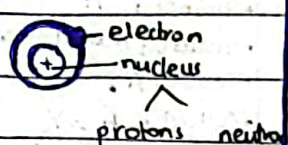
Date:.....

Atomic and Nuclear Physics

Wed Thu Fri Sat

• Atom & atomic nucleus:



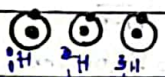
nucleons.

- Atomic no. (Z) = No. of protons
- Neutron no(N) = No of neutrons
- Atomic mass no. (A) = No. of P + No. of N.

• Isotopes:

Isotopes are the atoms of an element with same P but different A due to change in no. of N.

- Hydrogen has 3 isotopes: Deutrium, Protium, tritium.



• Natural Radioactivity.

→ unstable nuclei emit radiations spontaneously

- more than 82 z in unstable.

→ 3 types of radiations

alpha Beta Gamma

α β γ

• Background Radiations:

→ Radiations present in atmosphere due to different radioactive substances.

→ our body can tolerate these.

→ radiations recieved from outer space are called cosmic radiations.

→ cosmic mix with others and form secondary radiations.

• Nuclear transmutation

→ parent (unstable) nuclei changes into daughter (stable) nuclide.

• Ionizing effect:

→ radiations split matter into +ve & -ve ions.

$\alpha > \beta > \gamma$

- due to large +ve charge & large mass.

• penetrating Ability:

→ pass through same matter

$\gamma > \beta > \alpha$

- Due to large speed & neutral nature.

• Half-Life:

1st, 2nd, 3rd, 4th, 5th half life.

$\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{32}$

$\frac{1}{2}, \frac{1}{2^2}, \frac{1}{2^3}, \frac{1}{2^4}, \frac{1}{2^5}$

→ atoms / elements decay for stability

original atoms

$N = N_o \times \frac{1}{2^t}$

remaining atom, No. of half life

Radioisotopes & their Uses:

→ Difference b/w natural and artificial radioactivity.

Natural	Artificial
It is a spontaneous reaction	Protons, neutrons or alpha particles are hit
Natural process	Man-spontaneous reaction

→ artificially produced radioactive elements are called radioactive isotopes.

1. Tracers:

→ Iodine-131: thyroid gland

→ Phosphorus-32: Brain tumor.

→ Wear & tear of heavy machinery

→ P-32: plants absorbing phosphorus

2. Medical Treatment:

→ Cobalt-60: shrinking of tumor & curing cancerous tumor.

3. Carbon dating:

→ SLO Question: How is radiocarbon dating possible in plants and animals?

→ Ans: Fig 18.10 (2) 1st paragraph pg# 184.

FISSION Rxn:

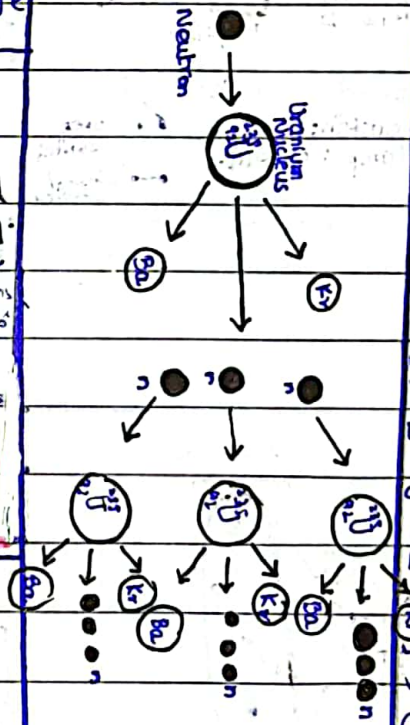
→ stable nucleus + neutrons (heavy) → form an unstable nucleus

$^1_0n + ^{235}_{92}U \rightarrow ^{141}_{56}Ba + ^{92}_{36}Kr + 3^1_0n$

→ Fission reaction produce a very large amount of energy, and if it is uncontrolled explosion can occur.

→ 200 MeV of energy released in every Fission event.

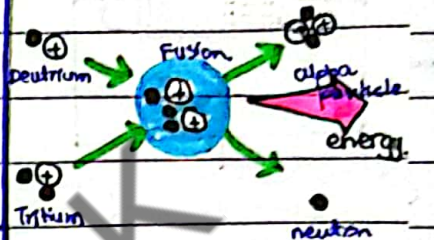
Neutrons are the projectiles



Nuclear Fusion.

2 lighter nuclei → 1 heavy nucleus

$^2_1H + ^3_1H \rightarrow ^4_2He + ^1_0n + Energy.$



- A large amount of energy is required to meet two positive charged atoms due to the large repulsion, and a large amount of energy is released by the Fusion reaction.

Hazards of Radiations:

→ prolonged dose on human body can have harmful effect on human body.

1. beta & gamma rays can cause redness & itching
2. Change in DNA.
3. Deformities in children.
4. blood cancers
5. Eye problems.

Safety Measures:

→ use particular instruments to hold the sources of it.

→ wear gloves and wash hands afterwards

→ radioactive sources should be stored in lead cuz lead absorbs radiations and doesn't allow them to pass.

→ Pointing toward the human can cause serious problem

→ Frequent visits to places where sensitive radiations are produced must be avoided.