KGS IAS

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Class will Start Shortly

Nuclear Power

3 parts

(P) (1) Scientific core

(P) (M) (2) India's nuclear power programme

(P) (M) (3) Fusion Energy

(I) Scientific Basics

2 smaller nuclei

E.g. → $U235$

n^1

$U236$ (Transition State Atom → Highly Unstabity)

↓ Fission

$Ba144 + Kr89 + 3n^1 + Energy$

⇒ Fission : well controllable

↳ deployed worldwide as Nuclear Power option

$_1H^2$ + $_1H^3$ ⟶ $_2He^4$ +

(D) (T)

→ releases a very high lev
of energy (~1000 times
than a typica
reaction)

→ Hard to carry out in
& economically feasible

⇓

- not deployed a

- Expt. → ITER

→ Cadarach

$$e = mc^2$$

e = energy

m = mass

c = speed of light

Nuclear Decay

- Loss of nuclear particle
  - Loss of Proton (H^+ decay)
    - → outcome
      - ↳ Atomic No. → Reduced by 1
      - ↳ " Mass → Reduced 1 a.m.u.
  - Loss of 2 protons + 2 neutrons together (α-decay)
    [α-particle = He nucleus]
    - ↳ Loss of atomic no. → 2
    - ↳ " " " mass → 4 a.m.u.
- Dissociation of nuclear particles (P.T.O.)

$$_{92}U^{230} \xrightarrow[(\alpha\text{-decay})]{} {}_{90}Th^{226} + {}_{2}He^{4}\ (\alpha\text{-particle})$$

(Nuclear decay leading to form' of some other element's nucleus → **Nuclear Transmutation**

↳ Increase in atomic no. → 1

↳ change in atomic mass → 0

Fertile Material

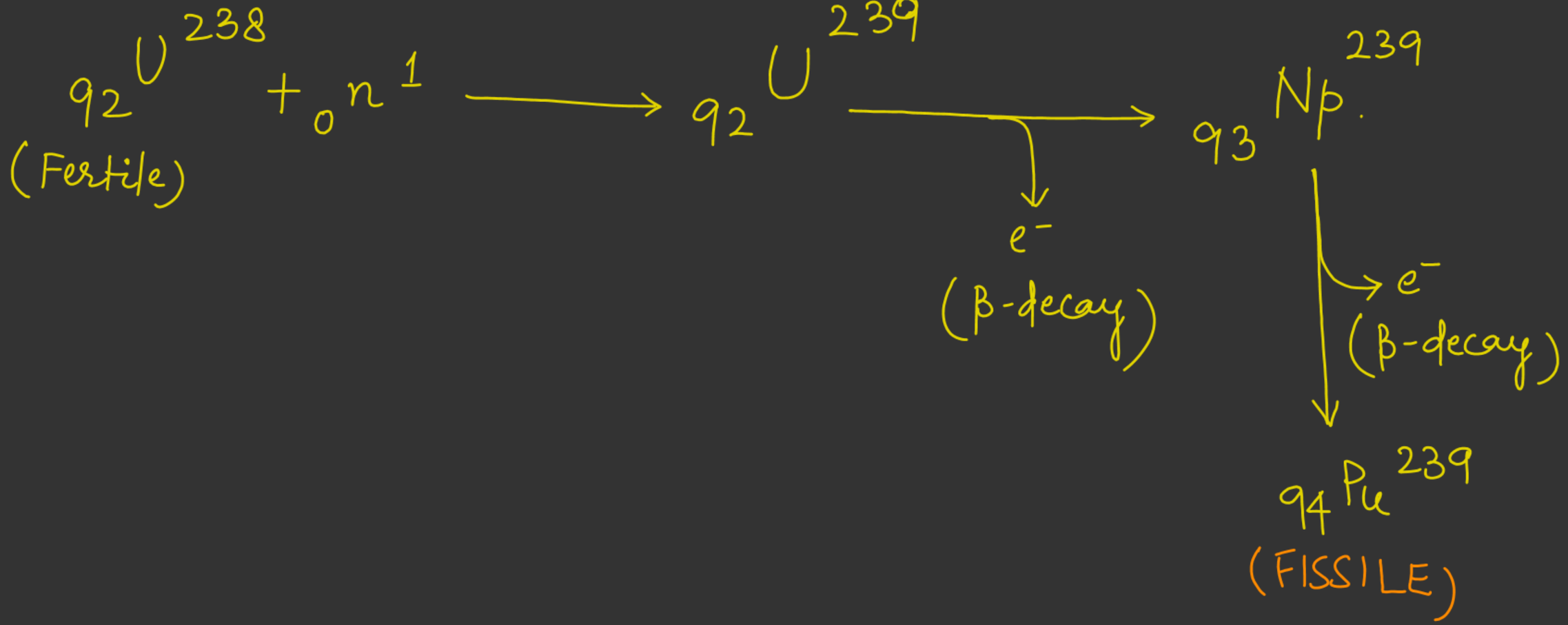
$_{90}Th^{232} + {}_{0}n^{1} \longrightarrow {}_{90}Th^{233} \xrightarrow{\beta\text{-decay}} {}_{91}Pa^{233} \xrightarrow{\beta\text{-decay}} {}_{92}U^{233}$ ← Fissile Material

① neutron absorption

e^- β-decay

e^- β-decay

2 steps of β-decay


$_{92}U^{238} + {}_{0}n^{1}$
(Fertile)
$_{92}U^{239}$
e^-
(β-decay)
$_{93}Np^{239}$
e^-
(β-decay)
$_{94}Pu^{239}$
(FISSILE)

U238
(Fertile)

UO_2

also k/a : Yellow cake

U235
(Fissile)

needs to be increased by ore processing

(U - enrichment)

3 - 5 %

Nuclear fuel grade enriched U

Above 20 %

Weapon grade enriched U

(may go upto 90 %)

2. India's Nuclear Programme

Kudankulam	TN	2	VVER
Kalapakkam	TN	2	PHWR
Narora	UP	2	PHWR

KAPP-3