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Composition and size of Nucleus and Nuclear Properties.

SUBJECT : PHYSICS
CHAPTER NUMBER: 13
CHAPTER NAME : NUCLEI

COMPOSITION OF NUCLEUS

- NUCLEONS
- Protons
- Neutrons
- Mass number
- Isotopes
- Isobars
- Isotones

ATOMIC MASS UNIT

Nuclear Size:- If R = Radius of a nucleus having mass number A, then

$$\frac{4}{3}\pi R^3 \propto A$$

$$\Rightarrow R \propto A^{1/3}$$

$$\Rightarrow R = R_0 A^{1/3}$$

R_0 is constant = $1.2\times10^{-15}\,m = 1.2\,fm$

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NUCLEAR DENSITY

Nuclear Density:-

Different nuclei are like drops of liquid, of different sizes but same density,

If m = Average mass of a nucleon

A = Mass number, Mass of nucleus = mA

The volume of nucleus = $\frac{4}{3}\pi R^3 = \frac{4}{3}\pi\left(R_0 A^{1/3}\right)^3 = \frac{4}{3}\pi R_0^3 A$

$$\Rightarrow \text{Nuclear density} = \frac{\text{mass of nuclus}}{\text{volume of nucleus}}$$

$$\Rightarrow \rho_{nu} = \frac{mA}{\frac{4}{3}\pi R_0^3 A} = \frac{3m}{4\pi R_0^3}$$

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NUCLEAR DENSITY

$\Rightarrow$ Nuclear density is independent of mass number A or size of the nucleus.

Putting $m = 1.67 \times 10^{-27} kg, \; R_0 = 1.2 \times 10^{-15} m$

We get

$\Rightarrow \rho_{nu} = 2.3 \; x \; 10^{17} \; kg/m^3$

The density of nuclei of all elements is the same

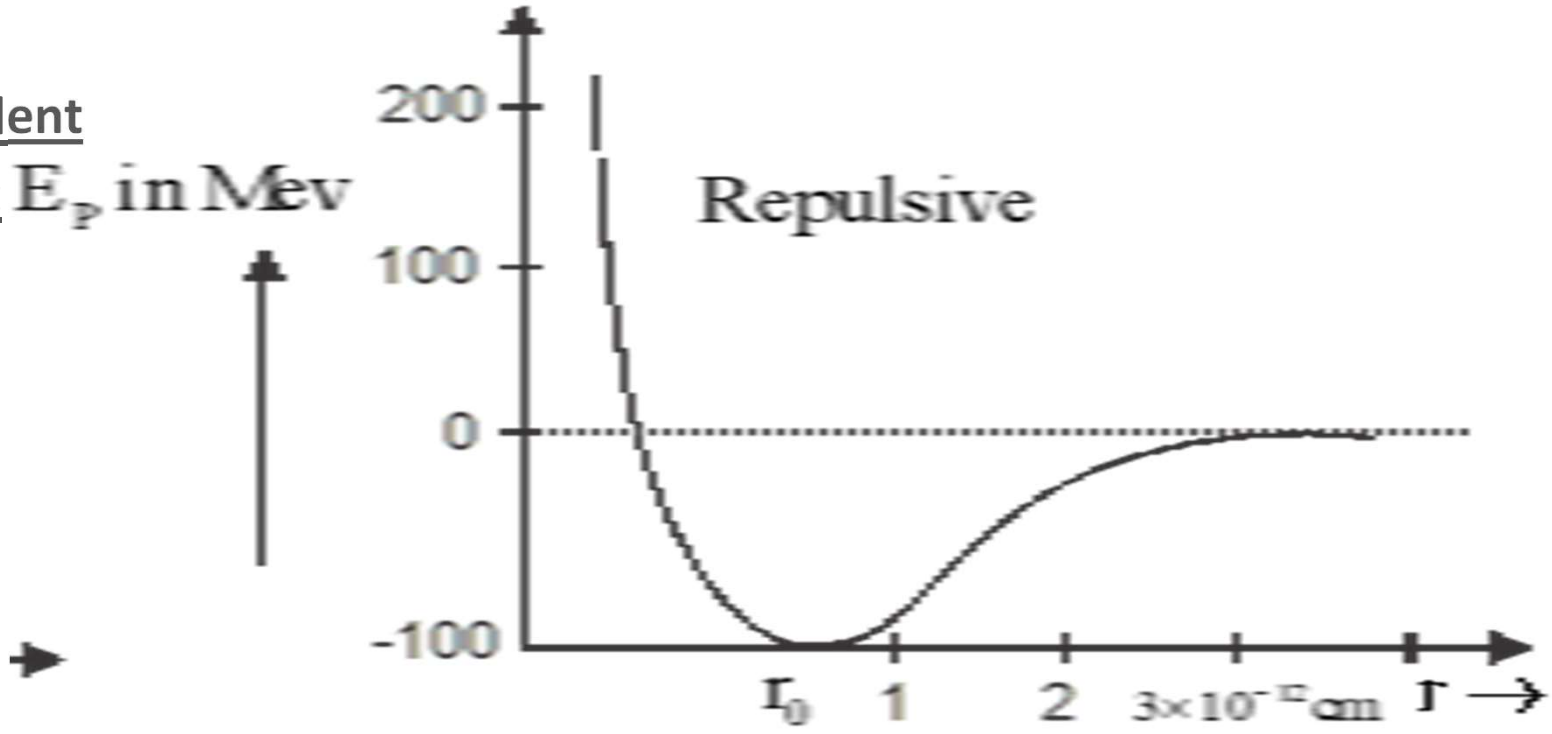
NUMERICAL

What is the nuclear radius of ^{125}Fe, if that of ^{27}Al is 3.6 fermi.

:- Boron has two stable isotopes, $_5B^{10}$ and $_5B^{11}$. Their respective masses are 10.01294 am and 11.00931 am and the atomic weight of boron is 10.811 amu. Find the abundances of $_5B^{10}$ and $_5B^{11}$.

PROPERTIES OF NUCLEAR FORCES

- Strongly attractive
- Short range
- Charge Independent
- Saturation effect
- Spin dependent
- Non Central



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