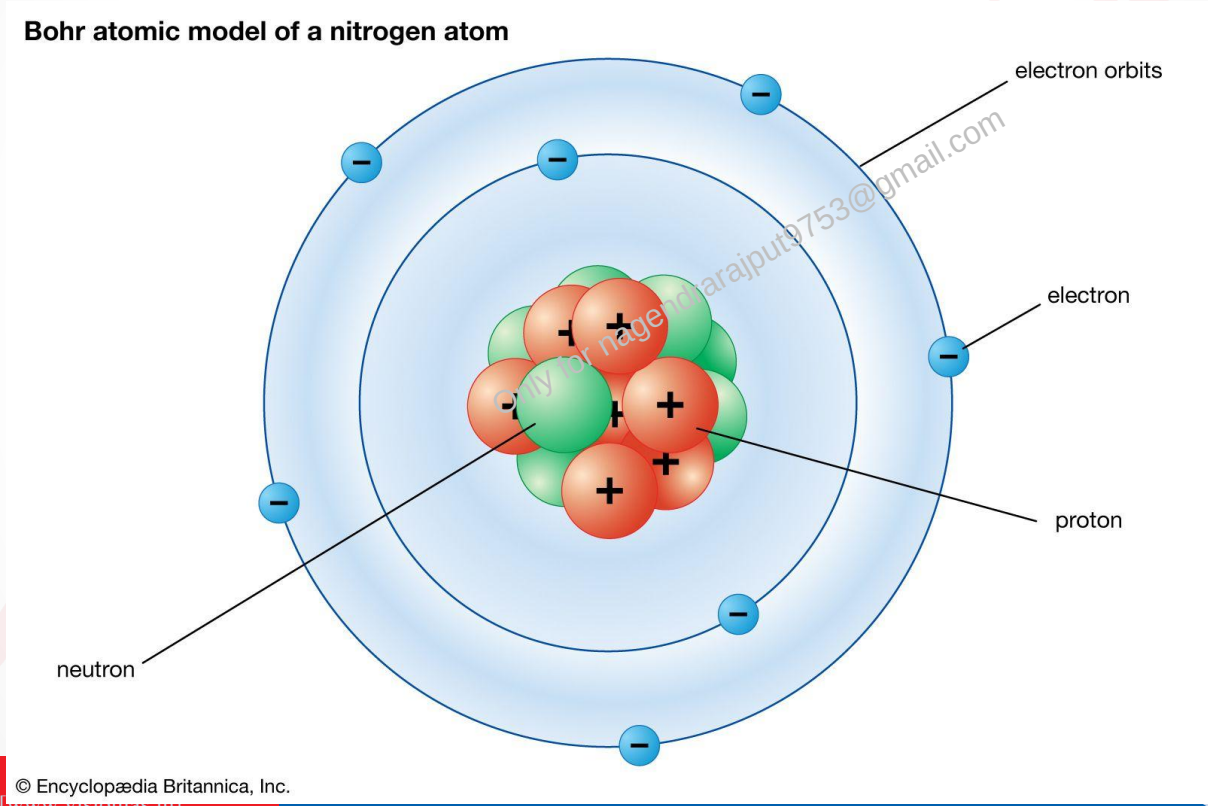
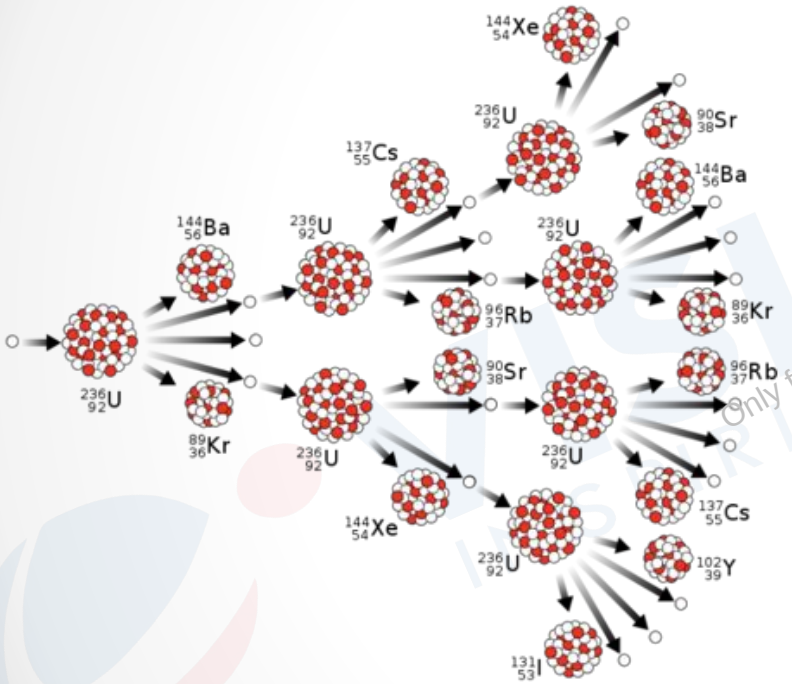
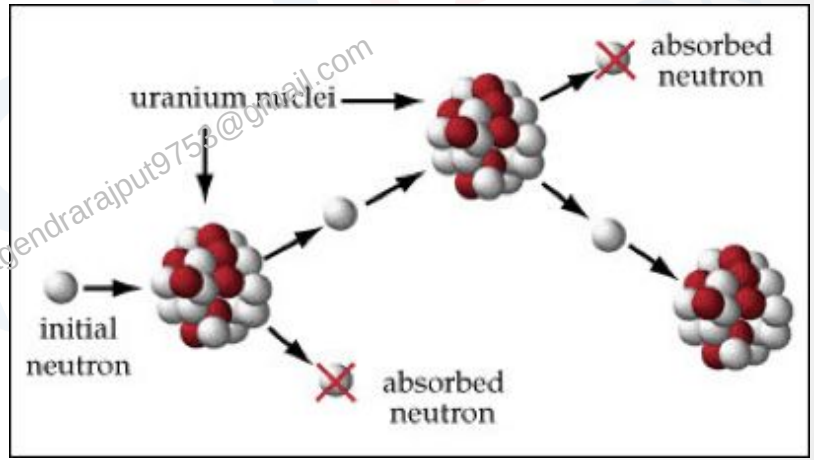
# Nuclear Technology

# Atomic Structure

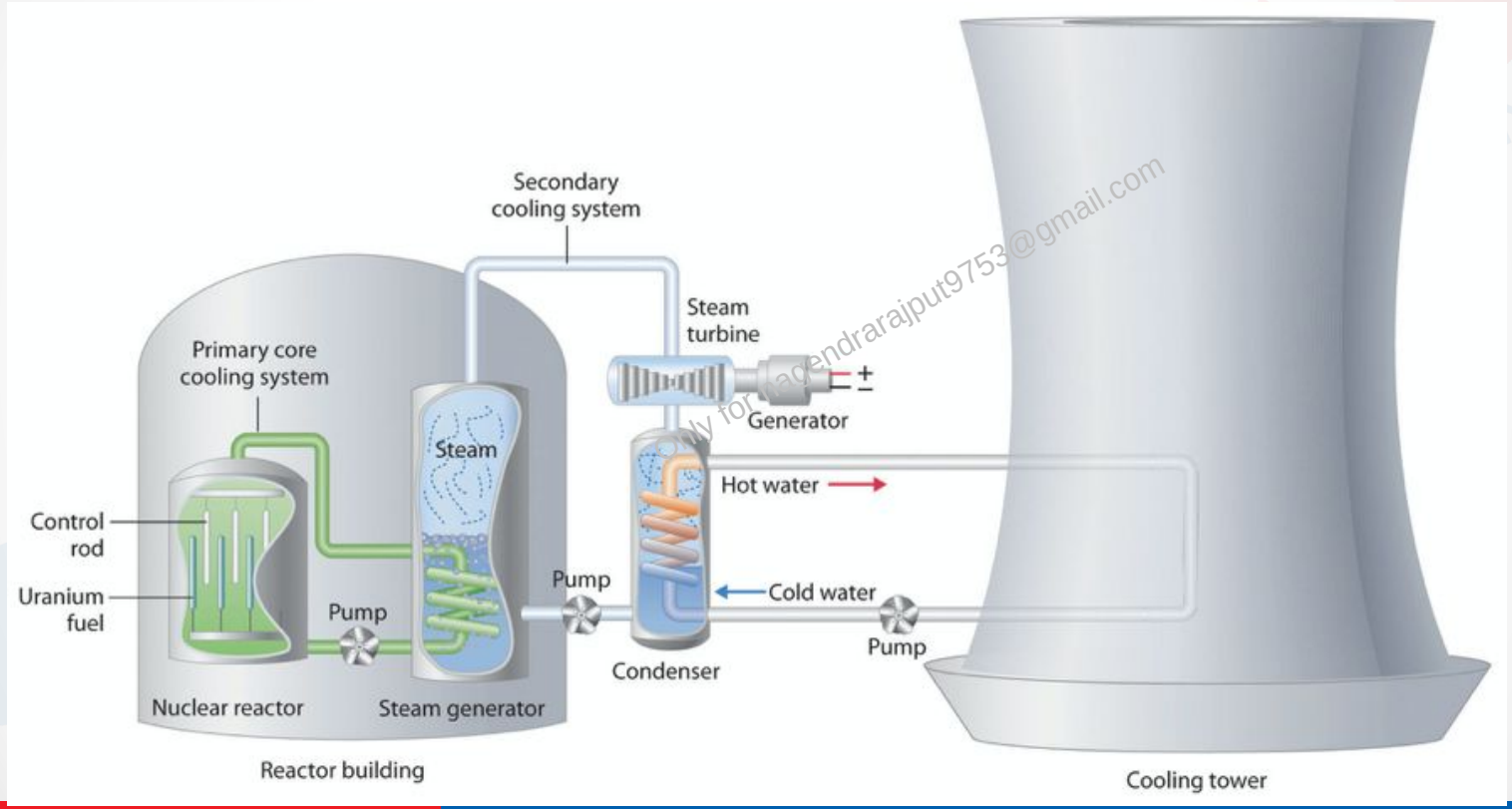


# Uncontrolled and Controlled Fission



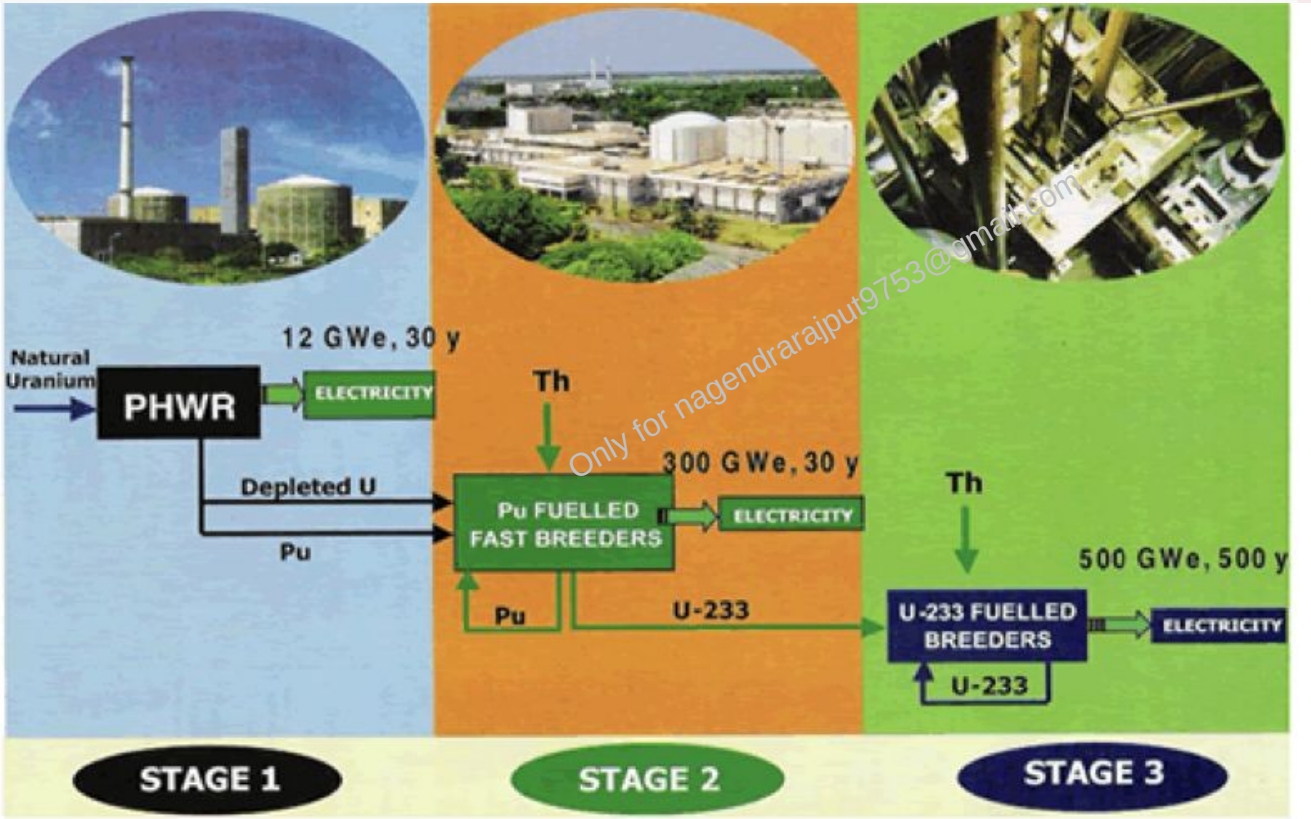
# Nuclear reactor



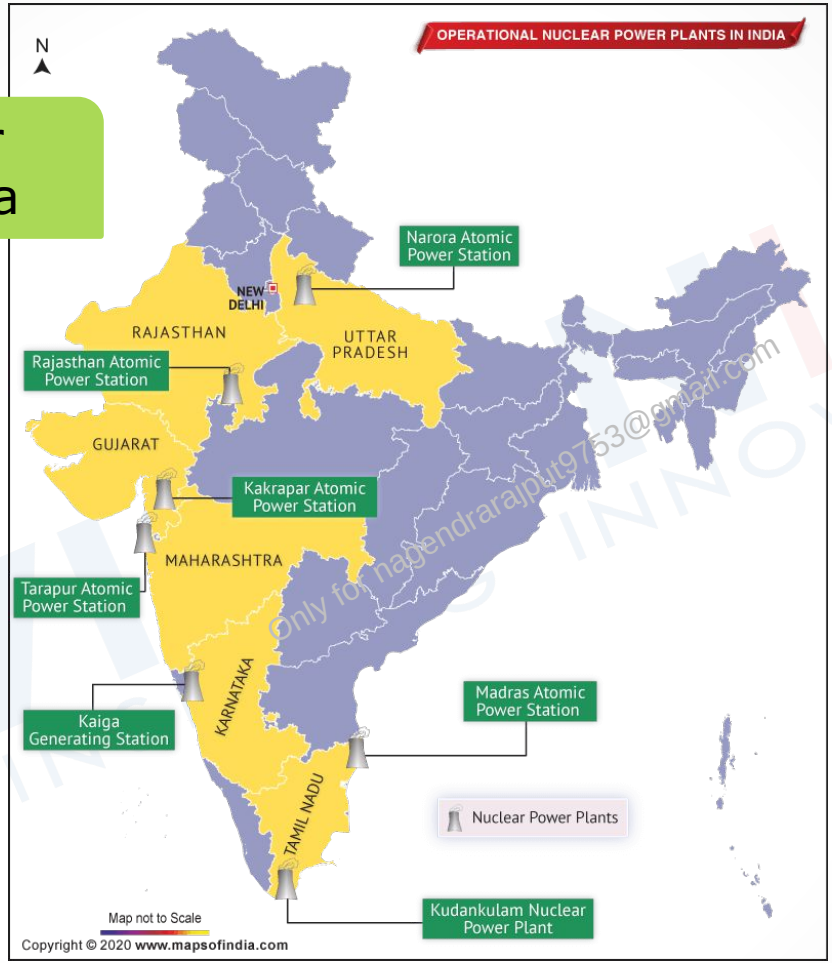
# Major types of Reactor

- Pressurized Heavy Water Reactor
- Boiling Water Reactor
- Fast Breeder Reactor

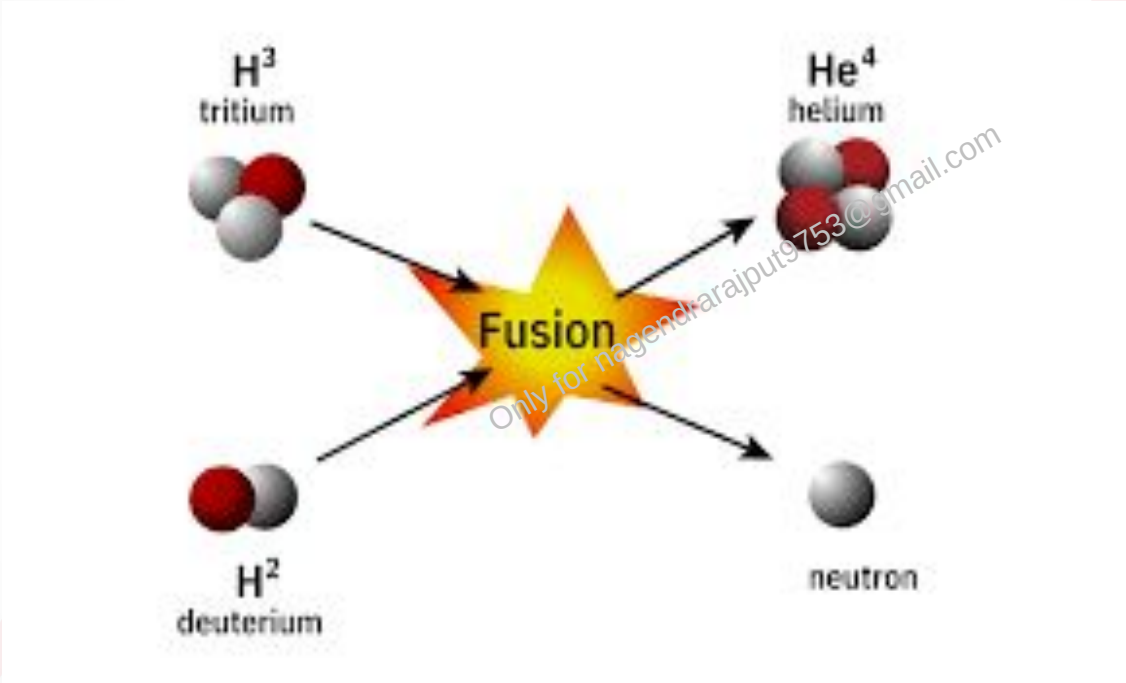
# 3 Staged Nuclear Programme



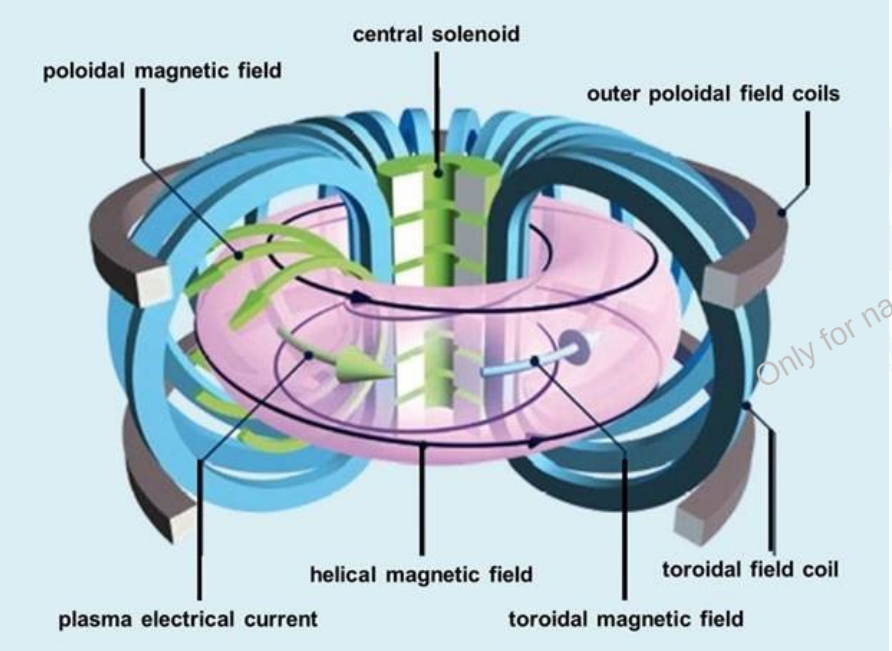
# Operational Nuclear Power Plants of India



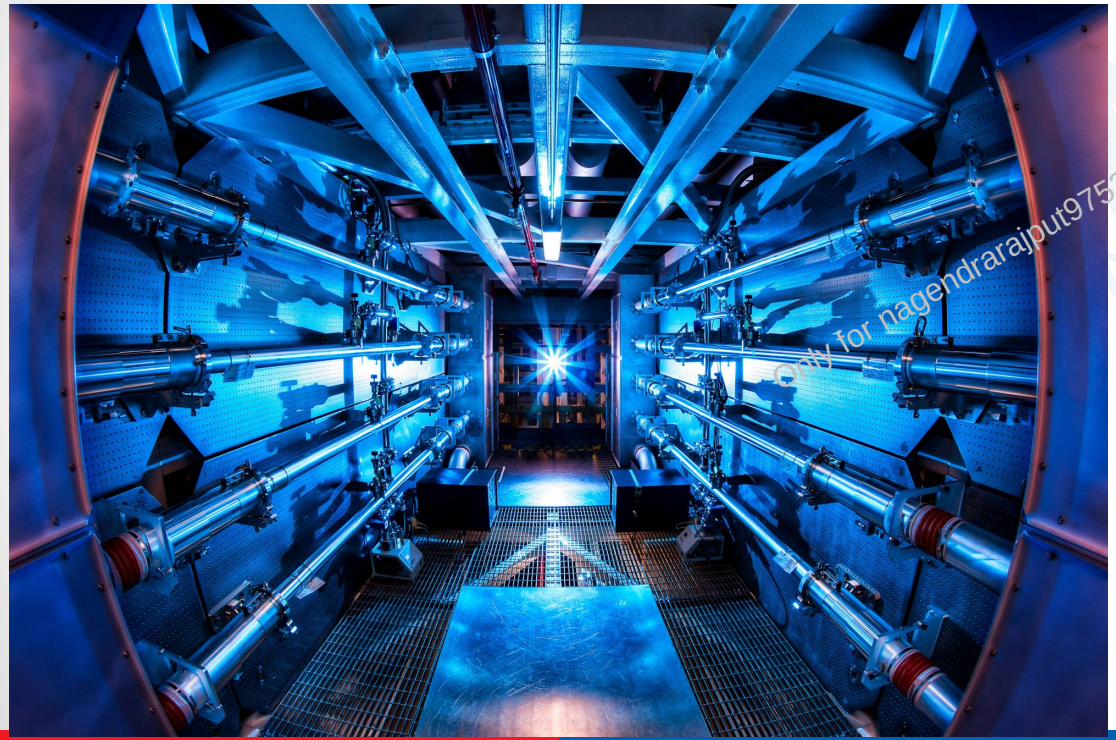
# Nuclear Fusion

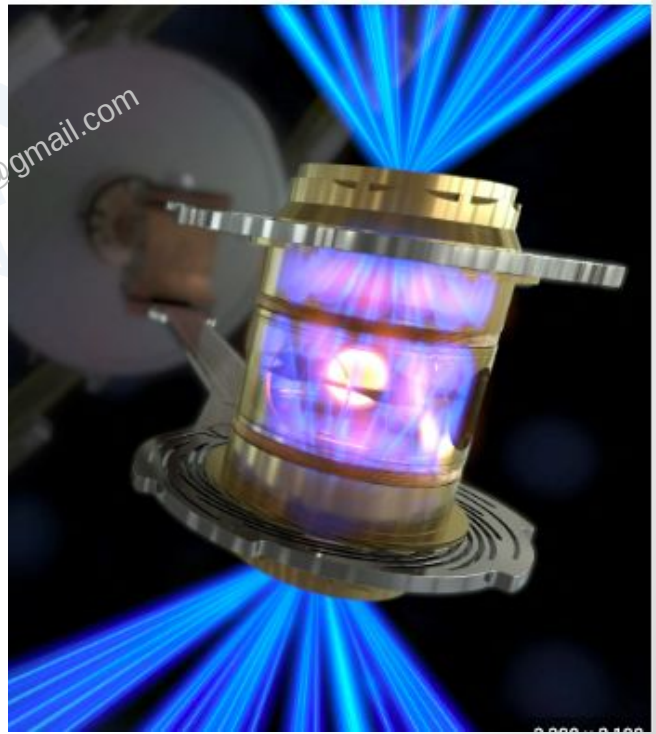


# Tokamak – Magnetic Fusion

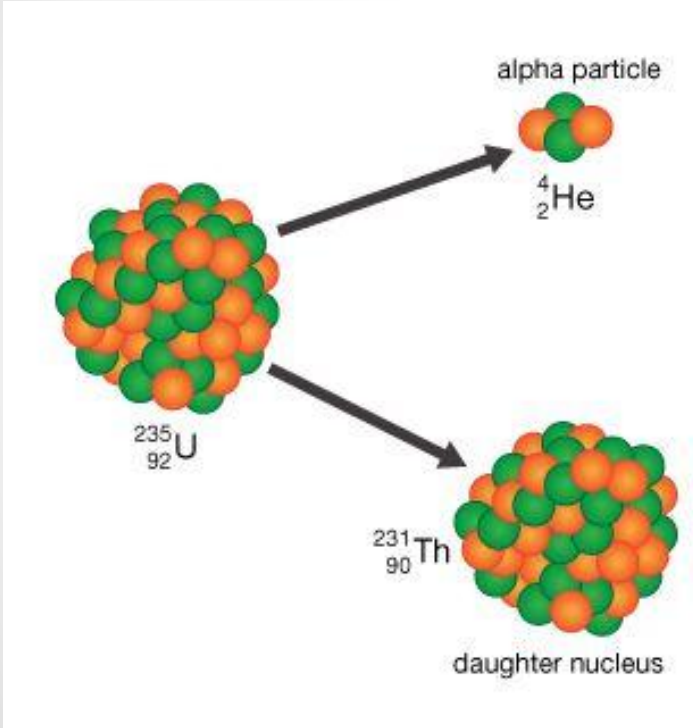



# Lawrence Lab – Static Fusion



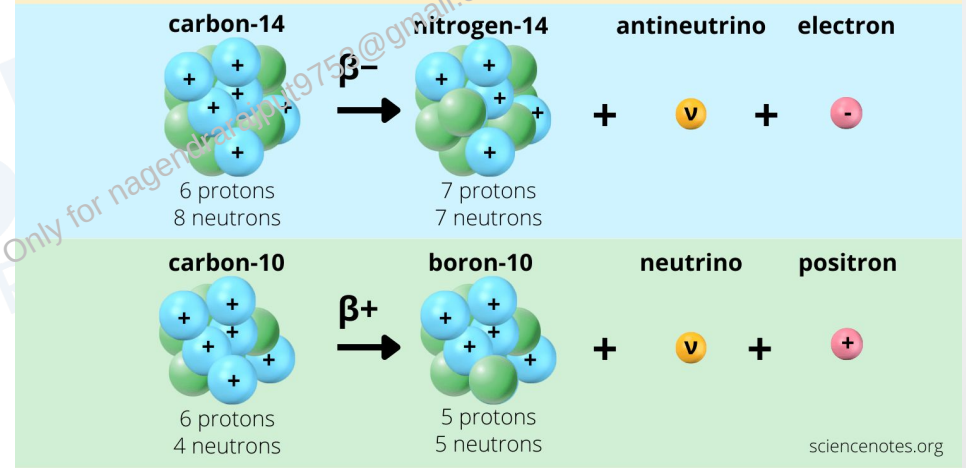


# Radioactivity

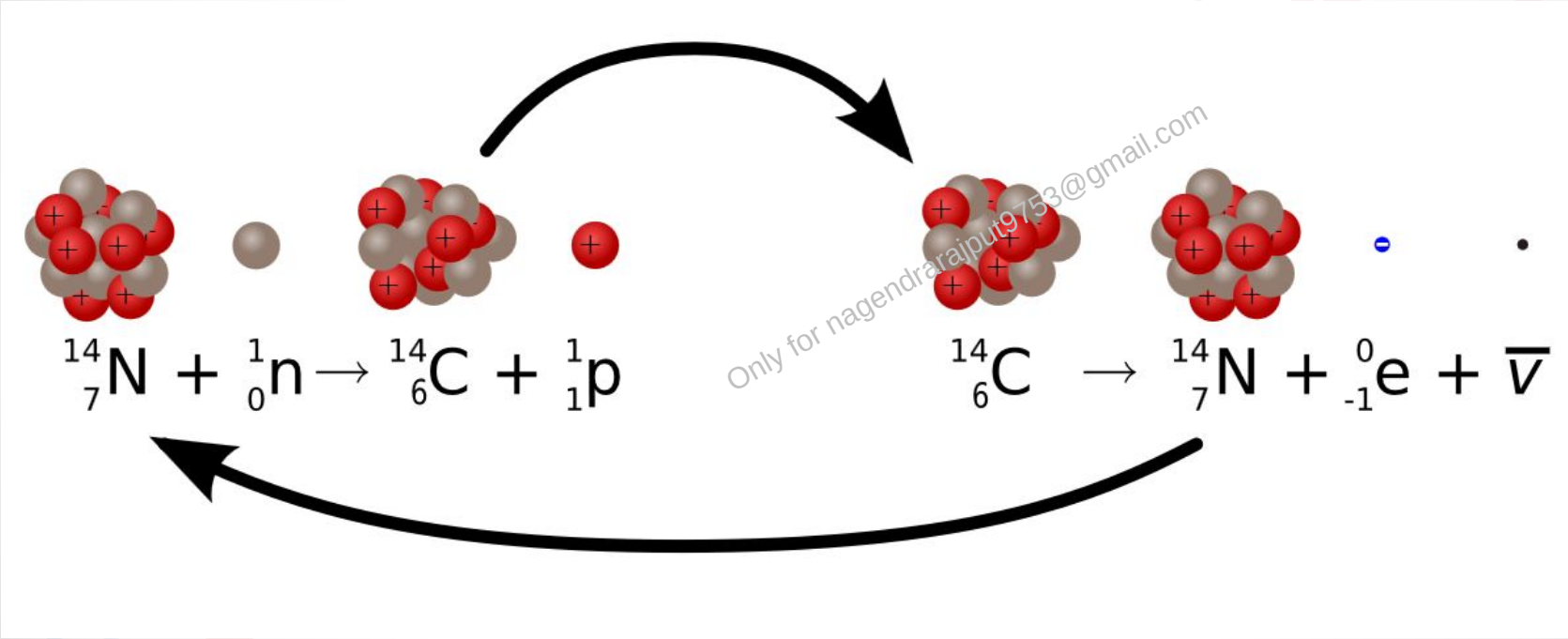



## Beta Decay

Beta decay is radioactive day that either releases an electron (beta minus) or positron (beta plus).



# Carbon 14

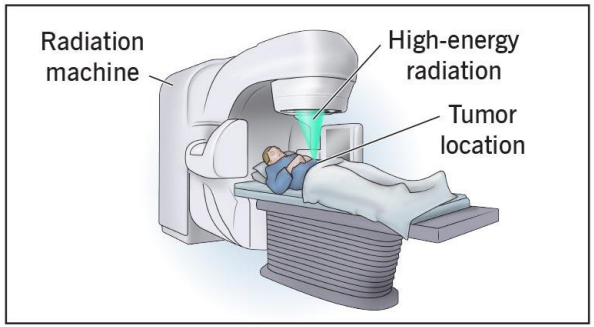


# Radioisotopes

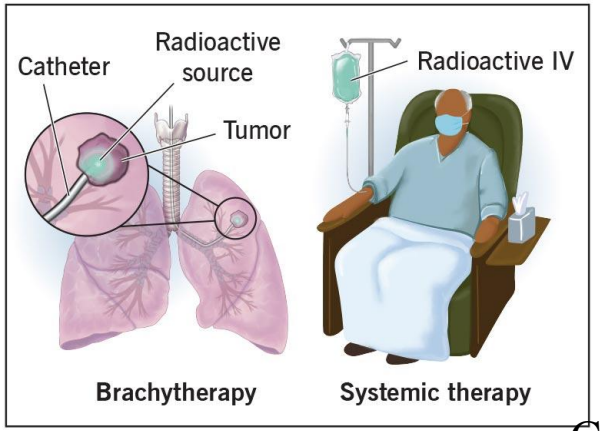
| Radioactive Isotope | Applications in Medicine |
|---|---|
| Cobalt-60 | Radiation therapy to prevent cancer |
| Iodine-131 | Locate brain tumors, monitor cardiac, liver and thyroid activity |
| Carbon-14 | Study metabolism changes for patients with diabetes, gout and anemia |
| Carbon-11 | Tagged onto glucose to monitor organs during a PET scan |
| Sodium-24 | Study blood circulation |
| Thallium-201 | Determine damage in heart tissue, detection of tumors |
| Technetium-99m | Locate brain tumors and damaged heart cells, radiotracer in medical diagnostics (imaging of organs and blood flow studies) |

## Radiation Therapy

**External beam radiation therapy (EBRT)**




**Internal radiation therapy**

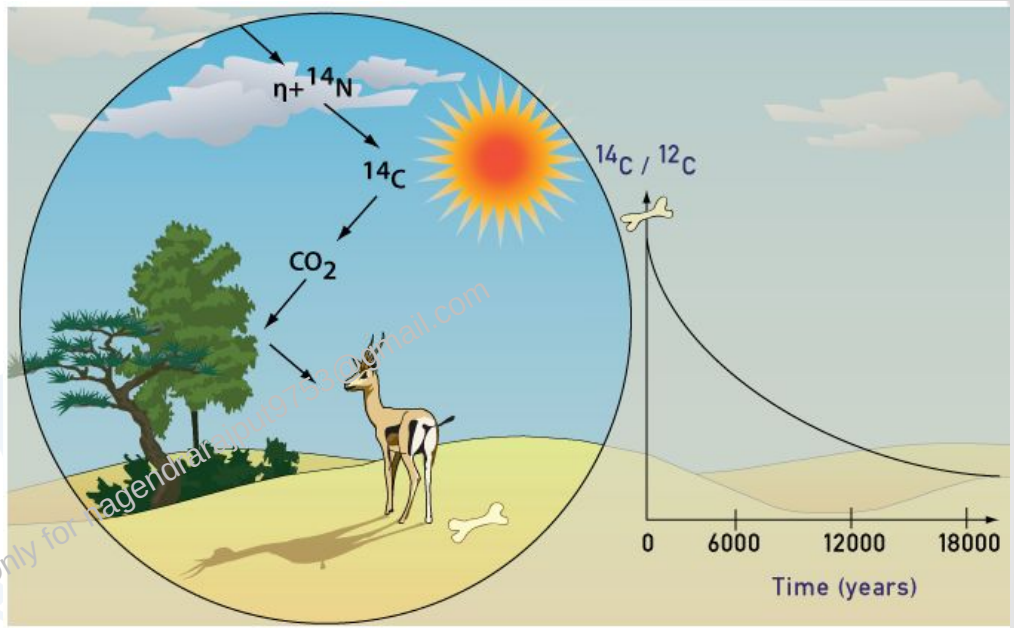



Cleveland Clinic ©2022

Cancer Treatment


Radiation Sterilization

Food Irradiation




C-14 Dating

Consider the following statements:

**Statement-I:** India, despite having uranium deposits, depends on coal for most of its electricity production.

**Statement-II:** Uranium, enriched to the extent of at least 60%, is required for the production of electricity.

Which one of the following is correct in respect of the above statements?

(a) Both Statement-I and Statement-II are correct and Statement- II is the correct explanation for Statement-I

(b) Both Statement-I and Statement-II are correct and Statement- II is not the correct explanation for Statement-I

(c) Statement-I is correct but statement- II is incorrect

(d) Statement-I is incorrect but Statement-II is correct

Q1. Recently Radioisotope Thermoelectric Generators (RTG) technology was in the news. Consider the following statements regarding the Radioisotope Thermoelectric Generators (RTG) technology:

1. It can be a steady source of both heat and electric energy for space missions.
2. It will help in launching missions deeper into space.
3. It uses a fission chain reaction to generate energy.
4. Plutonium-238 is used to provide heat and electricity in RTG.

Which of the statements given above are correct?

(a) 1, 2 and 3 only
(b) 2, 3 and 4 only
(c) 1, 3 and 4 only
(d) 1, 2 and 4 only

Q2. Which of the following best describes the rationale for fast breeder reactor (FBR) in India, which is integral to 3 staged Nuclear programme:

(a) To convert Natural Uranium in Pu-239, which is a good fissile material.
(b) To utilize the potential of efficient fission by FBR compared to other reactors
(c) To use fission base energy and use it for Nuclear fusion
(d) To use Thorium reserves and convert it into good fissile material

Q3. With respect to nuclear technology, consider the following statements:
1. The energy released in a nuclear fusion reaction is greater than the energy released by nuclear fission.
2. Nuclear Fusion does not normally occur in nature but fission occurs in stars.
3. At present, nuclear fission reaction is used in nuclear power plants and fusion is still in experimental stage for producing power.
Which of the statements given above is/are correct?
(a) 3 only
(b) 1 and 3 only
(c) 1 and 2 only
(d) 2 and 3 only

Q4. With reference to the different types of nuclear reactors used in the Indian power plants, consider the following pairs:

| **Type of Reactor** | **Power Plant** |
|---|---|
| 1. Pressurised Water Reactor. | Kudankulam |
| 2. Pressurized Heavy Water Reactor | Rawatbhatta |
| 3. Fast breeder Reactor | Tarapore |

Which of the pairs given above is/are correctly matched?
(a) 1 only
(b) 1 and 2 only
(c) 1, 2 and 3
(d) 3 only

Q5. Consider the following statements regarding nuclear fusion:
1. Deuterium and Tritium are used as fuels in nuclear fusion reactions.
2. There is no risk of a meltdown in a nuclear fusion reaction.
3. To date, there has been no net gain of energy in fusion reactions.
Which of the statements given above is/are correct?
(a) 1 only
(b) 1 and 2 only
(c) 2 and 3 only
(d) 1, 2 and 3

Q6. India is an important member of the 'International Thermonuclear Experimental Reactor'. If this experiment succeeds, what is the immediate advantage for India?
(a) It can use thorium in place of uranium for power generation
(b) It attain a global role in satellite-navigation
(c) It can drastically improve the efficiency of its fission reactors in power generation
(d) It can build fusion reactors for power generation

In India, why are some nuclear reactors kept under "IAEA Safeguards" while others are not ?

(a) Some use uranium and others use thorium

(b) Some use imported uranium and others use domestic supplies

(c) Some are operated by foreign enterprises and others are operated by domestic enterprises

(d) Some are State-owned and others are privately-owned

The function of heavy water in a nuclear reactor is to

(a) Slow down the speed of neutrons

(b) Increase the speed of neutrons

(c) Cool down the reactor

(d) Stop the nuclear reaction