HW #1

1.2 Q - d·d

d + d ⇒ p + t + 4.1 MeV

Q = 4.1 MeV

4.5 ~ 4.6

$Q = [2M_d - (M_p + M_t)]c^2$

↑ use Ion mass → 2.013553 u

not atom mass → 2.014102 u

1.5 1 L Water

↳ 1 kg ⇒ $\frac{18\,g}{mol}$ → # of $\frac{H_2O}{D_2O}$ $\frac{D}{H} = \frac{1}{6700} \sim \frac{1}{6800}$

D ~ $\frac{1}{2}$ Reaction $\left\langle \begin{matrix} \frac{1}{4}\,ddt \\ \frac{1}{4}\,ddp \end{matrix} \right\}$ $\frac{Q_1 + Q_2}{2}$ Why 8.6 MeV α ?

1.8 ${}^{7}_{3}Li + {}^{1}_{1}H \rightarrow 2\,{}^{4}_{2}He$

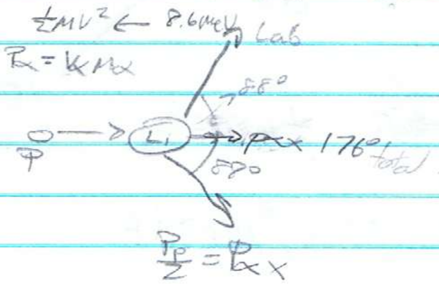
o ——→ (⁷Li)
rocket

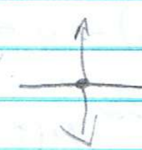
$Q = (M_i - M_f)c^2 \rightarrow 17.3\,MeV$

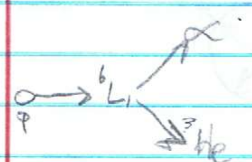
8.65 ↲

↘ 2 α's

Why 175° ?







Q ≃ 4 MeV others α's had 8.6 MeV

↑ Key point

$E_\alpha = \frac{M_h}{M_\alpha + M_h} Q = \frac{3}{7}(4.0)$

${}^{4}He + {}^{4}He \Rightarrow {}^{8}Be^{*} \Rightarrow T^{1/2} = 10^{-16}\,s$

${}^{8}_{4}Be + {}^{4}_{2}He \Rightarrow {}^{12}_{6}C + e^{+} + e^{-}$

Search Triple Alpha process

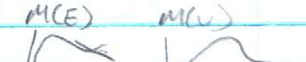
HW #2

2.3 $U = \frac{1}{4\pi\varepsilon_0}\frac{aeqn}{(R_a+R_b)}$

↳ $R_b = R_a(A_a^{1/3}+A_b^{1/3})$

	q	A
d	1	2
t	1	3
h	2	3
^{11}B	5	11

2.4 E $KT = 9keV$ $\bar{p}$ $\bar{v} \rightarrow \frac{1}{2}mv^{-2}$



↳ 9keV

$\bar{v}^2$ $(\bar{v})^2$

E ↓

$M(v) \rightarrow M(E)$

$M(E) = M(v)\frac{dv}{dE}$

$\int_0^\infty M(v)dv = \int_0^\infty M(E)dE$

↳ $\int_0^\infty M(v)dE\frac{dv}{dE}$

$\int_0^\infty M(v)\frac{dv}{dE}dE$

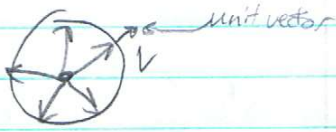
$dE = d(\frac{1}{2}mv^2)$

$= mvdv$

$f(v) \rightarrow v \Rightarrow E$ $\frac{1}{2}mv^2 = E$

2.6 $\int_{-\infty}^{\infty} M(\bar{v})d\bar{v} = \int_0^\infty M(E)dE$

$\bar{v} = v\hat{e}_r$

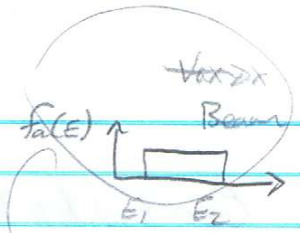


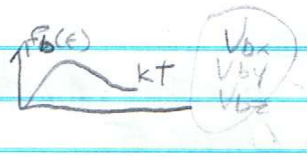
$d\bar{v} = v^2dv\sin\theta d\theta d\phi$

$d\bar{r} = r^2dr\sin\theta d\theta d\phi$

$\int M(\bar{v})v^2dv\int_0^\pi \sin\theta d\theta \int_{4\pi}^{2\pi} d\phi$

$M(\bar{v})v^2 4\pi = M(v)$





$$\langle \sigma v \rangle_{ab} = \int_{\vec{v}_a} \int_{\vec{v}_b} \sigma_{ab} \, |\vec{v}_a - \vec{v}_b| \, f_a(\vec{v}_a) f_b(\vec{v}_b) \, d\vec{v}_a \, d\vec{v}_b$$

$$|\vec{v}_a - \vec{v}_b| = \sqrt{|v_{ax} - v_{bx}|^2 + v_{by}^2 + v_{bz}^2}$$

$d\vec{v}_a \rightarrow dv_{ax}$ $d\vec{v}_b \rightarrow dv_{bx}\, dv_{by}\, dv_{bz}$

$f_b(\vec{v}_b) \rightarrow ( ) \exp \frac{-\frac{1}{2}mv^2}{kT}$

$v^2 = v_x^2 + v_y^2 + v_z^2$

$$\int_0^\infty f_a(E)\, dE = 1$$

$$f_a(E) = \frac{1}{E_2 - E_1} \qquad E_1 \le E \le E_2$$

$$f_a(\vec{v}_a) \rightarrow f_v(\vec{v}_{ax}) \qquad f_a(v_{ax}) = f(E)\frac{dE}{dv_{ax}}$$

$$f_a = \frac{1}{E_2 - E_1} mv$$

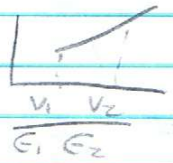
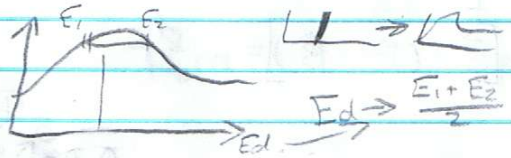


Fig 2.6



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