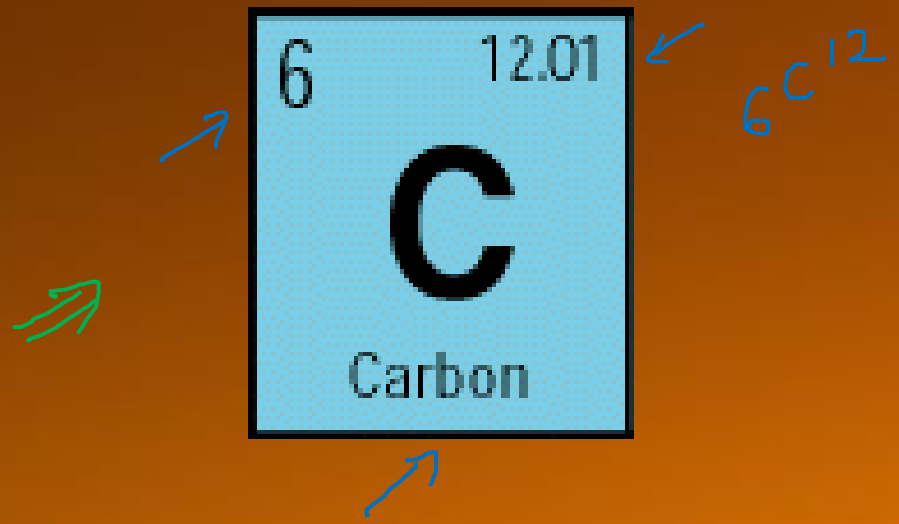
Carbon & {Compound}

SAFALTA CLASS™

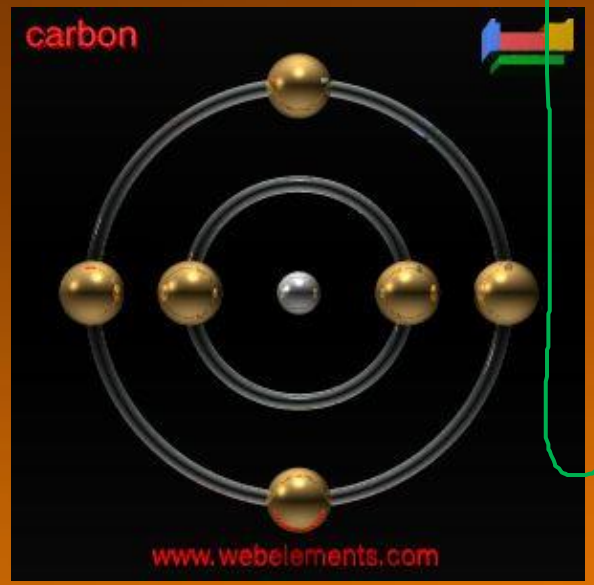
An Initiative by अमर उजाला

CARBON AND ITS COMPOUNDS



CARBON

- Carbon belongs to the group IV of the periodic table.
- It has four electrons in its outermost orbit, so its valancy is four.
- Carbon is a non-metal.

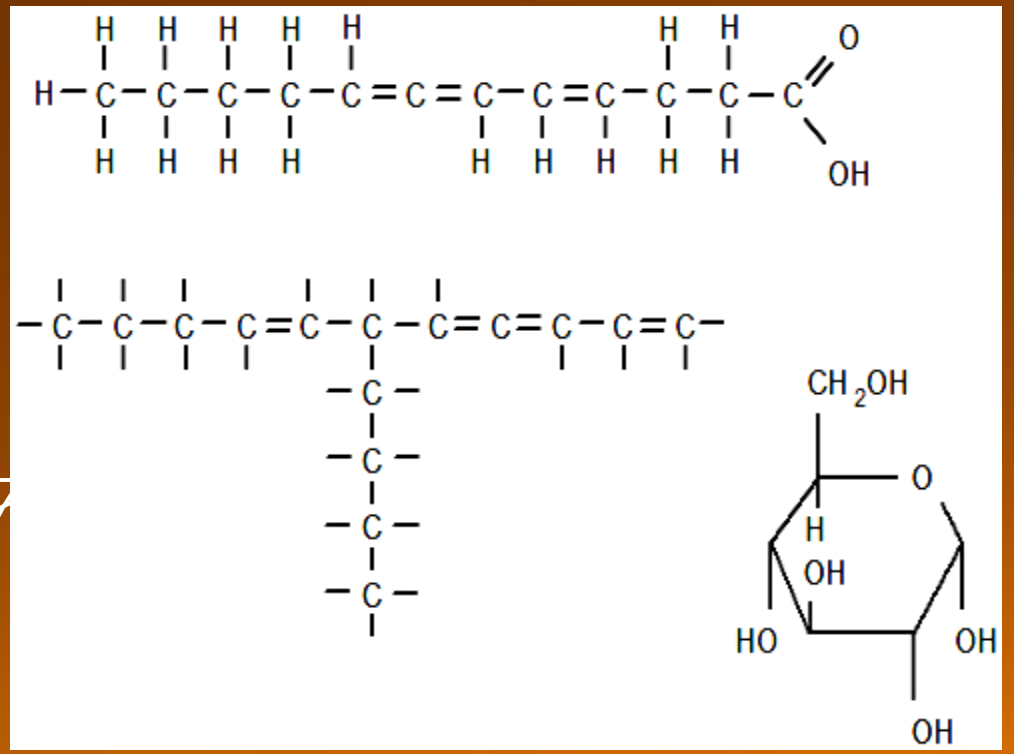


कार्बन :

- कार्बन आवर्त सारणी के समूह IV के अंतर्गत आता है।
- इसकी सबसे बाहरी कक्षा में चार इलेक्ट्रॉन हैं, इसलिए इसकी वैधता चार है।
- कार्बन एक गैर-धातु है।

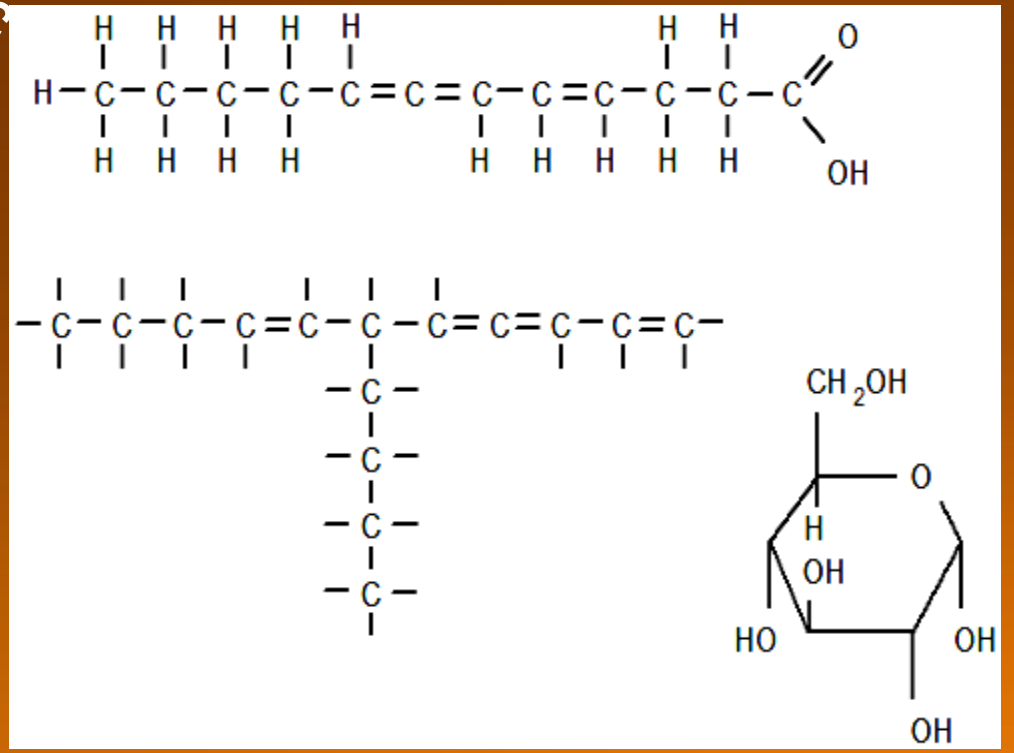
Why so many Carbon Compounds in nature?

- Because carbon is chemically unique.
- Only carbon atoms have the ability to combine with themselves to form long chains



प्रकृति में इतने सारे कार्बन यौगिक क्यों?

- क्योंकि कार्बन रासायनिक रूप से अद्वितीय है।
- केवल कार्बन परमाणुओं में लंबी श्रृंखला बनाने के लिए खुद के साथ गठबंधन करने की क्षमता होती है



Carbon

Atomic no. ⇒ 6

$p^+ = 6$

$e^- = 6$

ionic Bond नहीं बनाती

K , L

2 , 4 ← need 4e⁻

① 6 6

+4e⁻ X

6p⁺ ↔ 10e⁻

② 2 ionization

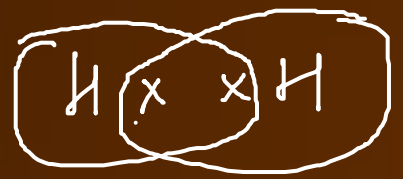
-4e⁻ X

* Carbon → Sharing

⇓

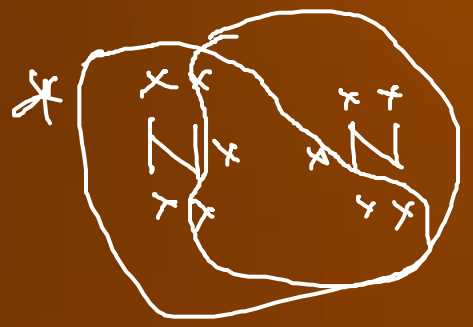
Covalant Bond

सहसंयोजी बन्ध

*  ⇒ H_2

x x

— → Single Bond (एकल बंध)

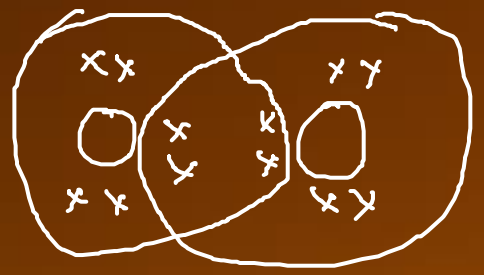
* 

N x x x x N

x x

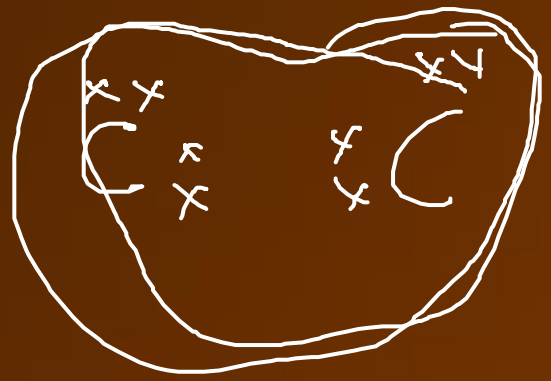
≡ ⇒ Triple Bond

→ त्रि बन्ध

*  ⇒ O_2

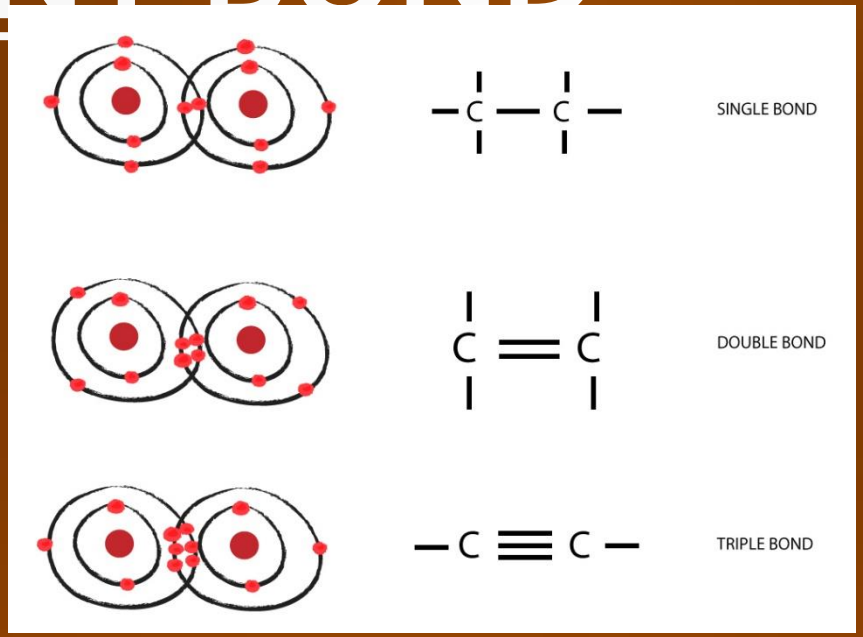
x x

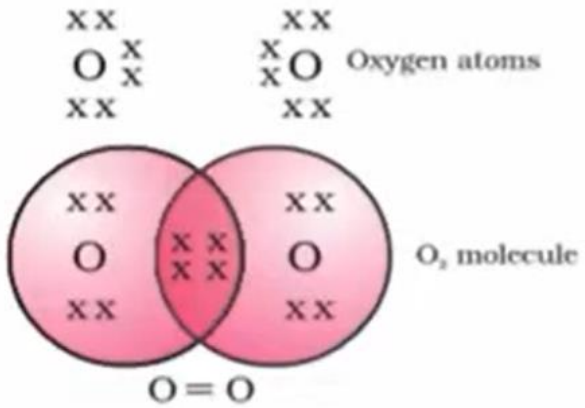
x x ⇒ = ⇒ Double Bond (द्वि बन्ध)

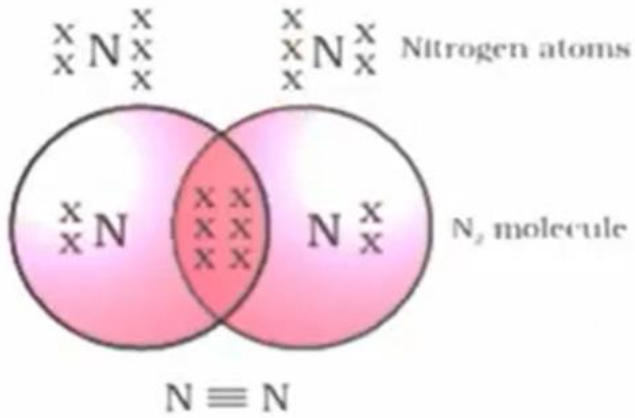


$$\left\{ \begin{array}{l} C - C \\ C = C \\ C \equiv C \end{array} \right\}$$

CARBON FORM COVALANT BOND







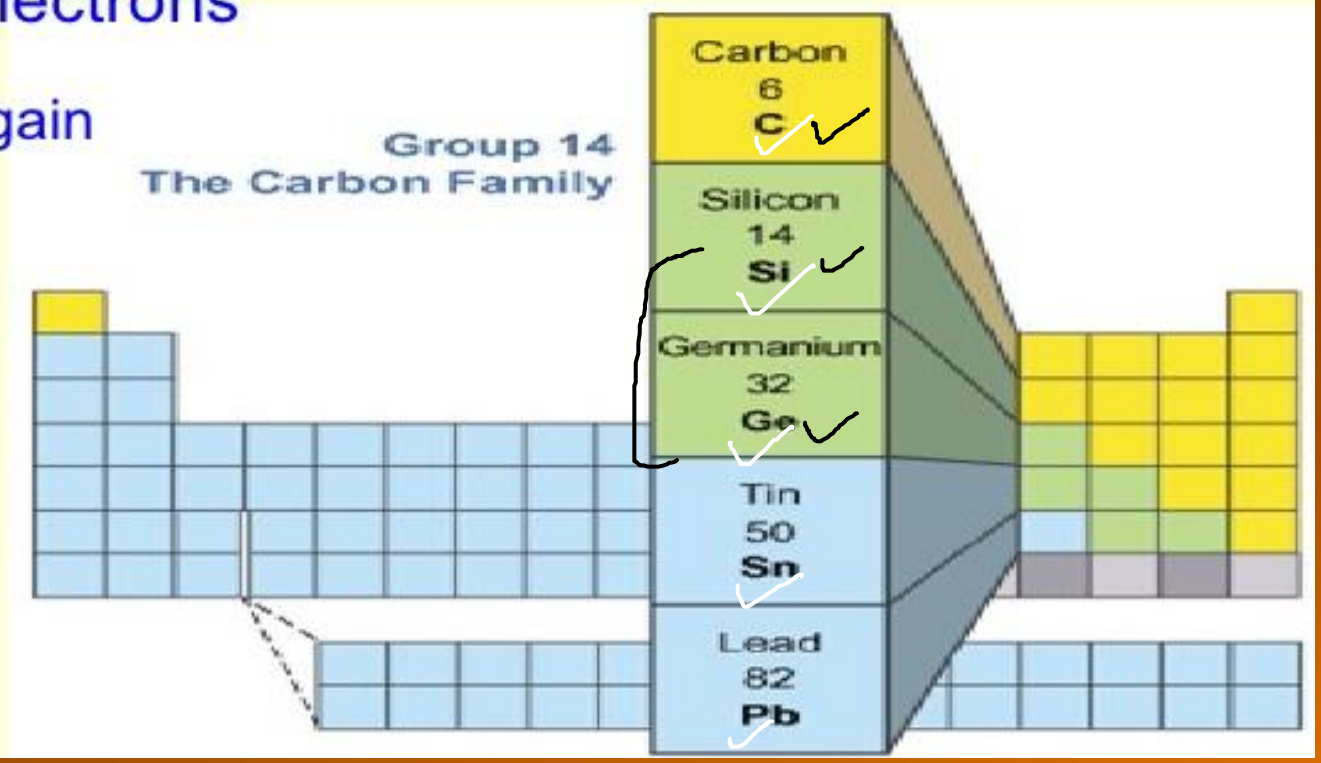
Single bond	Double bond	Triple bond
H–H	O=O	N≡N
H : H	O :: O	N ::: N

8. Carbon Family: Group 14 (4a)

- Metals, nonmetals, and metalloids
- Bond with many elements by sharing electrons
- Silicon is a semiconductor:
  1. Extremely abundant metalloid
  2. Used in computer chip manufacturing – "Silicon Valley"

D. 4 valence electrons

- Lose 4 or gain 4; same difference

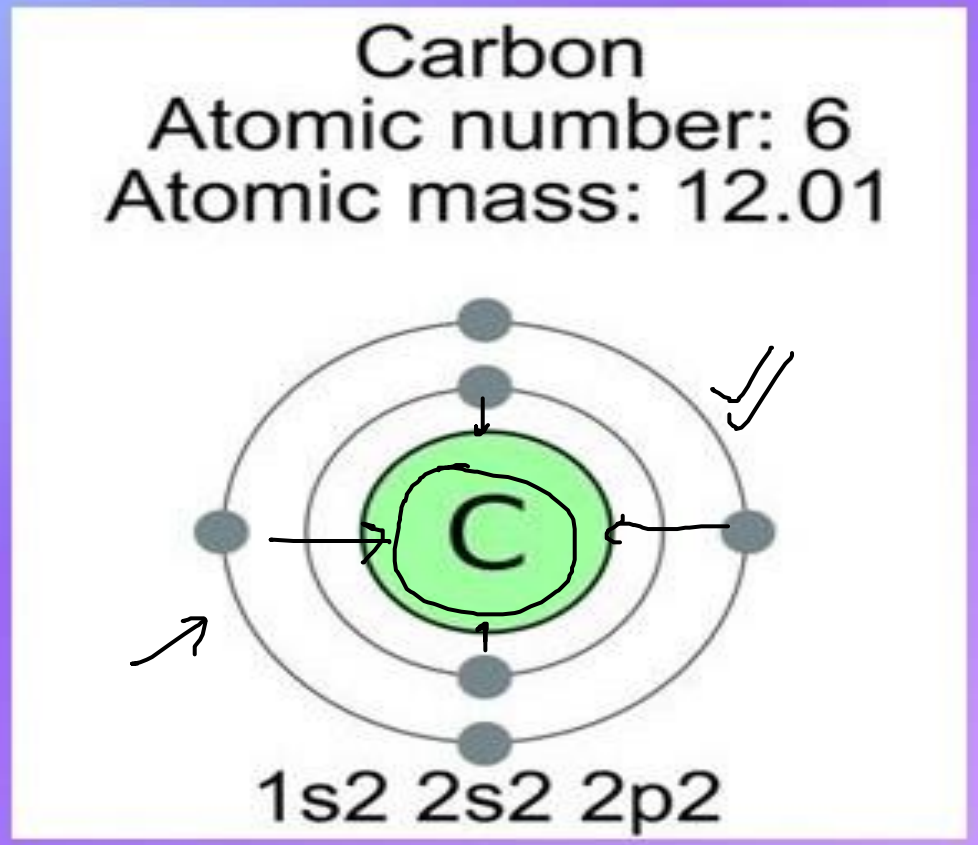


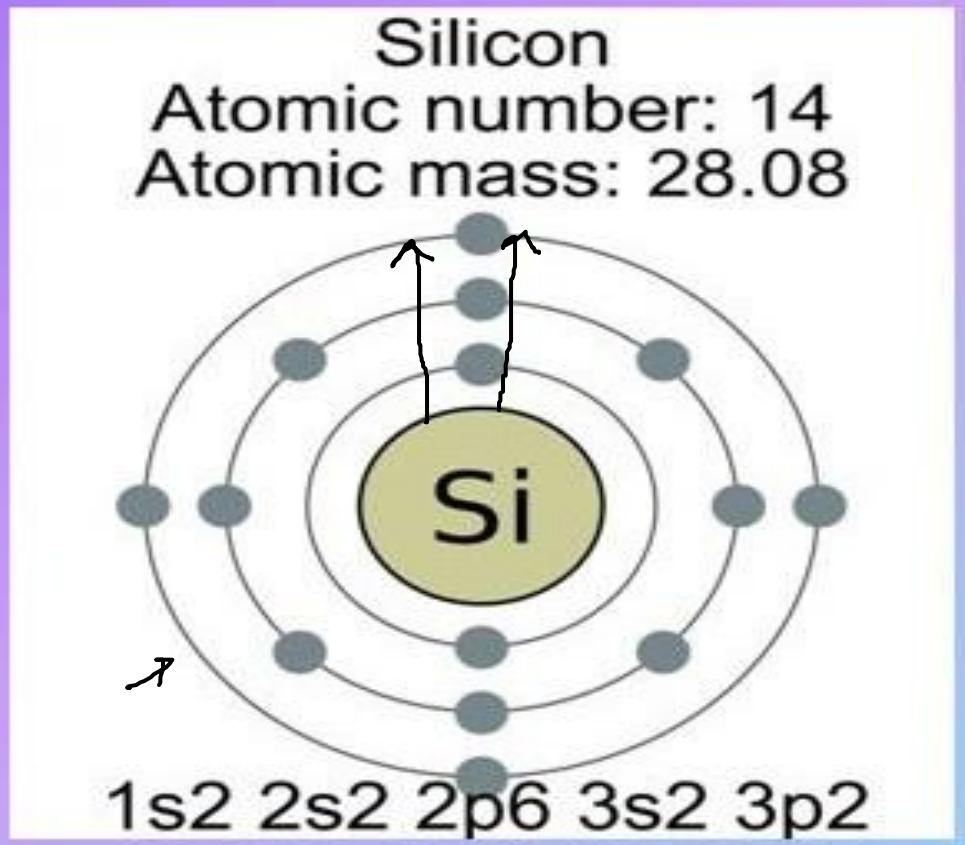
Long Chain Creation

* First organic compound → Urea

NH_2CONH_2

Size of Carbon is small. | 1828, F. Wohler



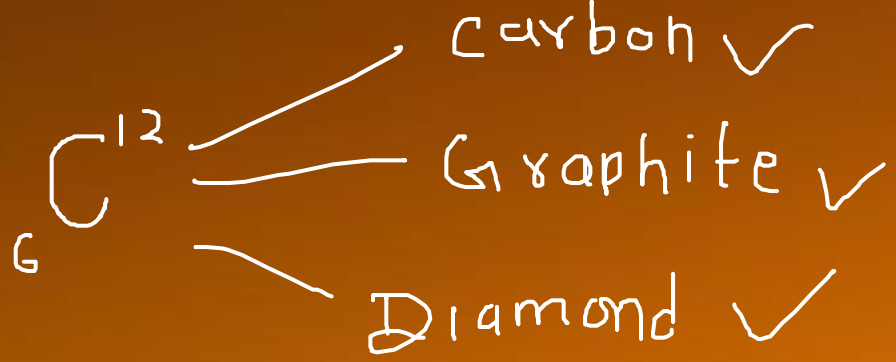


What are Allotropes ?

अपरूप

- Allotropes are elements which are chemically identical, but they differ markedly in their physical properties.

- Diamond and Graphite – two allotropes of carbon differ in their physical properties.



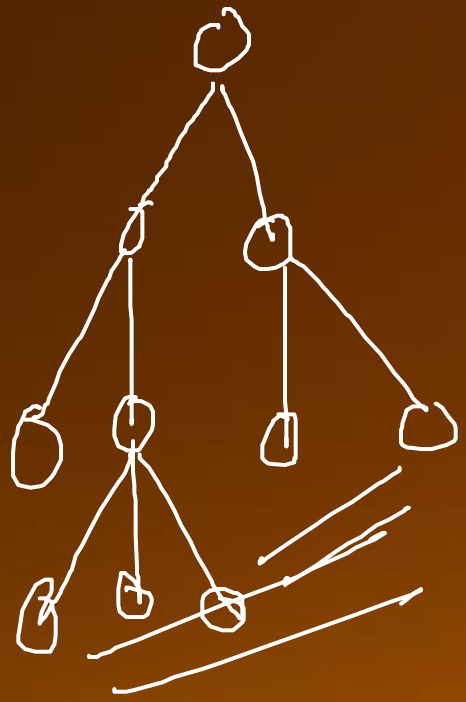
अपररूप क्या हैं?

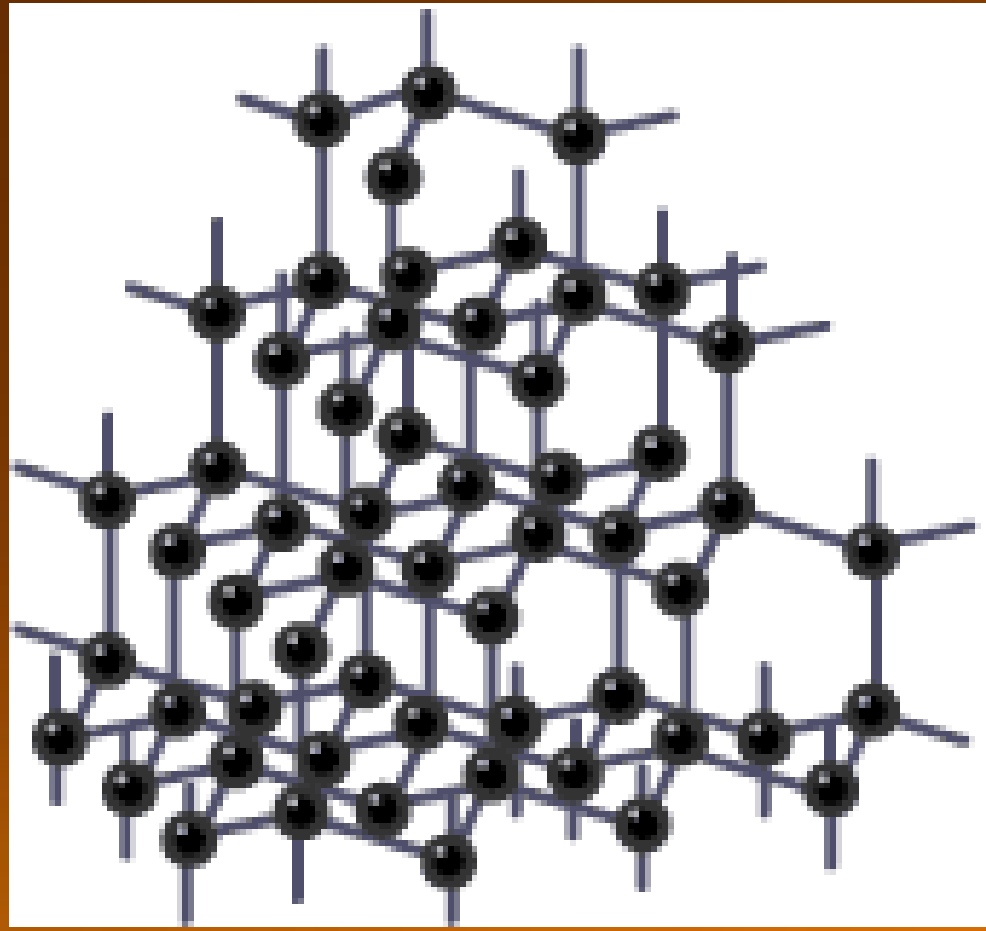
- अपररूप ऐसे तत्व हैं जो रासायनिक रूप से समान हैं, लेकिन वे अपने भौतिक गुणों में स्पष्ट रूप से भिन्न हैं।
- डायमंड और ग्रेफाइट - कार्बन के दो अपररूप उनके भौतिक गुणों में भिन्न होते हैं।

Allotropes of Carbon

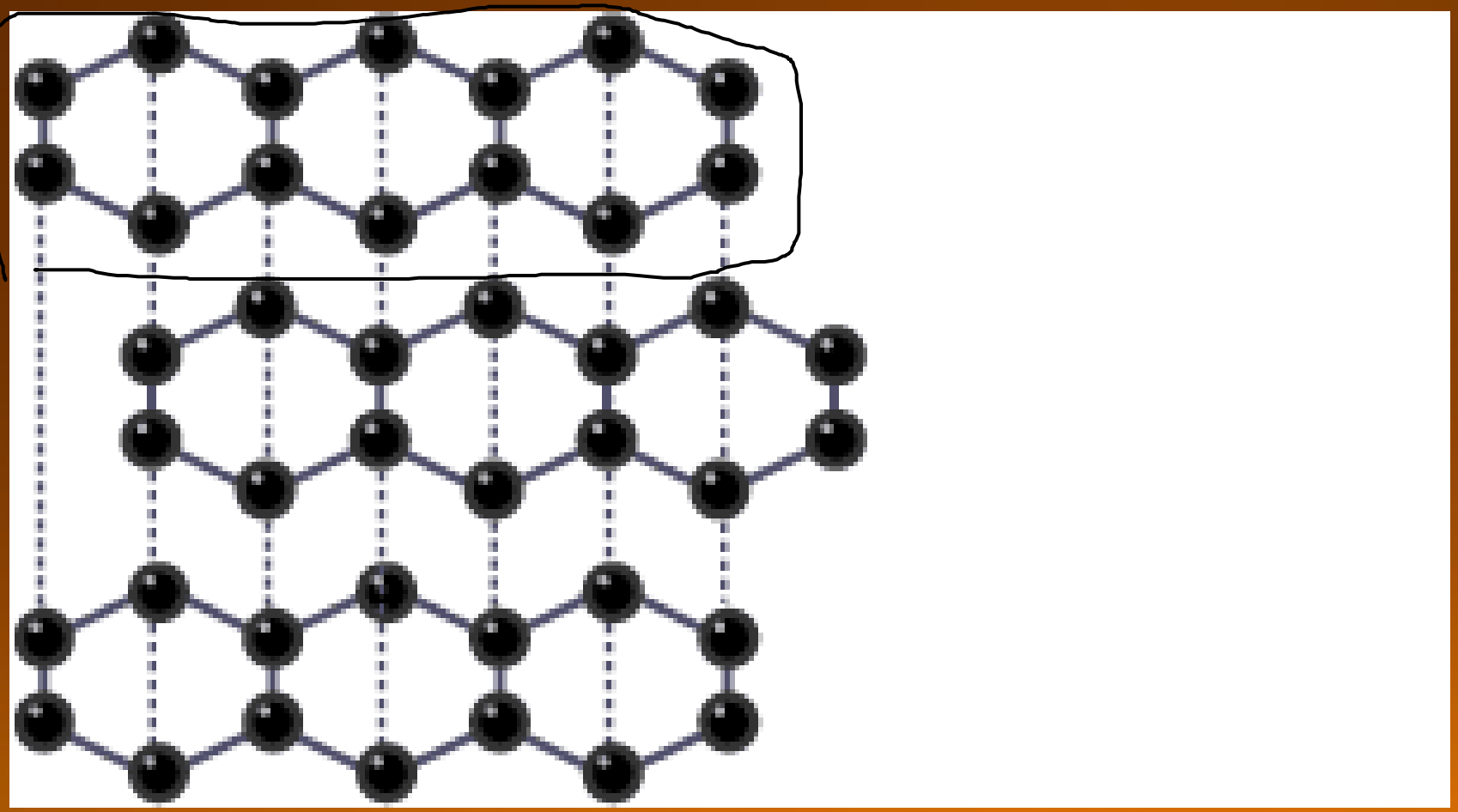
- In nature, pure carbon occur in two forms-
- Diamond
- Graphite
- Buckminsterfullerene
- Carbon Nano Tube

Diamond



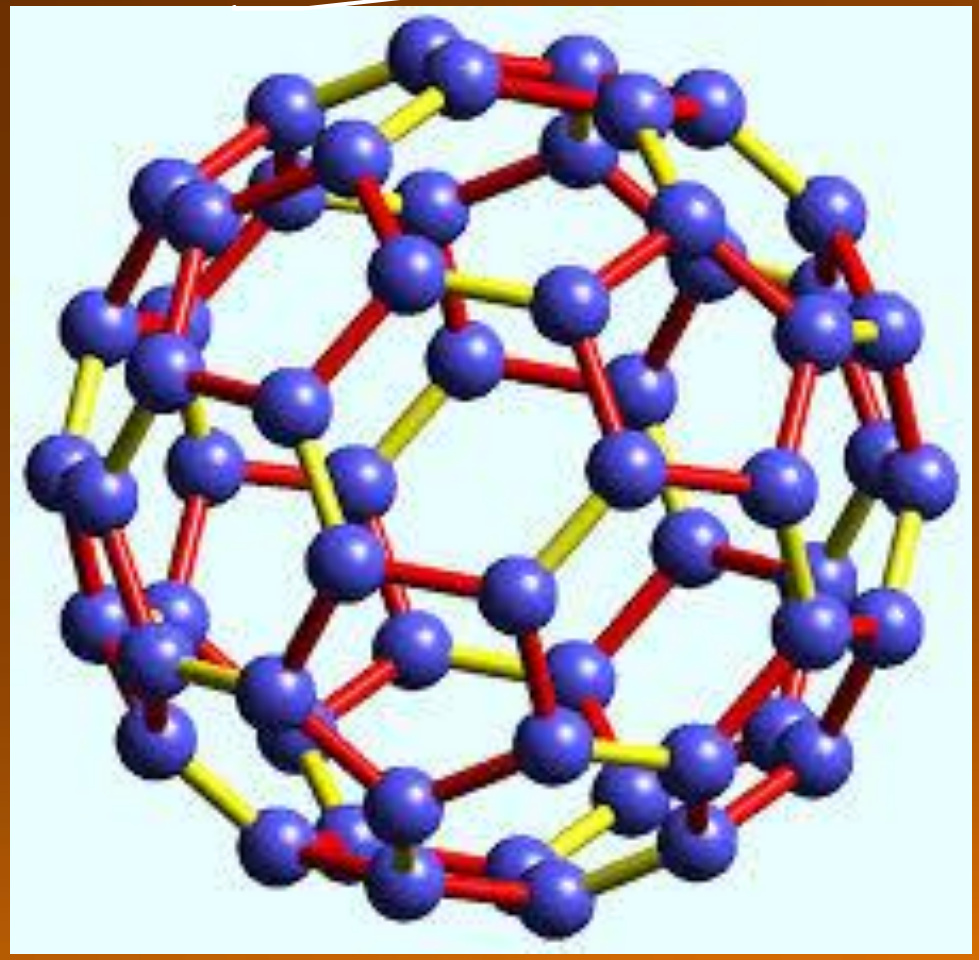


Graphite



- **Buckminsterfullerene**

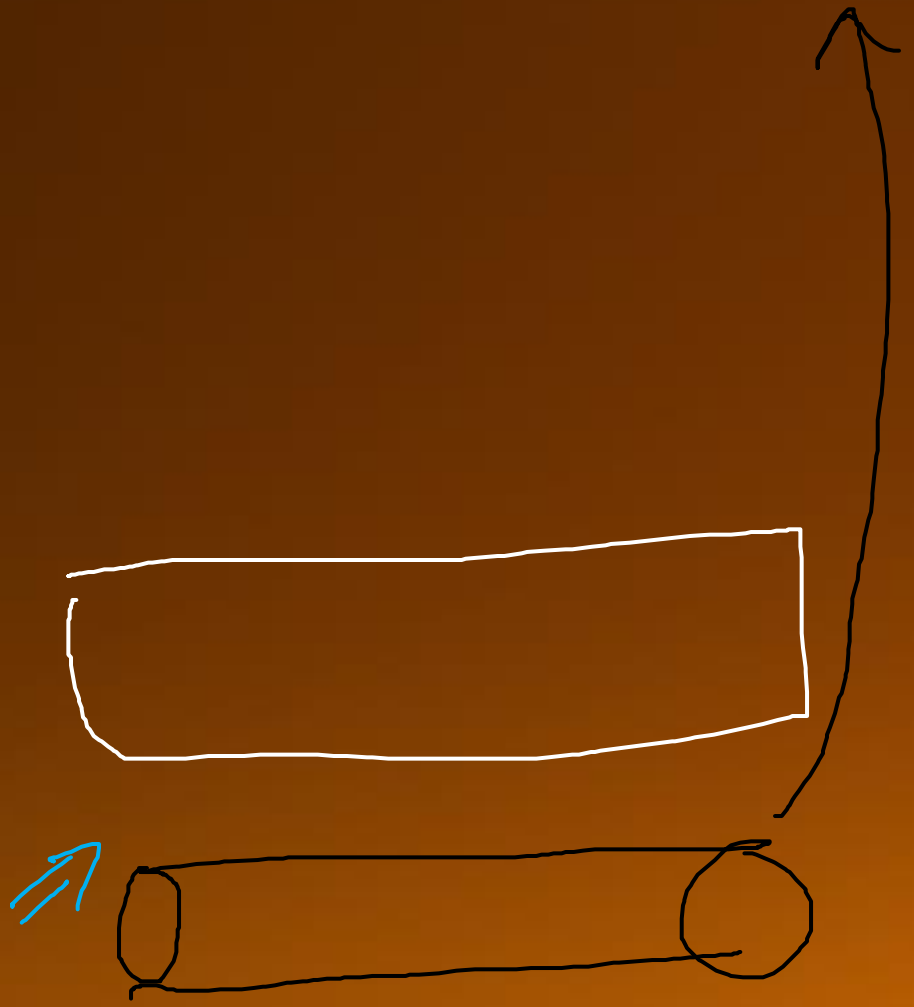
football

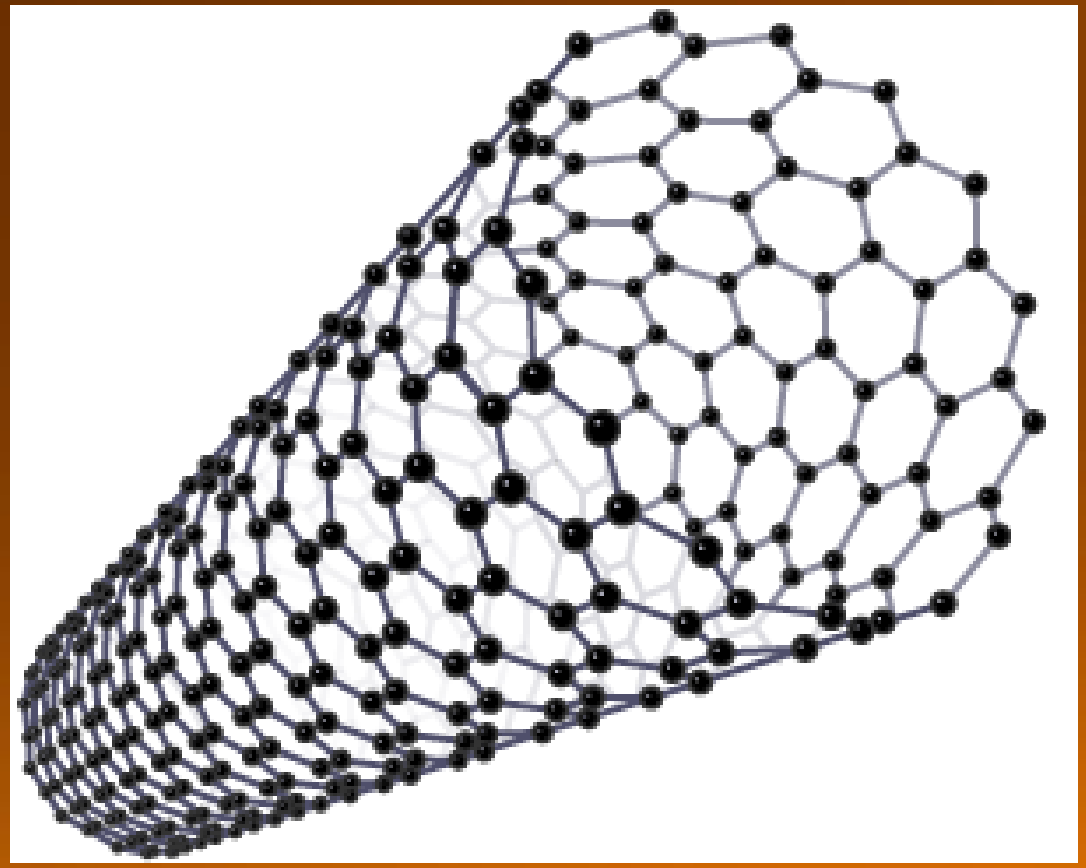


* 20 → Hexagon षट्भुज

* 12 → Pentagons पंचभुज

Carbon Nano Tube



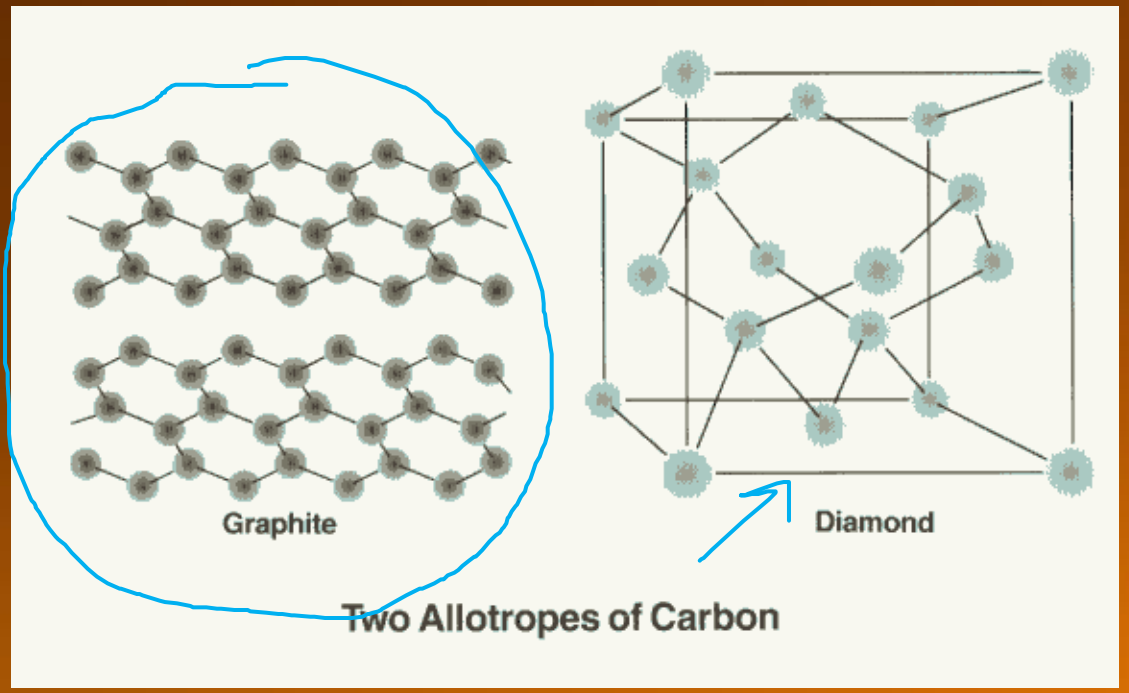


Physical Properties of Diamond and Graphite

Property	Diamond	Graphite
Appearance	Transparent	Black, Shiny
Hardness	Very Hard	Soft, slippery to touch
Thermal Conductivity	Very poor	moderate
Electrical Conductivity	Poor	Good conductor
Density(kg/m3)	3510	2250
Uses	Jewellery, drilling	Dry cell, electric arc, lubricant, pencil lead

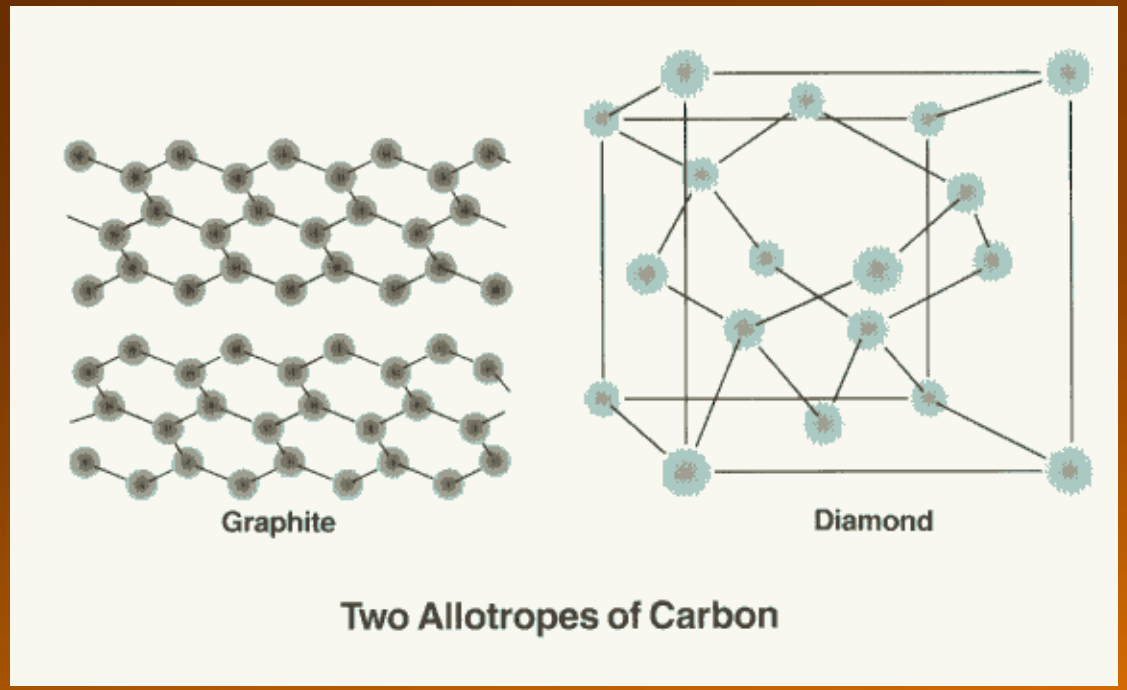
Why the physical properties of diamond and graphite are so different?

- Due to the difference in the arrangement of carbon atoms in diamond and graphite

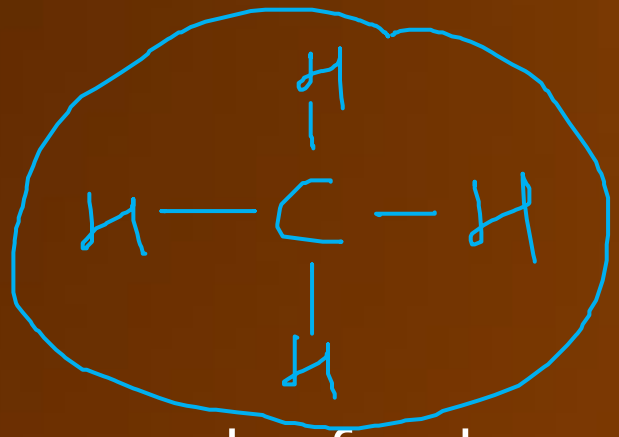


हीरे और ग्रेफाइट के भौतिक गुण इतने भिन्न क्यों हैं?

- हीरे और ग्रेफाइट में कार्बन परमाणुओं की व्यवस्था में अंतर के कारण|



Hydrocarbons

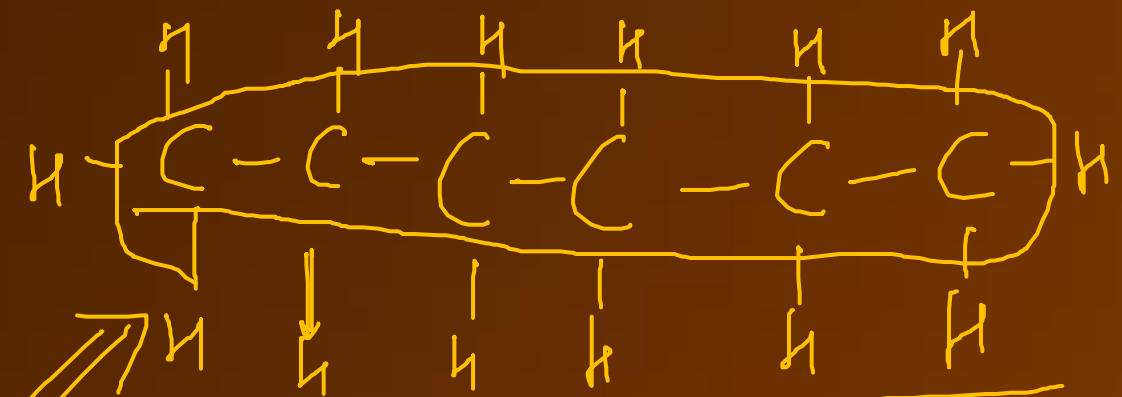


- Hydrocarbons are compounds of carbon and hydrogen.

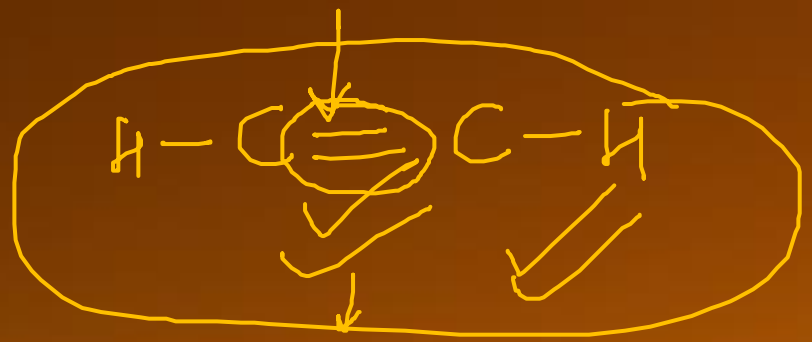
The natural source of hydrocarbons is petroleum (crude oil)

हाइड्रोकार्बन

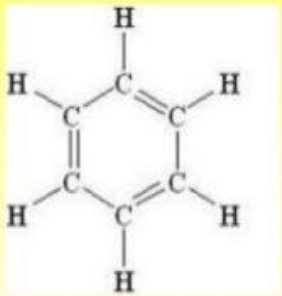
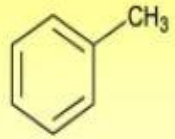
- हाइड्रोकार्बन कार्बन और हाइड्रोजन के यौगिक हैं।



संतृप्त

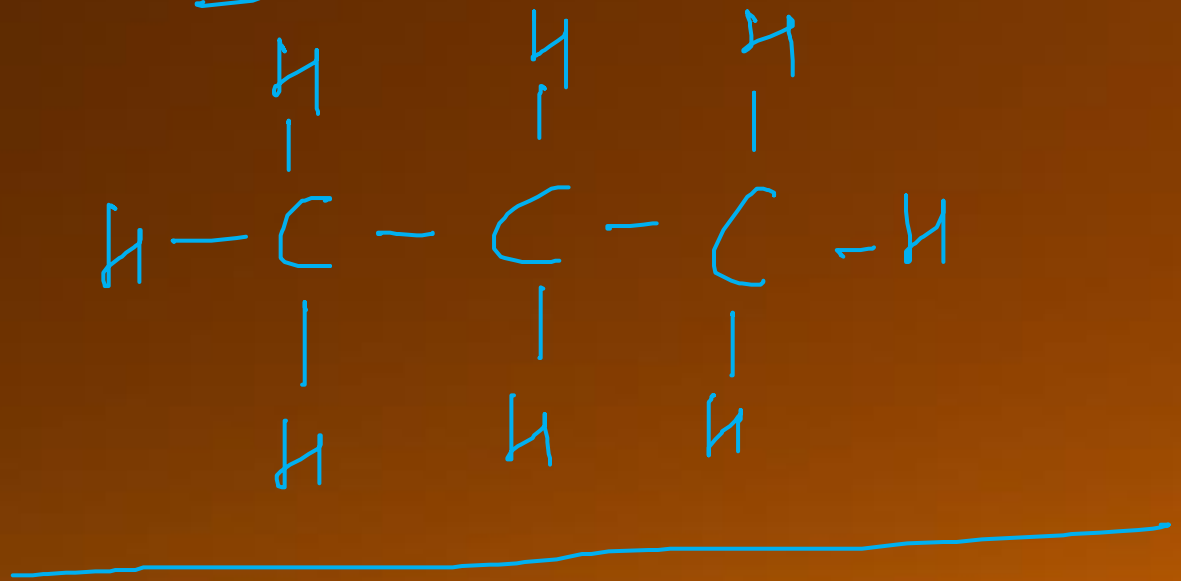


Unsaturated

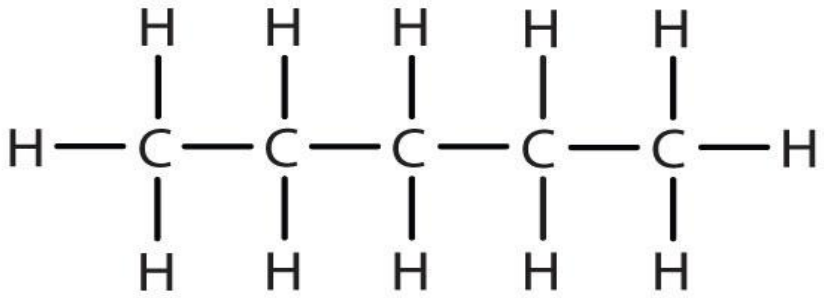
Hydrocarbon Type	Characteristic Group	Example
Saturated Hydrocarbon: Alkanes	No double or Triple Bond	$CH_3CH_2CH_3$ Propane
Unsaturated Hydrocarbon: 1. Alkenes 2. Alkynes	Double Bond Triple Bond	$CH_3–CH=CH_2$ Propene $CH_3–C\equiv CH$ Propyne
Aromatic Hydrocarbons:	Benzene ring 	 Methyl Benzene

I) Straight (unbranched chain)

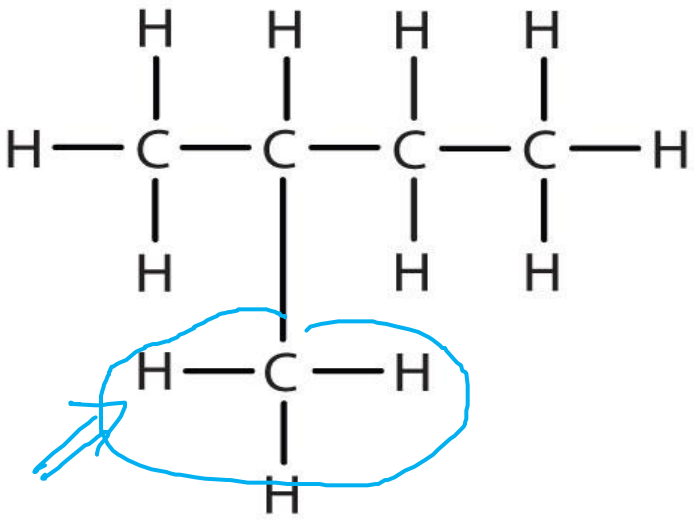
- Example : C3H8



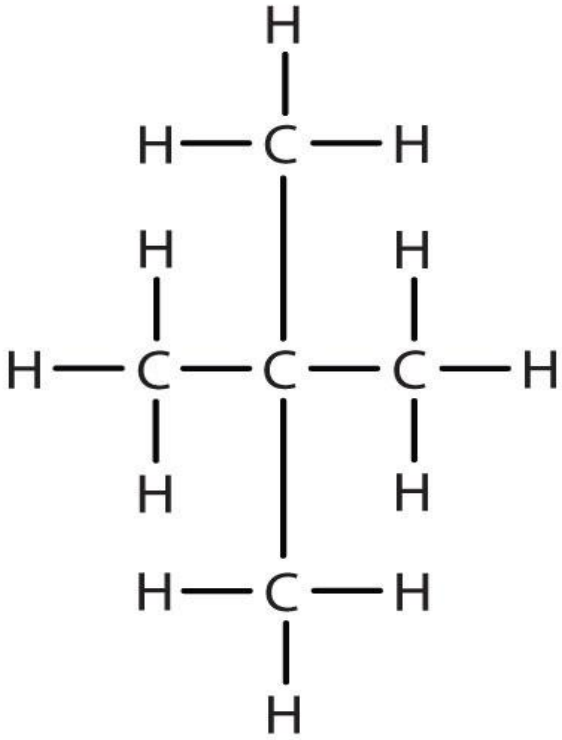
BRANCHED



Pentane



Isopentane

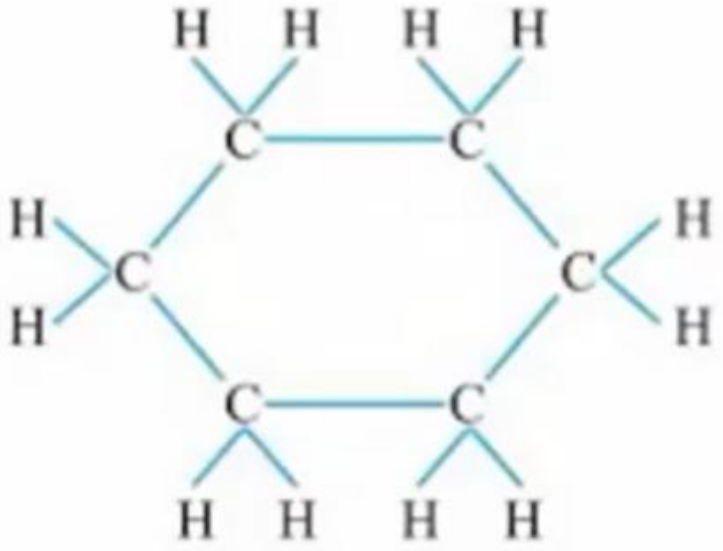


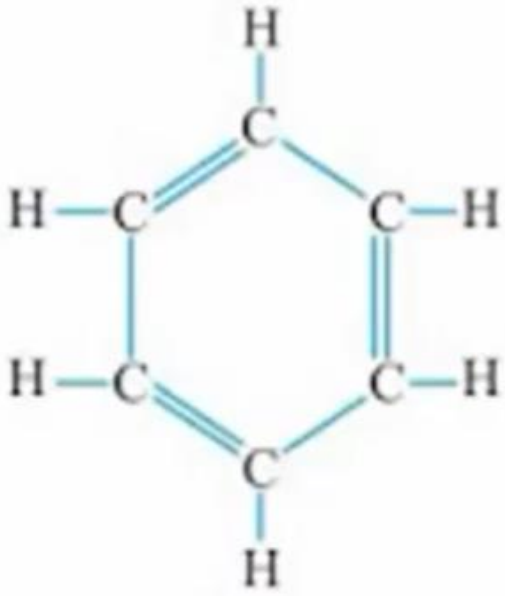
Neopentane

CYCLIC

Cydic soluated

Cyclic unsaluraled
C_6H_6 (Benezene)

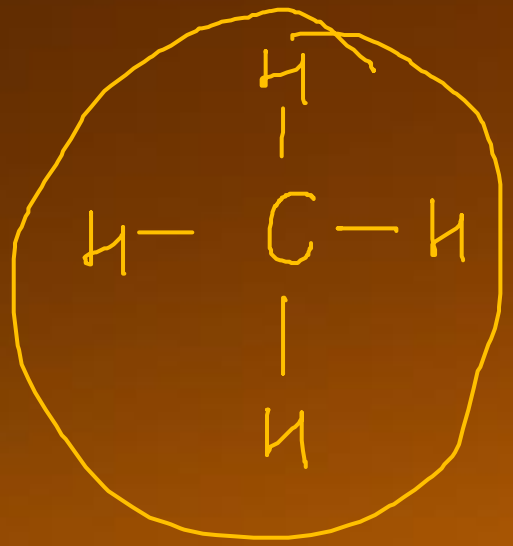




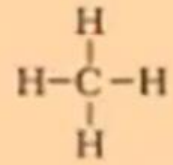
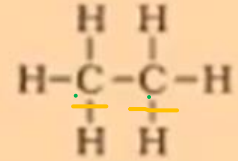
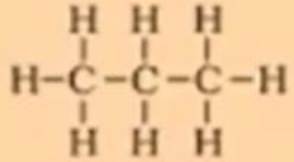
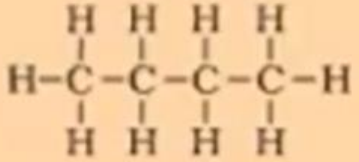
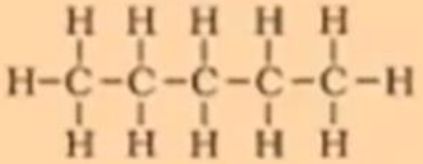
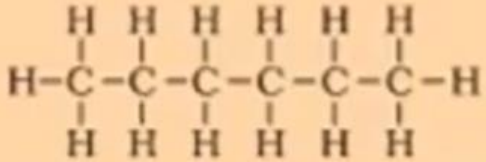
Ankane → Single Bond

Alkene ⇒ Double Bond

Alkyne ⇒ Triple Bond



methane

No. of C atoms	Name	Formula	Structure
1	Methane	CH_4	
2	Ethane	C_2H_6	
3	Propane	C_3H_8	
4	Butane	C_4H_{10}	
5	Pentane	C_5H_{12}	
6	Hexane	C_6H_{14}	

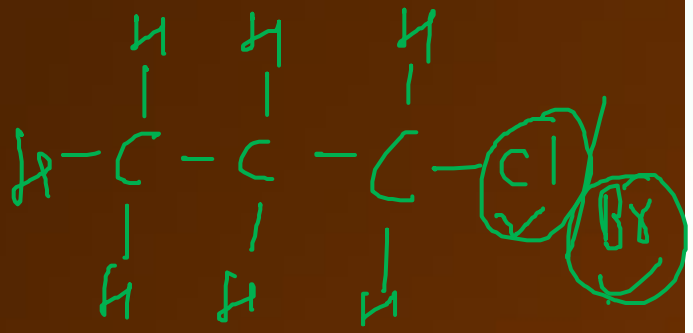
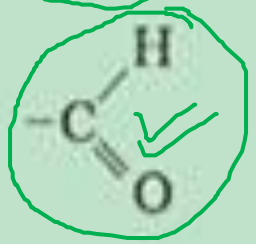
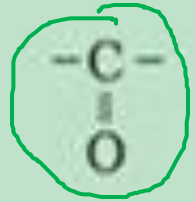
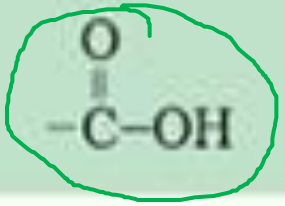
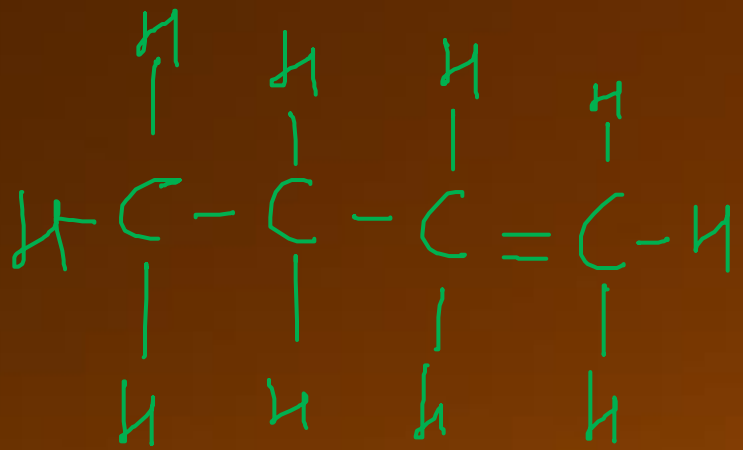
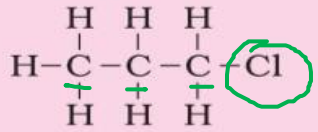
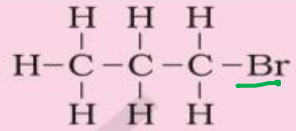
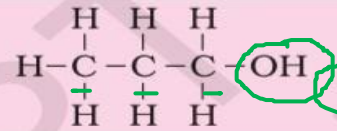
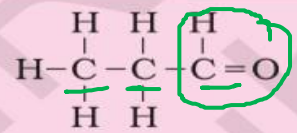
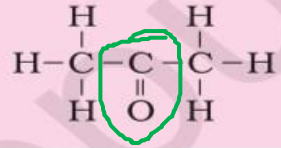
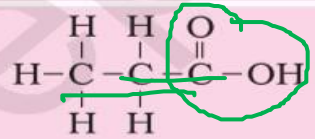
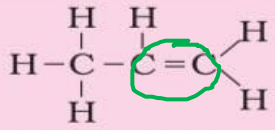
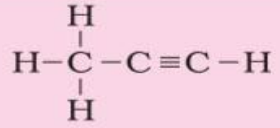


Table 4.3 Some functional groups in carbon compounds

Hetero atom	*Functional group*	*Formula of functional group*
Cl/Br	Halo- (Chloro/bromo)	—Cl, —Br (substitutes for hydrogen atom)
Oxygen	1. Alcohol	—OH
	2. Aldehyde	
	3. Ketone	
	4. Carboxylic acid	

Chloro Propane



Functional group	Prefix/Suffix	Example
1. Halogen	Prefix-chloro, bromo, etc.	 Chloropropane
		 Bromopropane
2. Alcohol	Suffix - ol	 Propanol
3. Aldehyde	Suffix - al	 Propanal
4. Ketone	Suffix - one	 Propanone
5. Carboxylic acid	Suffix - oic acid	 Propanoic acid
6. Double bond (alkenes)	Suffix - ene	 Propene
7. Triple bond (alkynes)	Suffix - yne	 Propyne

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