

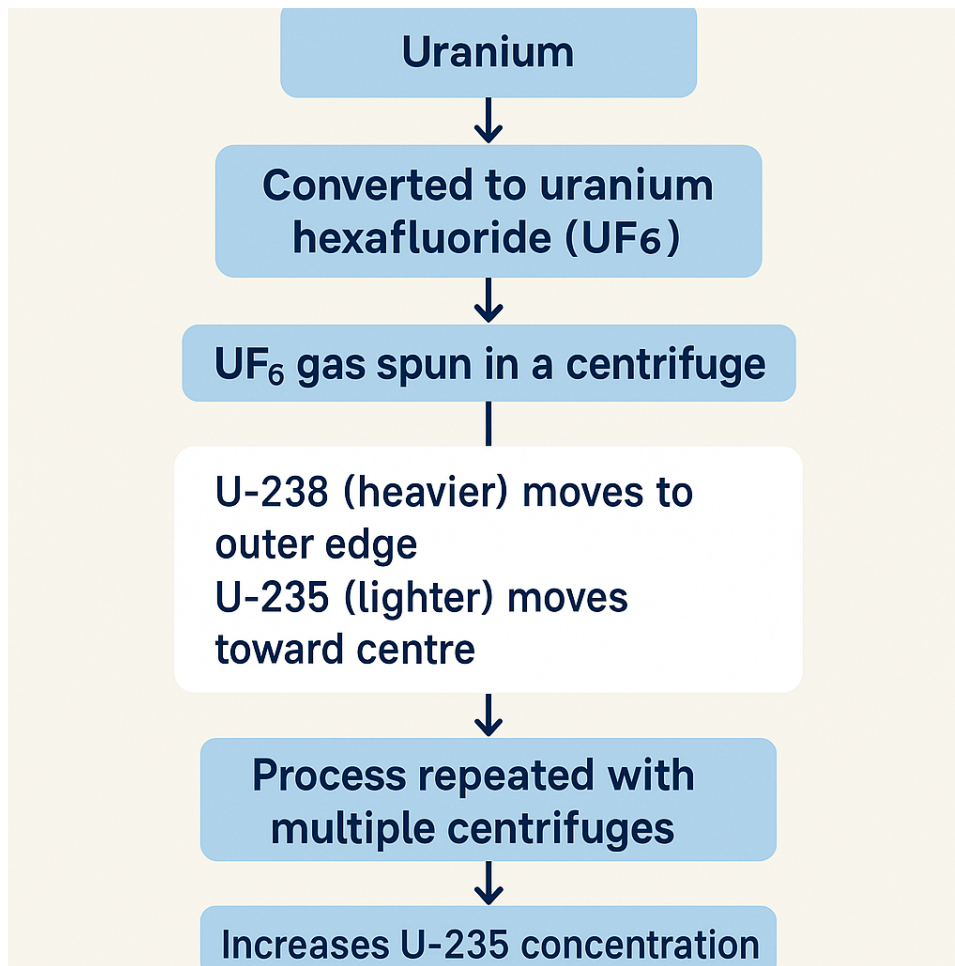


Centrifuge Process of Uranium Enrichment

[Source: TH](#)

Uranium Enrichment is used to **increase U-235 concentration to the desired level.**

- **Need for Enrichment:** Natural uranium has **99.3% U-238** and **0.7% U-235**. Nuclear **reactors** require **3-20% U-235**, while **nuclear weapons** require about **90% U-235**.
 - Uranium enriched **beyond 20%** is considered as **highly enriched**.
- **Centrifuge Process of Uranium Enrichment:**
 - In this method, uranium is first converted into a gas called **uranium hexafluoride (UF_6)**.
 - **UF_6** is the **only gaseous** form of uranium suitable for centrifuge separation.
 - Uranium has two main isotopes **U-238 (heavier)** and **U-235 (lighter and used in nuclear reactors/weapons)**, having a **small mass difference of 1.27%**.
 - When the **UF_6** gas is spun at **very high speeds (around 50,000 rpm)** inside a centrifuge, the **heavier U-238 moves to the outer edge**, and the **lighter U-235 stays closer to the centre**.
 - This process is **repeated across many centrifuges**, gradually **increasing the U-235 concentration** in the final product.



▪ **Centrifuge Design:**

- The centrifuge has a **rotor chamber** made from **strong, lightweight material (like carbon fibre)** to withstand **extreme speeds and forces** without breaking.

Isotopes of Uranium

²³⁴ U	²³⁵ U	²³⁸ U
Uranium 234 92 protons 142 neutrons	Uranium 235 92 protons 143 neutrons	Uranium 238 92 protons 146 neutrons
U-234 is not fissile, therefore it cannot spontaneously undergo a nuclear chain reaction	Most nuclear reactors use fuels containing fissile U-235	U-238 makes up over 99% of the 3 naturally occurring isotopes of uranium on Earth

Legend: Proton Neutron Electron

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