CARBON AND ITS COMPOUNDS

Class - 10

Subject - Science

Module 1/3

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OCCURRENCE OF CARBON

- Carbon is found in two different forms:-
  - Combined form
  - Elemental form

OCCURRENCE OF CARBON

- Carbon is found in the atmosphere, inside the earth's crust and in the living organisms.
- Carbon is present in fuels like wood, coal, charcoal, coke, petroleum, natural gas, biogas, marsh gas etc.
- Carbon is present in compounds like carbonates, hydrogen carbonates etc.
- Carbon is found in the free state as diamond, graphite, fullerenes etc.

COMBINED FORM

- All living creatures

COMBINED FORM

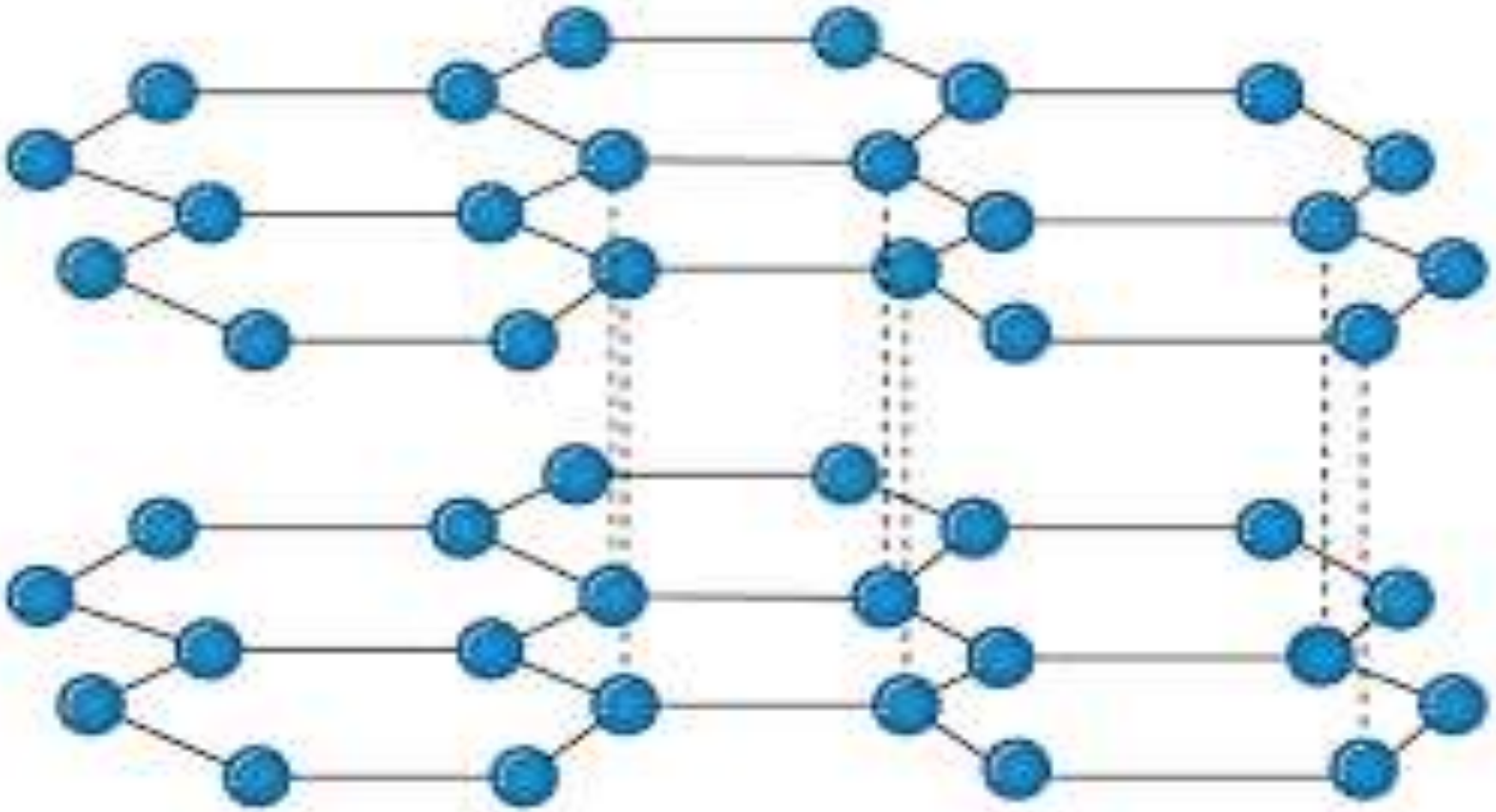
- Earth's crust contains carbonates, coal and petroleum

OCCURRENCE OF CARBON

- Atmosphere has 0.03% of CO_2

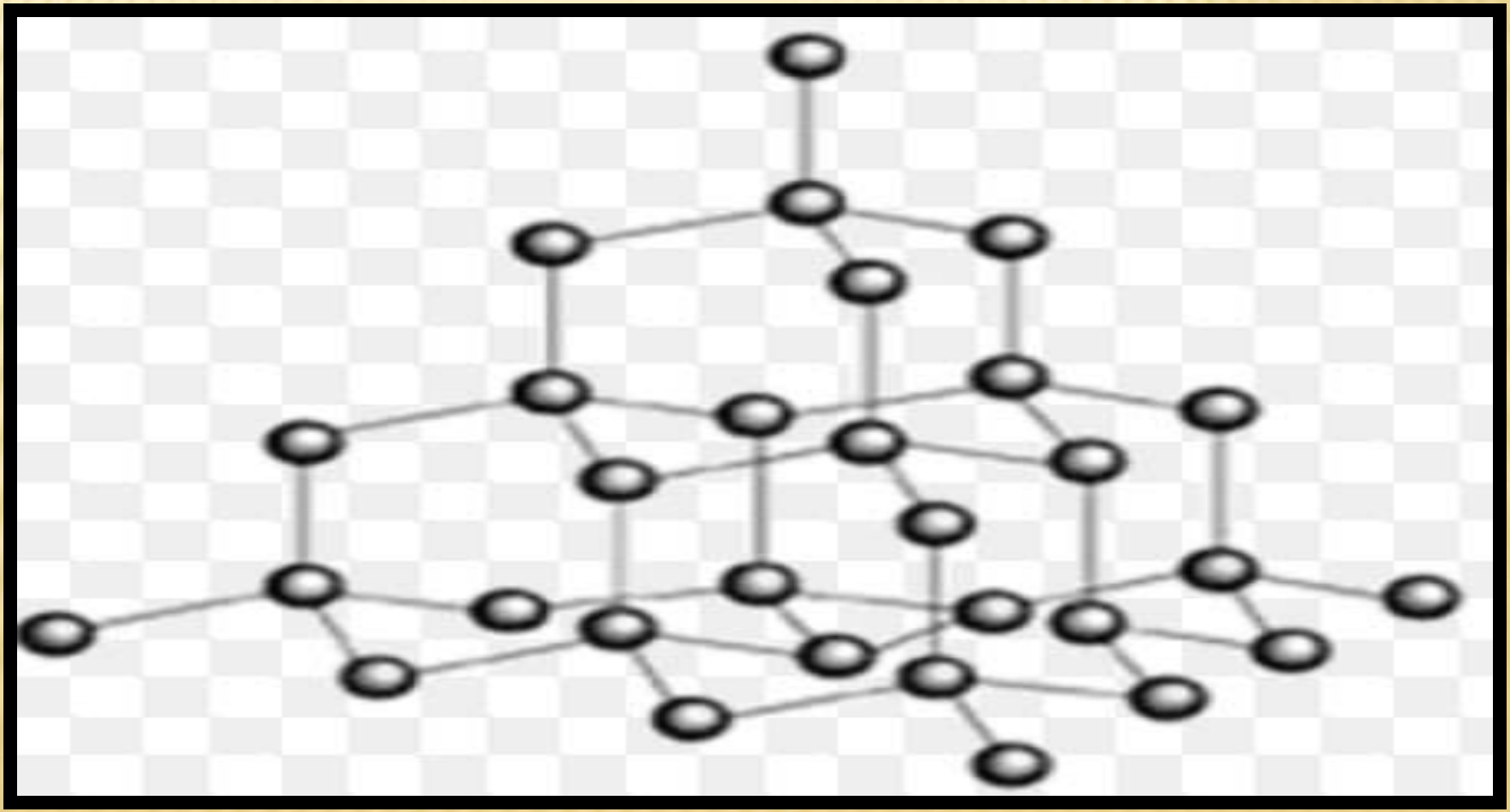
ELEMENTAL FORM -ALLOTROPES OF CARBON

- Structure of Graphite



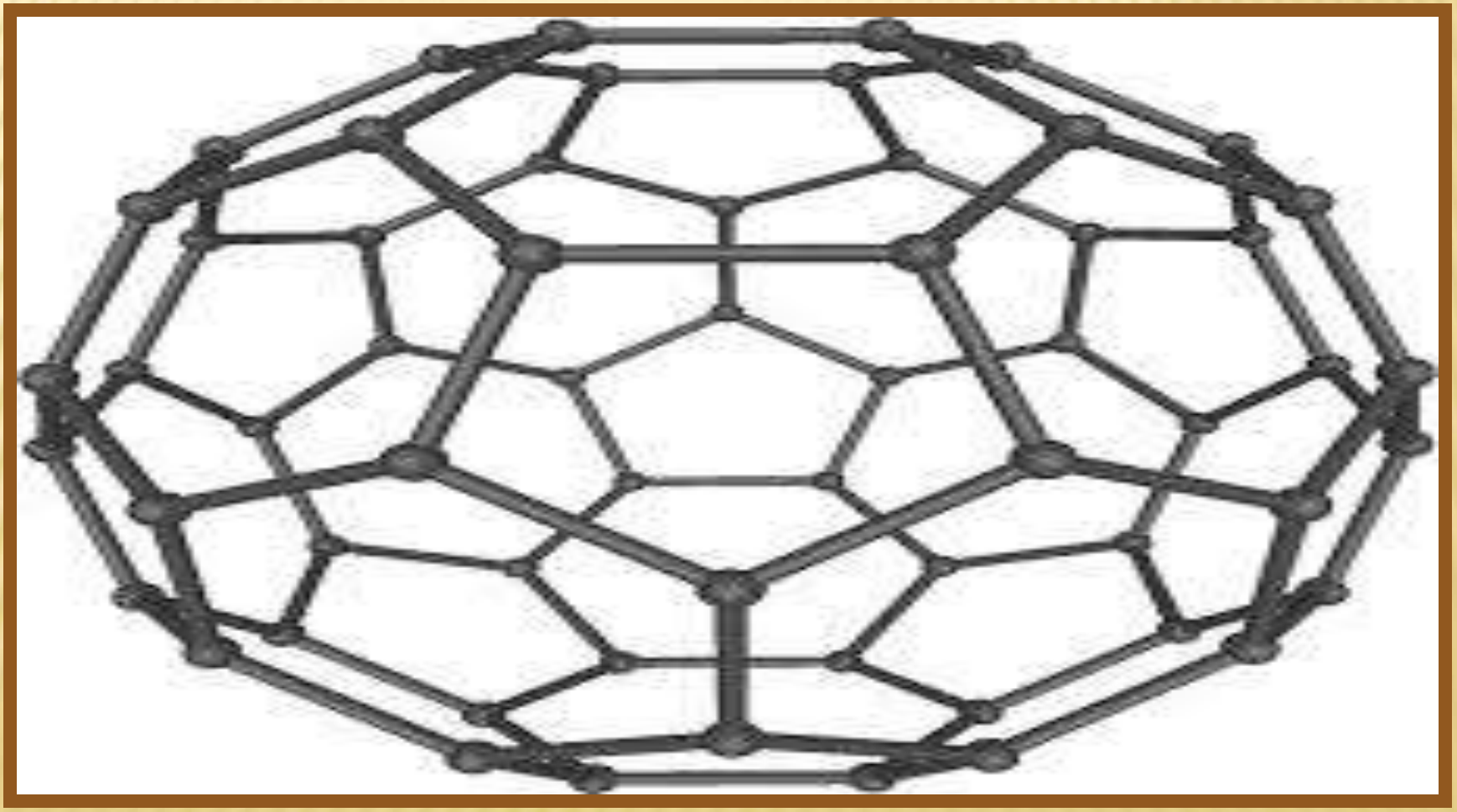
ELEMENTAL FORM -ALLOTROPES OF CARBON

- Structure of Diamond



ELEMENTAL FORM -ALLOTROPES OF CARBON

- Structure of Buckminster Fullerene



BONDING IN CARBON

Melting points and boiling points of some compounds of carbon

Compound	Melting point (K)	Boiling point (K)
Acetic acid (CH_3COOH)	290	391
Chloroform ($CHCl_3$)	209	334
Ethanol (CH_3CH_2OH)	156	351
Methane (CH_4)	90	111

BONDING IN CARBON

- From the above data in the table we find that these compounds have low melting and boiling points as compared to ionic compounds. We can conclude that the forces of attraction between the molecules are not very strong.
- These compounds are largely non-conductors of electricity, we can conclude that the bonding in these compounds does not give rise to any ions.

ATTAINING STABILITY

- The atomic number of carbon is 6.
- It's electronic configuration is 2,4.
- Valence electrons is 4. So to attain stability :-

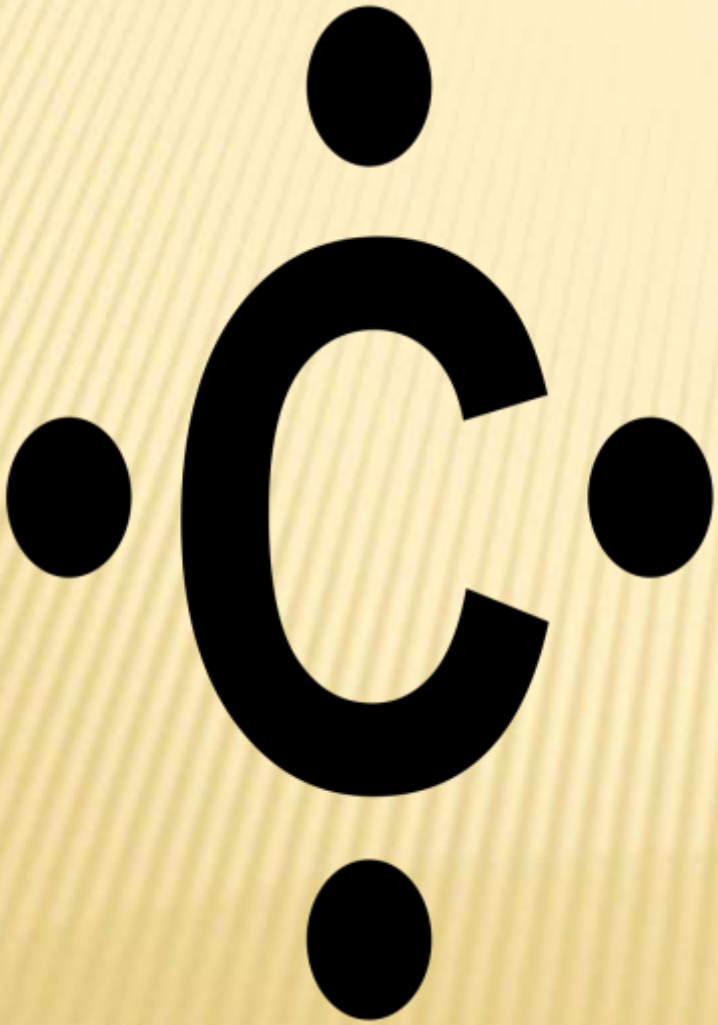
1) It could gain four electrons forming C4- anion. But it would be difficult for the nucleus with six protons to hold on to ten electrons, that is, four extra electrons.
2) It could lose four electrons forming C4+ cation. But it would require a large amount of energy to remove four electrons leaving behind a carbon cation with six protons in its nucleus holding on to just two electrons.

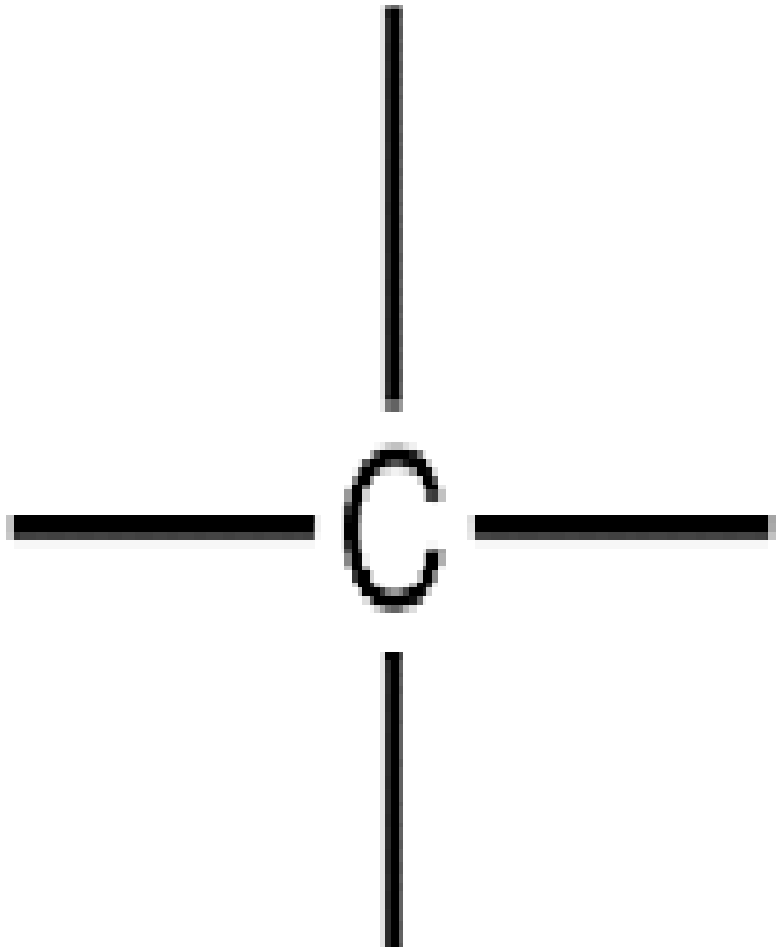
COVALENT BOND

- So carbon shares 4 electrons with other atoms to attain stability resulting in the formation of covalent bonds.

- Since carbon atom needs 4 electrons to attain stability, its valency is 4 and it is tetravalent.

COVALENT BOND





FORMATION OF COVALENT BOND

- Covalent bond is formed by the sharing of electrons between atoms.
- Types of Covalent Bonds :-

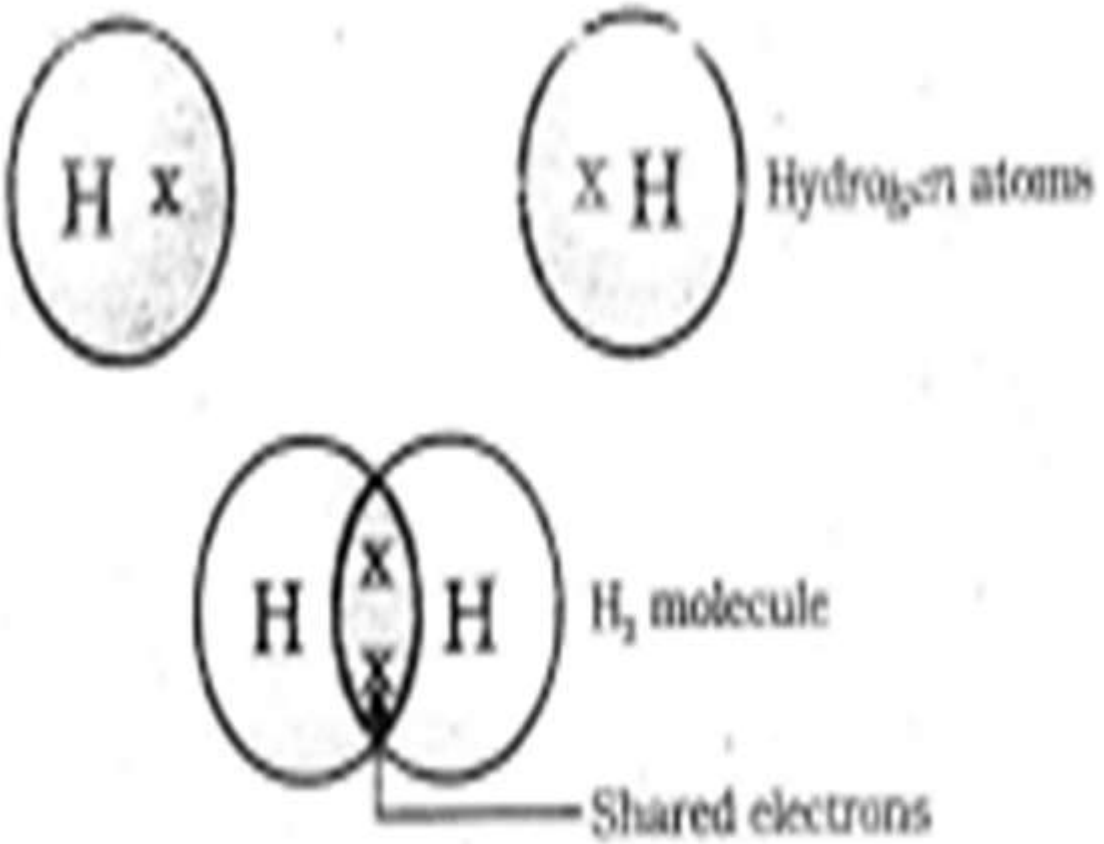
i) Single covalent bond

ii) Double covalent bond

iii) Triple covalent bond

FORMATION OF SINGLE COVALENT BOND- HYDROGEN MOLECULE H_2

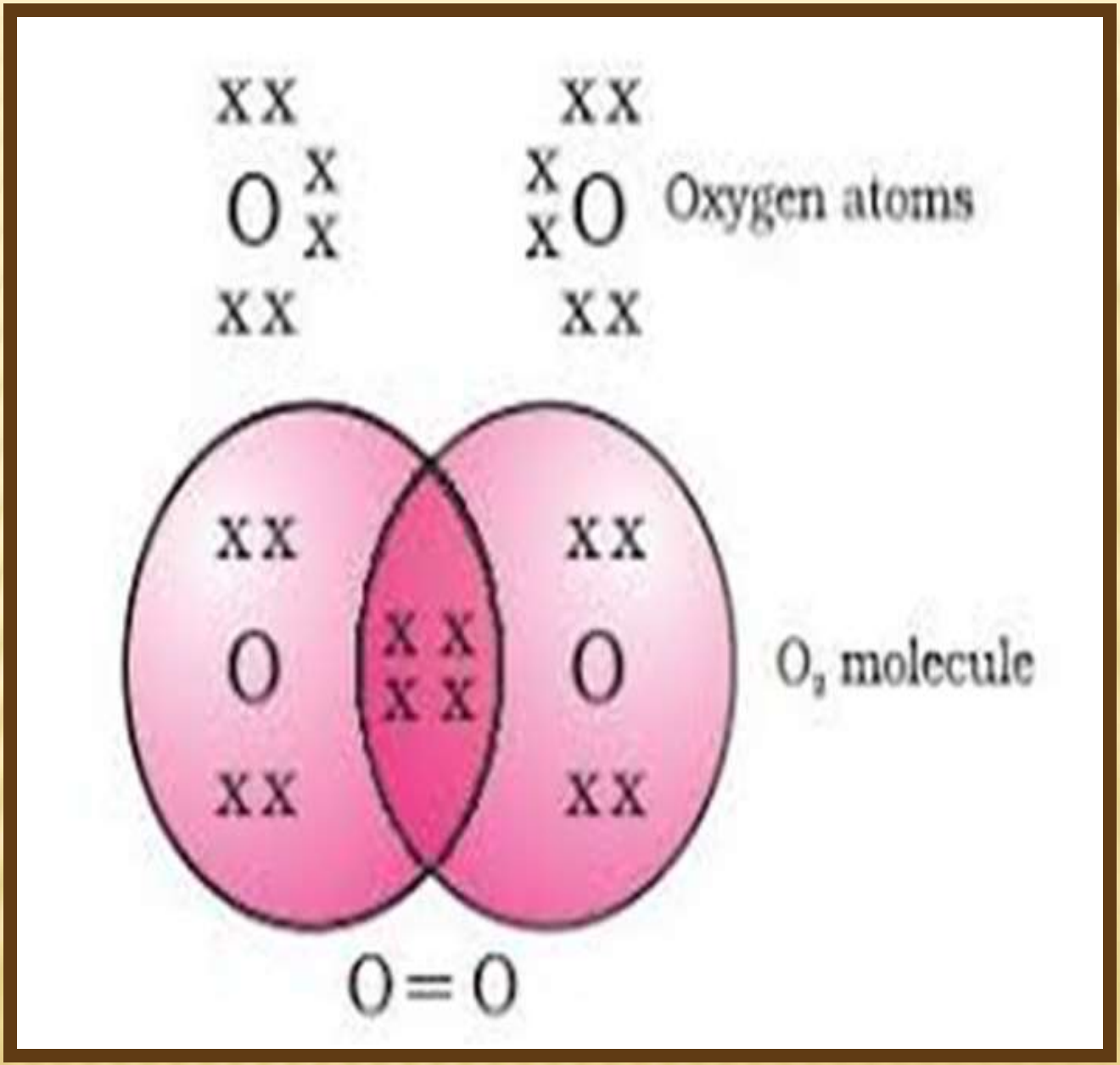
- The atomic number of hydrogen is 1, its electronic configuration is 1, it has 1 valence electron. It needs 1 electron more to attain stability. So two hydrogen atoms share 1 pair of electrons resulting in the formation of a single covalent bond in hydrogen molecule H_2



A molecule of hydrogen

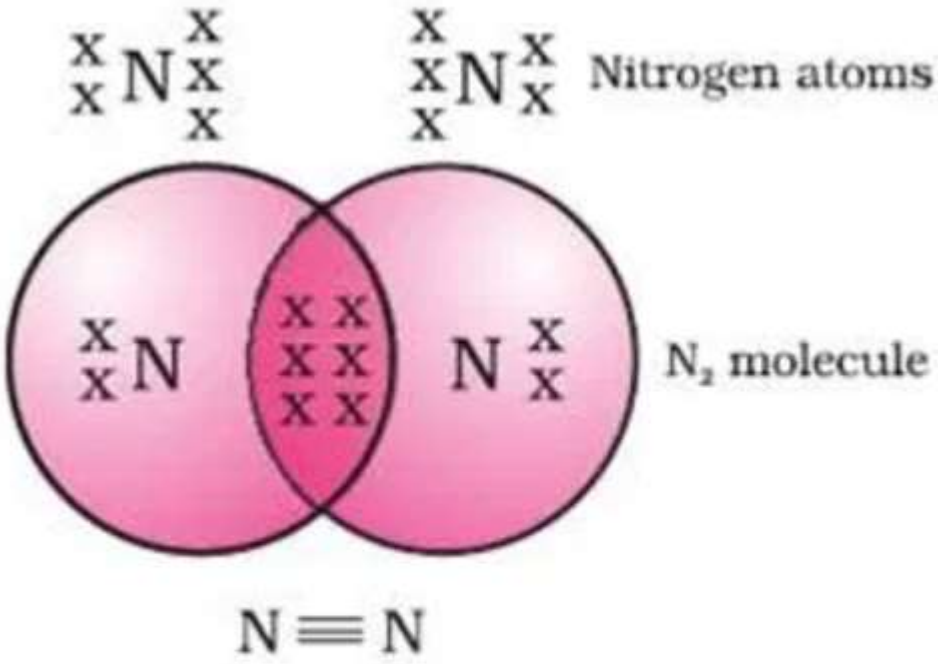
FORMATION OF DOUBLE COVALENT BOND- OXYGEN MOLECULE O_2

- The atomic number of oxygen is 8, its electronic configuration is 2,6; it has 6 valence electrons, it needs 2 electrons more to attain stability. So two oxygen atoms share two pairs of electrons resulting in the formation of a double covalent bond in oxygen molecule O_2


Oxygen atoms
O2 molecule
O=O

FORMATION OF TRIPLE COVALENT BOND- NITROGEN MOLECULE N_2

- The atomic number of nitrogen is 7, its electronic configuration is 2,5; it has 5 valence electrons, it needs 3 electrons more to attain stability. So two nitrogen atoms share three pairs of electrons resulting in the formation of a triple covalent bond in nitrogen molecule N_2



Triple bond between two nitrogen atoms


Thank you