{2n+2})

2. Unsaturated hydrocarbons

- Alkenes (C_nH_{2n})
- Alkynes (C_nH_{2n-2})

Functional groups

- ❖ Functional group may be defined as an atom (or) group of atoms (or) reactive part which is responsible for the characteristic properties of the compounds.

Generally Transition metal and their compound are coloured.

Sl.No.	Molecular formula	Common Name	IUPAC Name
1.	CH ₃ OH	Methyl alcohol	Methanol
2.	CH ₃ CH ₂ OH	Ethyl alcohol	Ethanol
3.	CH ₃ CH ₂ CH ₂ OH	n-Propyl alcohol	1-propanol
4.	$\begin{array}{c} \text{CH}_3 \text{ CH CH}_3 \\ \\ \text{OH} \end{array}$	Isopropyl alcohol	2-propanol
5.	CH ₃ CH ₂ CH ₂ CH ₂ OH	n-Butyl alcohol	1-Butanol
6.	$\begin{array}{c} \text{CH}_3 \text{ CH CH}_2\text{OH} \\ \\ \text{CH}_3 \end{array}$	Isobutyl alcohol	2-methyl-1-Propanol

Sl.No.	Molecular formula	Common Name	IUPAC Name
1.	HCOOH	Formic Acid	Methanoic Acid
2.	CH ₃ COOH	Acetic Acid	Ethanoic Acid
3.	CH ₃ CH ₂ COOH	Propionic Acid	Propanoic Acid
4.	CH ₃ CH ₂ CH ₂ COOH	n-Butyric Acid	Butanoic Acid

Sl.No.	Molecular formula	Common Name	IUPAC Name
1.	HCHO	Formaldehyde	Methanal
2.	CH ₃ CHO	Acetaldehyde	Ethanal
3.	CH ₃ CH ₂ CHO	Propionaldehyde	Propanal
4.	CH ₃ CH ₂ CH ₂ CHO	Butyraldehyde	Butanal

1. Alcohol – OH is the functional group

2. Carboxylic Acid

❖ Functional group of the carboxylic acid is – COOH

3. Aldehydes

❖ Functional group of the aldehyde is – CHO

4. Ketones

❖ The functional group of Ketone is – Co

Lithium is the lightest and the most reluctant metal.

♦.....♦

CARBON AND ITS COMPOUNDS

SI.No.	Molecular formula	Common Name	IUPAC Name
1.	$\text{CH}_3 \text{COCH}_3$	Dimethyl ketone (Acetone)	Propanone
2.	$\text{CH}_3 \text{COCH}_2 \text{CH}_3$	Ethyl Methyl ketone	Butanone
3.	$\text{CH}_3 \text{CH}_2 \text{COCH}_2 \text{CH}_3$	Diethyl ketone	3-pentanone

Methylated spirit

- ❖ 95% Ethanol
- ❖ 5% Methanol

Rectified spirit

- ❖ 95.5% Ethanol
- ❖ 4.5% water

Amorphous Carbon

1. Coal
2. Charcoal
3. Lamp-black
4. Carbon black
5. Gas carbon
6. Petroleum charcoal

Ethanol is used

1. as an anti-freeze in automobile radiators.
2. as a preservative for biological specimen.

3. as an antiseptic to sterilize wounds, in hospitals.

4. as a solvent for drugs, oils, fats, perfumes, dyes, etc. In the preparation of methylated spirit (mixture of 95% of ethanol and 5% of methanol), rectified spirit (mixture of 95.5% of ethanol and 4.5% of water), power alcohol (mixture of petrol and ethanol) and denatured spirit (ethanol mixed with pyridine). in cough and digestive syrups.

Evil effects of consuming alcohol

1. If ethanol is consumed, it tends to slow down the metabolism of our body and depresses the central nervous system.
2. It causes mental depression and emotional disorder.

Gold and Silver are the most malleable metals.

3. It affects our health by causing ulcer, high blood pressure, cancer, brain and liver damage.
4. Nearly 40% accidents occur due to drunken driving.
5. Unlike ethanol, intake of methanol in very small quantities can cause death.
6. Methanol is oxidized to methanal (formaldehyde) in the liver and methanol reacts rapidly with the components of cells
7. Methanal causes the protoplasm to get coagulated, in the same way an egg coagulates while cooking. Methanol also affects the optic nerve, causing blindness.

Coal

Sl. No.	Type	Carbon	Grade
1.	Peat	27%	Very Low grade
2.	Lignite	28.30%	Low grade
3.	Bituminous	80%	High grade
4.	Anthracite	90%	Most superior variety

Isotopes of Carbon

Stable radioactive

C^{12} (98.93%)
 C^{13} (1.07)

C^{14} (half life period 5730 years)

Uses of Carbon and its compounds

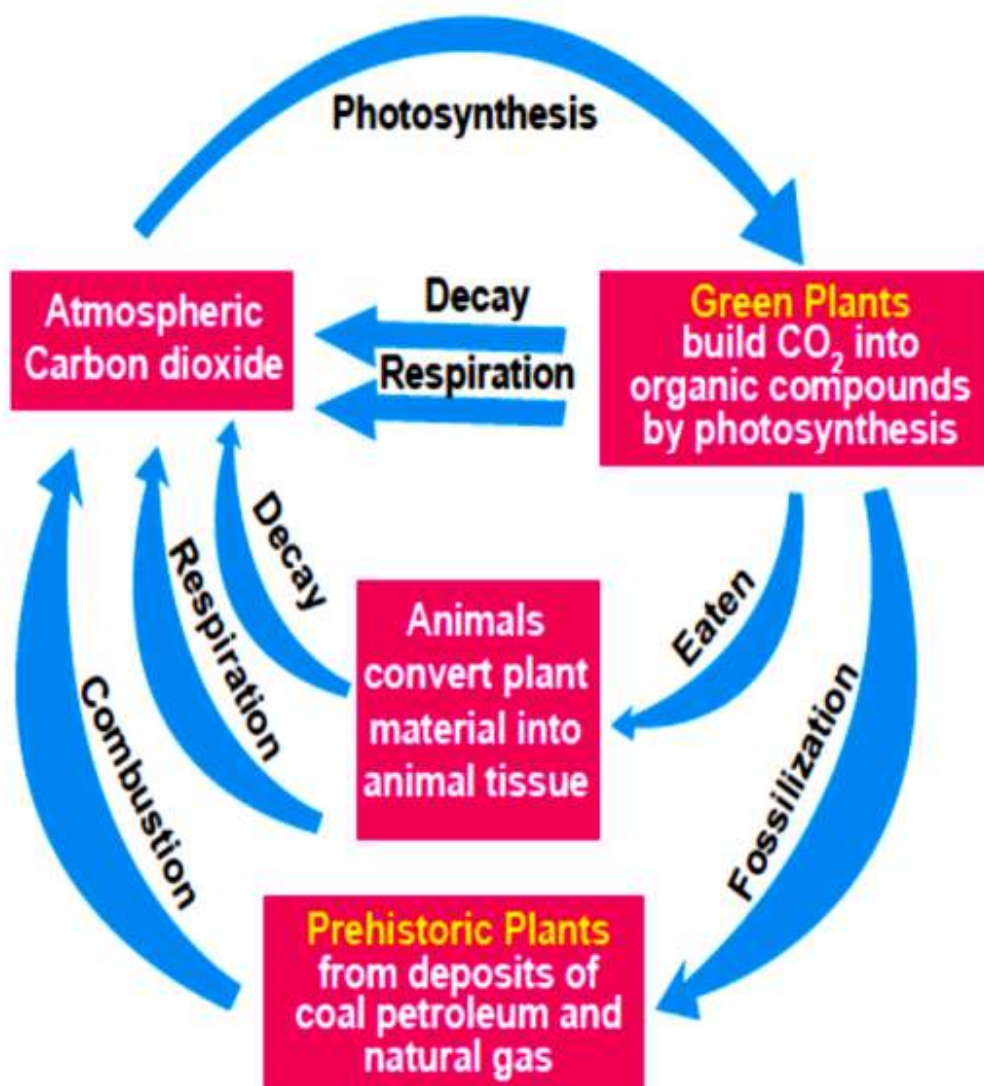
Ethanoic acid

1. For making vinegar which is used as a preservative in food and fruit juices.
2. As a laboratory reagent.
3. For coagulating rubber from latex.
4. In the preparation of dyes, perfumes and medicines.

1. Carbon and its compounds play important role in world economy.
2. Halogenated carbon compounds are used in coolant, fire extinguishers and solvent.
3. CS_2 , viscose rayon (Artificial silk) and can be used for preparation

World famous Eiffel Tower has steel and cement base

CARBON CYCLE



Potassium Carbonate K_2CO_3 is known as Pear acid.