CH #42
H.W. solution

#9.

nuclear density

$\rho = \frac{Am}{\frac{4}{3}\pi r^3}$ ← mass density.

A = Mass number

m = mass of a nucleon.

$r = r_0 A^{\frac{1}{3}}$

$\rho = \frac{m}{\frac{4}{3}\pi r_0^3}$

$\rho = \frac{Ze}{\frac{4}{3}\pi r^3}$ — charge density.

#14.

$\Delta E_{be} = (M_F)c^2 - (M_i)c^2$

a. $^4He \rightarrow {}^3H + P$

$\Delta E_b = [(3.01605u + 1.00783u)$
$- 4.00260u]c^2$
$= 0.02128 c^2$
$= 0.02128u \times 931 \frac{MeV}{1u}$
$= 19.8$ MeV

#21

$T_{\frac{1}{2}} = 30$ years

what fraction remain after

a. 60 years

b. 90 years.

$$N = N_0 e^{-\lambda t}$$

$$T_{\frac{1}{2}} = \frac{\ln(2)}{\lambda}$$

$$\lambda = \frac{\ln(2)}{T_{\frac{1}{2}}} = \frac{\ln(2)}{30} = 0.0231$$

a. $$\frac{N}{N_0} = e^{-0.0231 \times 60}$$

$$= e^{-1.386} = 0.25$$

$$\frac{N}{N_0} = 25\%.$$

#~~40~~ 23.

$$\underset{^{238}U}{\cancel{Fe}} \rightarrow \alpha + {}^{234}Th.$$

a. Energy is conserved.
b. Momentum is conserved.

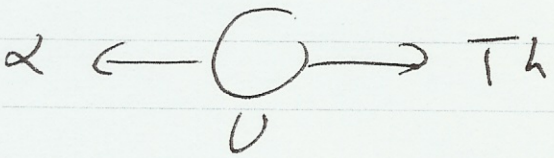
$$Q = -\Delta M c^2 +$$

$\cancel{\Delta}M$

$Q =$ KE of α
$\quad$ + KE of Th.

$KE(\alpha) = 4.196\ \text{MeV}$

$P(\alpha) = P(Th).$



$$KE = \frac{p^2}{2m}$$

$$p = \sqrt{2KEm}$$

$$\frac{KE(\alpha)}{KE(Th)} = \frac{P^2(\alpha)}{2m\alpha} \cdot \frac{2M_{Th}}{P^2(Th)}$$

$$= \frac{M(Th)}{m(\alpha)}$$

$$\therefore KE(Th) = \frac{m(\alpha)}{M(Th)} \cdot KE(\alpha)$$

$$= \frac{4}{234} \cdot 4.196$$

$$= 0.0717$$

$$Q = 4.196 + 0.0717$$
$$= 4.2677 \text{ Mev}$$

45

$$^{137}Cs \to {}^{137}Ba + \bar{e} + \nu$$

$$Q = -\Delta M$$

$$Q = -\left[(\text{final atomic mass}) - (\text{initial atomic mass})\right] \times c^2$$

$$= -\left[136.9058 - 136.9071\right] c^2$$

$$= +1.3 \times 10^{-3} \times \overset{931.494}{\cancel{931\ \text{MeV}}}/u$$

$$= 1.21\ \text{MeV}$$

#47. $n \to p + \bar{e} + \nu$

$$Q = \left[\left(M(p+e^-)\right) - M(n)\right] c^2$$

$$= 840 \cancel{\times} 10^{-6}\, u\, c^2$$

$$= \overset{0.782}{\cancel{0.782\ \text{MeV}}} =$$

$$KE(e) + KE(p) = 0.782$$

$$KE(p) = \frac{m(e)}{m(p)} \cdot KE(e)$$

$$\therefore KE(p) = \frac{0.5485 \times 10^{-3}\, u}{1.007\, u} \times$$

$$= 5.44 \times 10^{-4}\, KE(e).$$

$$\cancel{KE(e) = 0.782}$$

$$KE(e) = \frac{0.782}{1 + .000544}$$

$$= 0.7816 \text{ MeV}.$$

#63 $\Delta E \Delta t = \hbar$

$$\Delta E = \frac{\hbar}{\Delta t}.$$

---

64. Magic numbers (Z).

2, 8, 20, 28, 50, 82, 126.

$^{18}_{8}O$ $Z = 8$, Magic → ~~sta~~ Stable

Just By knowing Z and the magic numbers you can solve this question