

GENERAL CHEMISTRY

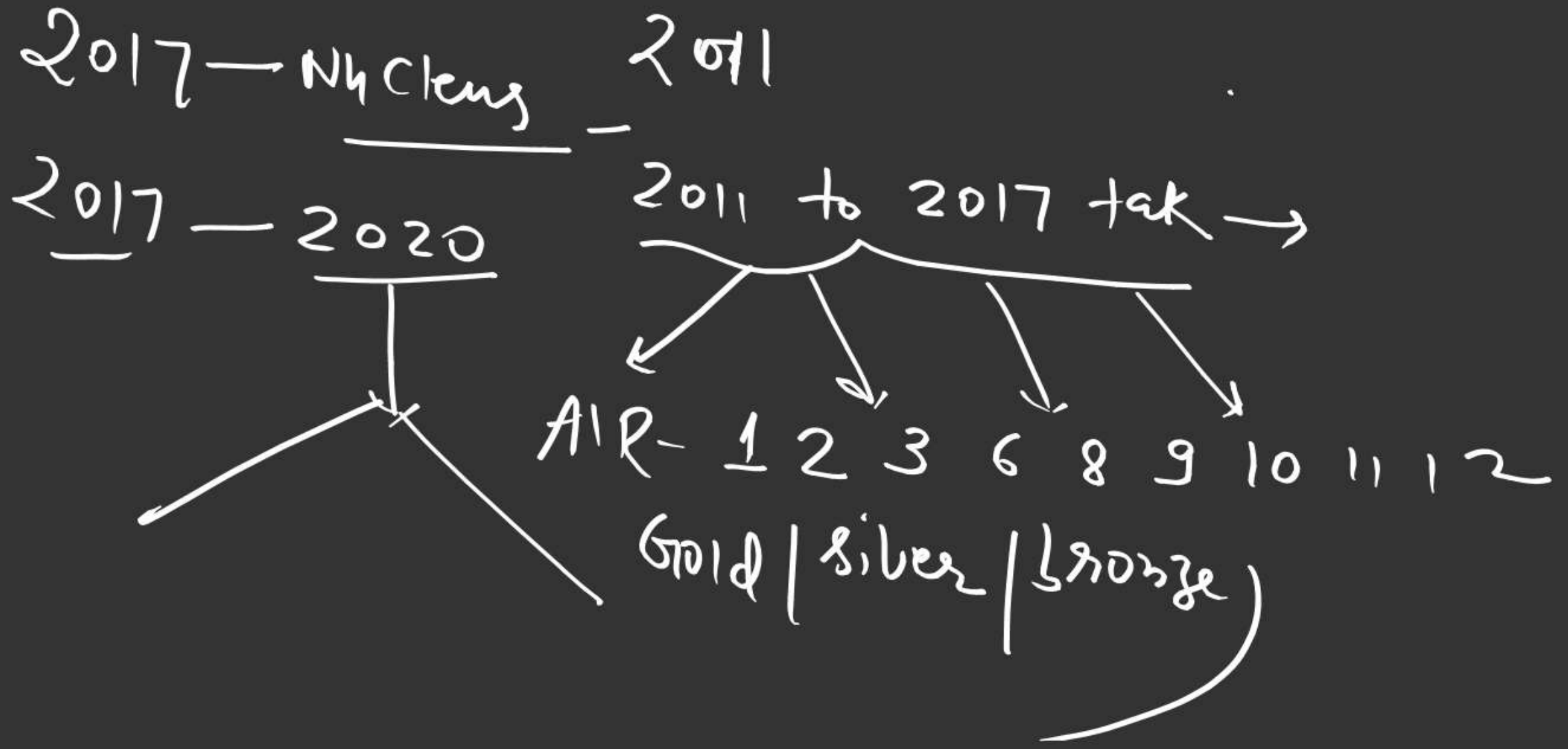
➤ Chemistry:

It is a branch of physical science, which deals with the study of matters, its physical and chemical properties, chemical composition, physical and chemical changes, which it undergoes and the energy changes accompany these process.

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22y.

Sheet



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Problem

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Live Class

level → JEE Mains / Adv.

General Chemistry

GENERAL CHEMISTRY

➤ Type of chemistry

- Organic chemistry : Study of hydrocarbons and their derivatives.

- Inorganic chemistry : Study of all known elements and their compounds except hydrocarbons and their derivatives

Physical chemistry : Study of laws governing by physical and chemical changes

GENERAL CHEMISTRY

Matter

Matter

Anything that has mass and occupies space

Na Element
Na atom

Physical Classification

Chemical Classification

Physical Classification

Chemical Classification

Solid

Liquid

Gas

Solid

liq.

gas

Pure Substance

Pure substances

Mixture

Mixtures

Element

Compound

Homogeneous

Heterogeneous

Substance which are made up of same type of atom

Metal

Metalloid

Non-metal

Metal

Nonmetal

Metalloids

Contain two or more element in fix ratio

have same Composition throughout mixture

have non-uniform mixing

Organic

Inorganic

Organic

Inorganic

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- **Physical Substance:** Three types on the basis of physical state.

Property	Solid	Liquid	Gas
Particle distance	Minimum	Moderate	Maximum
Density	Maximum	Moderate	Minimum
Volume	Minimum	Moderate	Maximum
Shape	definite shape	no definite shape	no definite shape

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➤	<u>Atomicity:</u>	<u>Number of atoms in a molecule.</u>				
		S_8	Se_8	Te_8	Po	P_4
	Example:	N_2	O_2	H_2	X_2 [X → F, Cl, Br, I]	S_8
		P_4	As_4	Sb_4	Bi	

➤ **Examples of non-metal:**

Liquid - Bromine

Gas - N_2 , O_2 , H_2 , Cl_2 , F_2 , all noble gas (He, Ne, Ar, Kr, Xe, Rn)

Solid - Phosphorus, Sulphur, Iodine

➤ **Examples of metal:**

Liquid metal – Hg

Solid - Iron, Sodium, Aluminium

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Metalloid : Element which shows both metallic and non-metallic property

Example : Si, As, Sb, Ge, B, Te, Po

Compound : Made up of two or more than two different type of atom.

Example : H₂O oxidane NH₃ azane PH₃ phosphane

CH₄ methane BH₃ borane PbH₃ plumbane

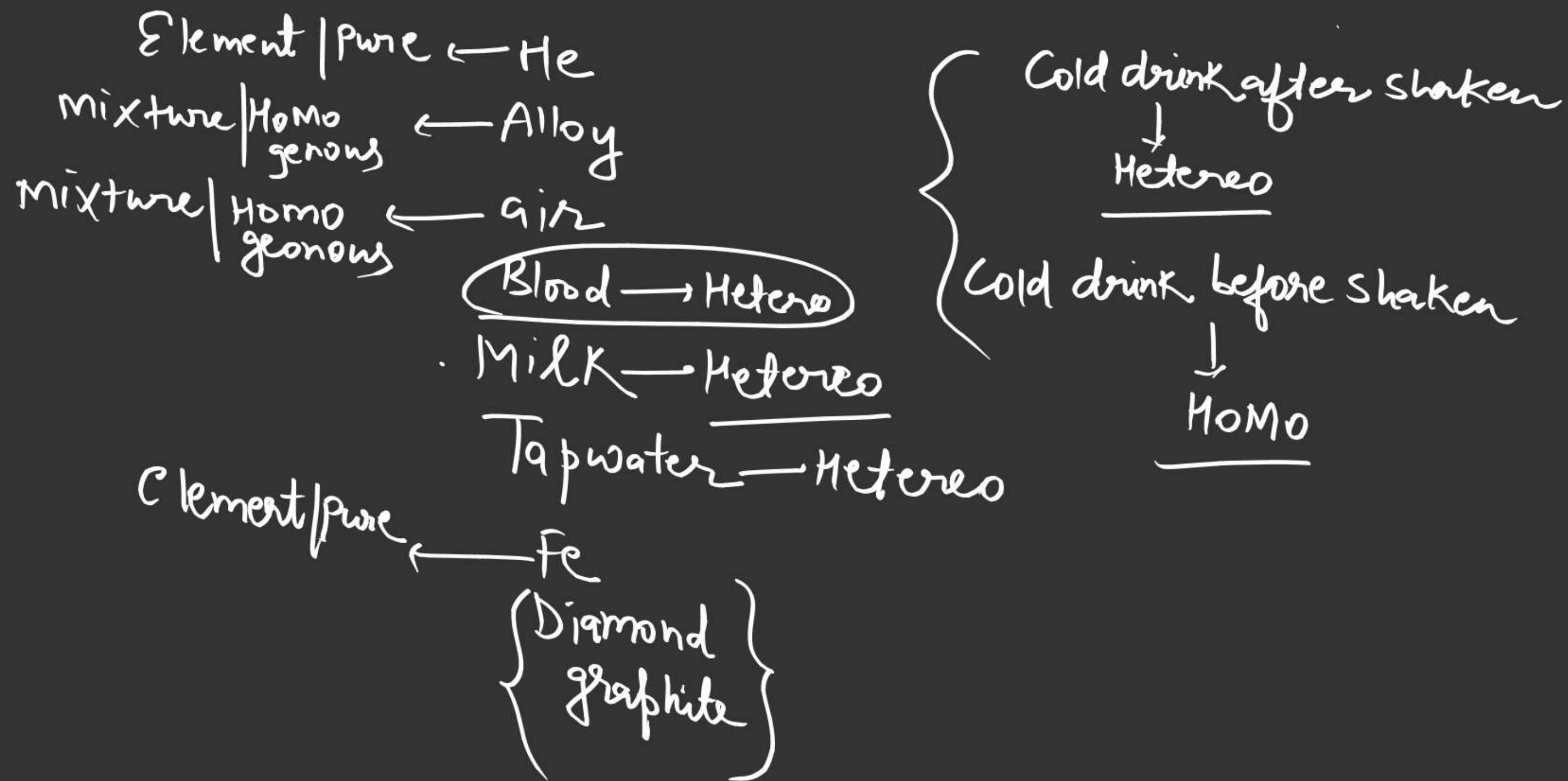
Element : Substance made up of same atoms

Compound : Substance made up of two or more elements in a fixed ratio by mass.

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Homogenous mixture : The mixture which has same composition throughout.

Hetrogenous mixture : The mixture which has different composition throughout.



allotrope \rightarrow (Element) pure

Carbon allotrop 
Diamond
graphite
fullerene

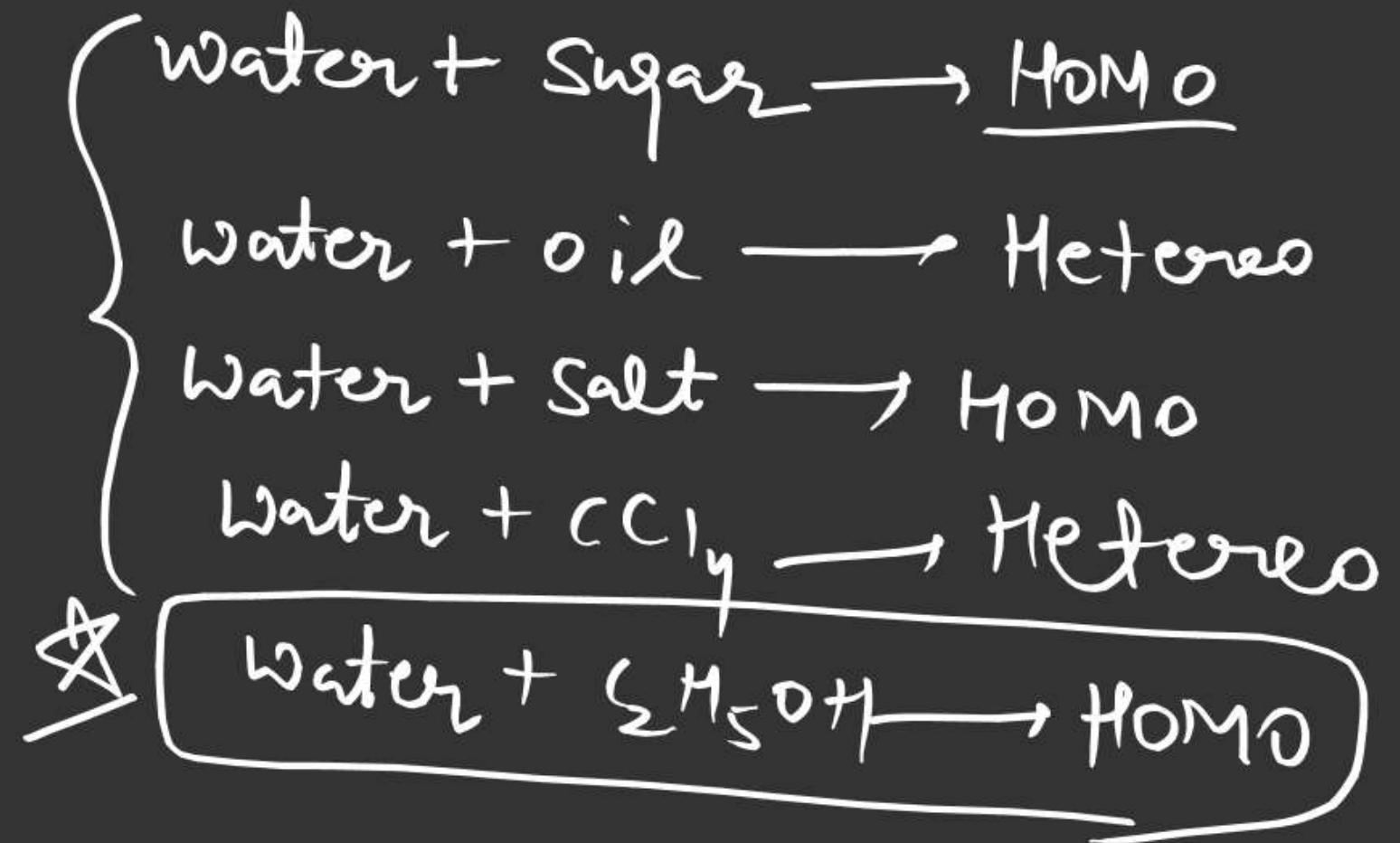
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Example :-

Matter

Classification

<u>He</u>	-	Pure → element → non-metal
<u>Diamond</u>	-	Pure → element → non-metal
<u>Graphite</u>	-	Pure → element → non-metal
<u>Iron</u>	-	Pure → element → metal
<u>Air</u>	-	mixture → homogenous
<u>Alloy</u>	-	mixture → homogenous (Note: All alloy <u>are</u> homogenous mixture)
<u>Tap water</u>	-	mixture → heterogenous (Bacteria not distributed equally)



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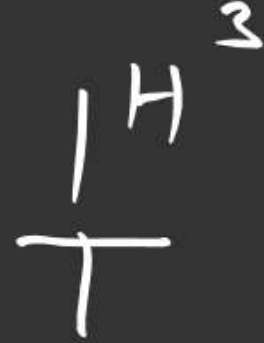


Z = Atomic number [number of proton]

A = Mass number [number p + number n]

$$\text{number of } n = \underline{\underline{A - Z}}$$

Isotope → atoms of same element
having same atomic number
diff mass number



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e

Name of Particle	Mass	Nature of charge	Amount of charge	Presence in the atom
(i) Electron Symbol = (e) Notation = ${}_{-1}e^0$ Discoverer <u>J.J. Thomson</u> (1897)	$9.11 \times 10^{-28} \text{ g } \frac{1}{1837}$ th of H-atom	Negatively Charged — Positive	$-1.602 \times 10^{-19} \text{ Coulomb}$ Or $-4.8 \times 10^{-10} \text{ e.s.u}$	Outside the nucleus
(ii) Proton Symbol = (p) Notation = $({}_1\text{H}^1)$ Discoverer <u>Rutherford</u> (1911)	$1.6725 \times 10^{-24} \text{ g}$	Positively Charged	$+1.602 \times 10^{-19} \text{ Coulomb}$ Or $+4.8 \times 10^{-10} \text{ e.s.u}$	Inside the nucleus of an atom
(iii) Neutron Symbol = (n) Notation = $({}_0\text{n}^1)$ Discoverer J. Chadwick (1932)	$1.6725 \times 10^{-24} \text{ g}$ —	<u>Neutral</u>	<u>0</u>	Inside the nucleus of an atom

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Representation of atom:



where,

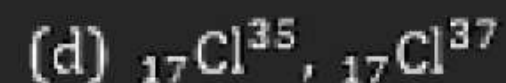
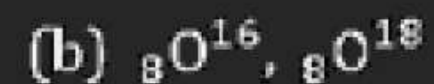
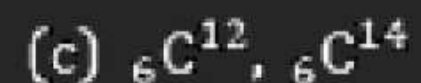
A → Mass number : (total number of protons + total number of neutrons present in an atom.)

Z → Atomic number : (total number of protons present in an atom.)

Example :- ${}_{20}\text{Ca}^{40}$

- Isotope: Atoms of given element which have same atomic number but different mass number are called isotope.

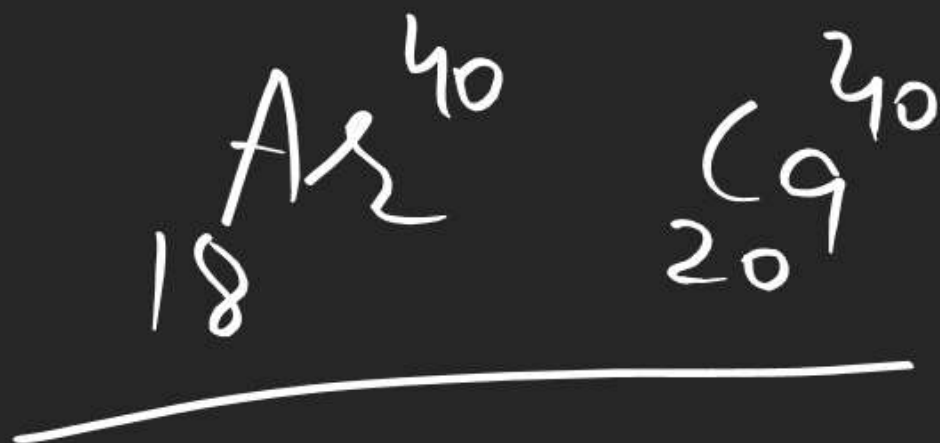
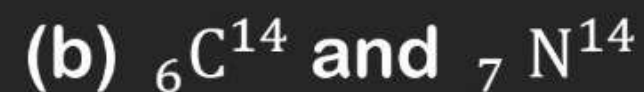
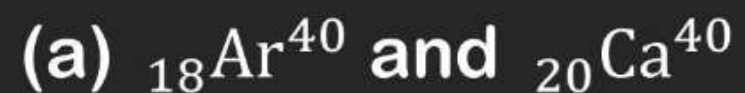
Example:



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➤ **Isobar** : Atoms of different elements with the same mass number but different atomic number

Example:



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➤ Iso-electronic species : Species (atom, molecules or ions) having same number of electrons are called iso-electronic.

Example :

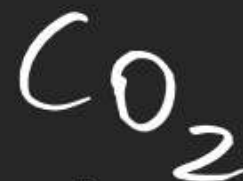
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|--|----------|----------|---------|----|
| (a) C^{4-} , N^{3-} , O^{2-} , F^{-} , Ne, Na^{+} , Mg^{+2} , Al^{3+} | N^{-3} | O^{-2} | F^{-} | Ne |
| (b) Si^{4-} , P^{3-} , S^{2-} , Cl^{-} , Ar, K^{+} , Ca^{2+} , Sc^{3+} | 10 | 10 | 10 | 10 |
| (c) H_2S , HCl, Ar, SH^{-} | | | | |
| (d) NH_2^{-} , NH_3 , CH_4 , H_2O , OH^{-} , NH_4^{+} , NH_2^{2-} | | | | |
| (e) $[Ni(CO)_4]$, $[Co(CO)_4]^{-}$, $[Fe(CO)_4]^{2-}$, $[Fe(CO)_2(NO)_2]$ | | | | |
| (f) CO_3^{2-} , NO_3^{-} , BO_3^{3-} | | | | |
| (g) SiO_4^{4-} , PO_4^{3-} , SO_4^{2-} , ClO_4^{-} | | | | |

Note : Now a days this concept is extended to consider the same valence shell electron also.

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➤ Iso-sters : Species having same number of electrons & same number of atoms.

Example:



no of atoms 3

3

$$\begin{aligned} \text{no } e^- &= 6 + (8 \times 2) & (7 \times 2) + 8 \\ &= 22 & 14 + 8 \\ & & \underline{22} \end{aligned}$$

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➤ Iso-diaphers : Species having same [difference in number of neutrons and protons.]

Example :

$$\frac{(n-p)}{\text{neutron excess isotopic excess}}$$

(a) ${}_{15}\text{P}^{31}$, ${}_{17}\text{Cl}^{35}$, ${}_{11}\text{Na}^{23}$, ${}_3\text{Li}^7$, ${}_{13}\text{Al}^{27}$, ${}_{19}\text{K}^{39}$, ${}_9\text{F}^{19}$, all have isotopic excess of $(A - 2Z) = 1$.

(b) ${}_6\text{C}^{14}$, ${}_8\text{O}^{18}$, ${}_1\text{T}^3$, ${}_{24}\text{Cr}^{50}$, all have isotopic excess of $(A - 2Z) = 2$.

$$\begin{array}{cc} \begin{array}{c} p = 15 \\ n = 16 \\ (n-p) = 16-15 = 1 \end{array} & \begin{array}{c} p = 17 \\ n = 18 \\ (n-p) = 18-17 = 1 \end{array} \end{array}$$

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Isotones: Elements having the same number of neutrons are known as isotones.

Example:

