$$m({}_{Z}X^{A})c^2 =$$

$$[Z\, m({}_1H^1) + N m_n]c^2 - BE$$

$$= Z m_H c^2 + N m_n c^2 - a_v A + a_s A^{2/3} + a_c \frac{Z(Z-1)}{A^{1/3}} + a_{sym}\frac{(A-2Z)^2}{A} - \delta$$

for min. mass energy for a given A; Z can be obtained by condn:

$$\frac{d(mc^2)}{dZ} = 0$$

$$\frac{d(mc^2)}{dz} = m_H c^2 - m_N c^2$$

$$+ \frac{a_c}{A^{1/3}} (2Z-1)$$

$$+ \frac{a_{sy}}{A} 2 (A-2Z)(-2)$$

$$= 0$$

<u>then;</u>

$$Z\left[\frac{2a_c}{A^{1/3}} + 8\frac{a_{sym}}{A}\right] =$$

$$m_N c^2 - m_H c^2 + \frac{a_c}{A^{1/3}} +$$

$$4\, a_{sym}$$

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$$Z = \frac{(m_n - m_H)c^2 + \frac{a_c}{A^{1/3}} + 4a_{sym}}{\frac{2a_c}{A^{1/3}} + 8\frac{a_{sym}}{A}}$$

$$Z = \frac{0.7824\,\text{MeV} + \frac{0.72\,\text{MeV}}{A^{1/3}} + 4 \times 23\,\text{MeV}}{\frac{2 \times 0.72}{A^{1/3}} + 8\frac{23\,\text{MeV}}{A}}$$

$$Z \simeq \frac{4a_{sym}}{\frac{2a_c}{A^{1/3}} + 8\frac{a_{sym}}{A}} \simeq \frac{4a_{sym}}{2a_c A^{2/3} + 8a_{sym}}$$

$$= \frac{4A}{\frac{2a_c A^{1/3}}{a_{sym}} + 8}$$

$$= \frac{A}{2}\left(\frac{1}{1 + \frac{1}{4}\frac{a_c}{a_{sym}} A^{2/3}}\right)$$

$$= \frac{A}{2}\left[\frac{1}{1 + \left(\frac{0.72}{4 \times 23}\right) A^{2/3}}\right]$$

$$= \frac{A}{2}\left[\frac{1}{1 + 0.0078 A^{2/3}}\right]$$

for $A < 10$

$$Z \simeq \frac{A}{2}$$

But for $A > 10$

$$Z < A/2$$

Example : —

1

$A = 8$,

then $Z = 4$ — ${}_4Be^8$

Highly unstable

breaks into 2α

$${}^{8}_{4}Be \longrightarrow {}^{4}_{2}He + {}^{4}_{2}He$$

2 $A = 100$

then $Z \simeq 42$

3 $A = 235$

then $Z \simeq 90$ $\rightarrow$ ${}_{92}U^{235}$