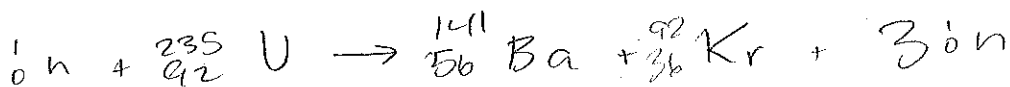
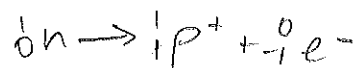


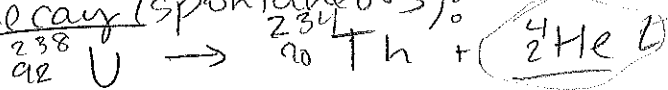
$^{235}_{92}\text{U}$ ← mass = neutrons + protons (not exact)
 ← charge (# of protons)



mass conserved
charge conserved

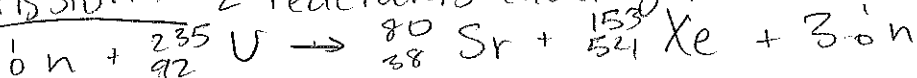


decay (spontaneous):



α particle; $^0_{-1}\text{e}^- = \beta$ particle

Fission - 2 reactants causing the reaction



products are lower in energy

exothermic

$E = mc^2 \rightarrow$ change in energy = change in mass
 $c = 3 \times 10^8 \frac{\text{m}}{\text{s}}$ speed of light



$$\Delta m = -1.394 \times 10^{-30} \text{ kg}$$

← use kg to get J

$$E = mc^2 = (1.394 \times 10^{-30} \text{ kg}) (3 \times 10^8 \frac{\text{m}}{\text{s}})^2 = 1.255 \times 10^{-13} \text{ J}$$

for 1 neutron

for 1 mol, $E \approx 7. \times 10^{10} \text{ J}$
(multiply by Avogadro's number)

nuclear - change in atoms, atomic identity changes

fusion (in the stars!)



$$\begin{array}{l}
 2.01325\text{g} \quad 3.0149\text{g} \quad 4.00150\text{g} \quad 1.00728\text{g} \quad \Delta m = 0.0196\text{g} \\
 \Delta E = (0.0196 \times 10^{-3} \text{ kg}) (3 \times 10^8 \frac{\text{m}}{\text{s}})^2 \\
 = 1.764 \times 10^{12} \frac{\text{J}}{\text{mol}}
 \end{array}$$

* masses are different for nuclei than individual protons/neutrons