

fusion → all reactions happen really fast and rapidly generate enormous amts. of gas.

# Nuclear Energy - Unit 7

Day 1:

Day 2:

- Nuclear change → a lot bigger than chemical change; huge differences in amt. of energy released.
  - For nuclear, any + Any time there's an energy change, there's a mass ~~change~~ change.
  - For nuclear change, energy changes are so big that mass change can be measured too.

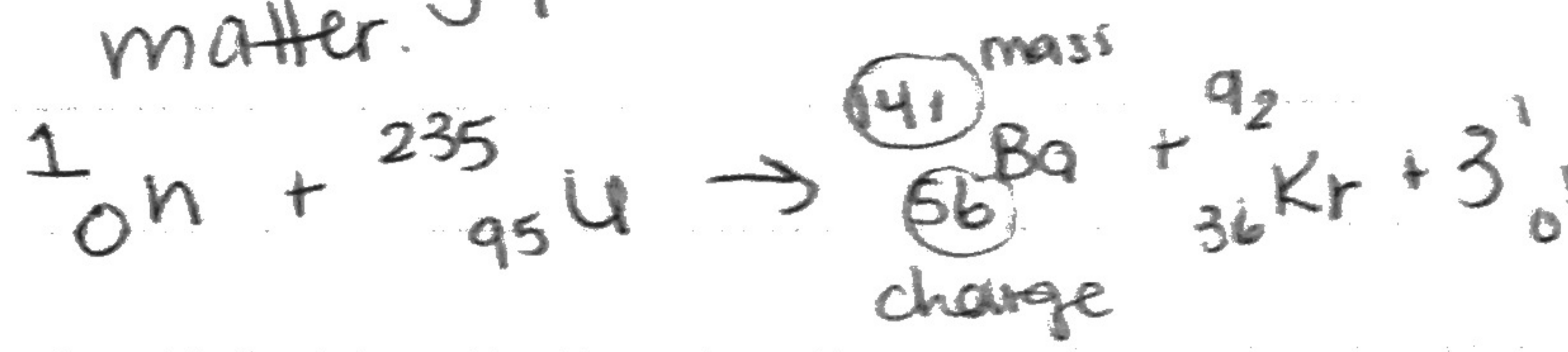
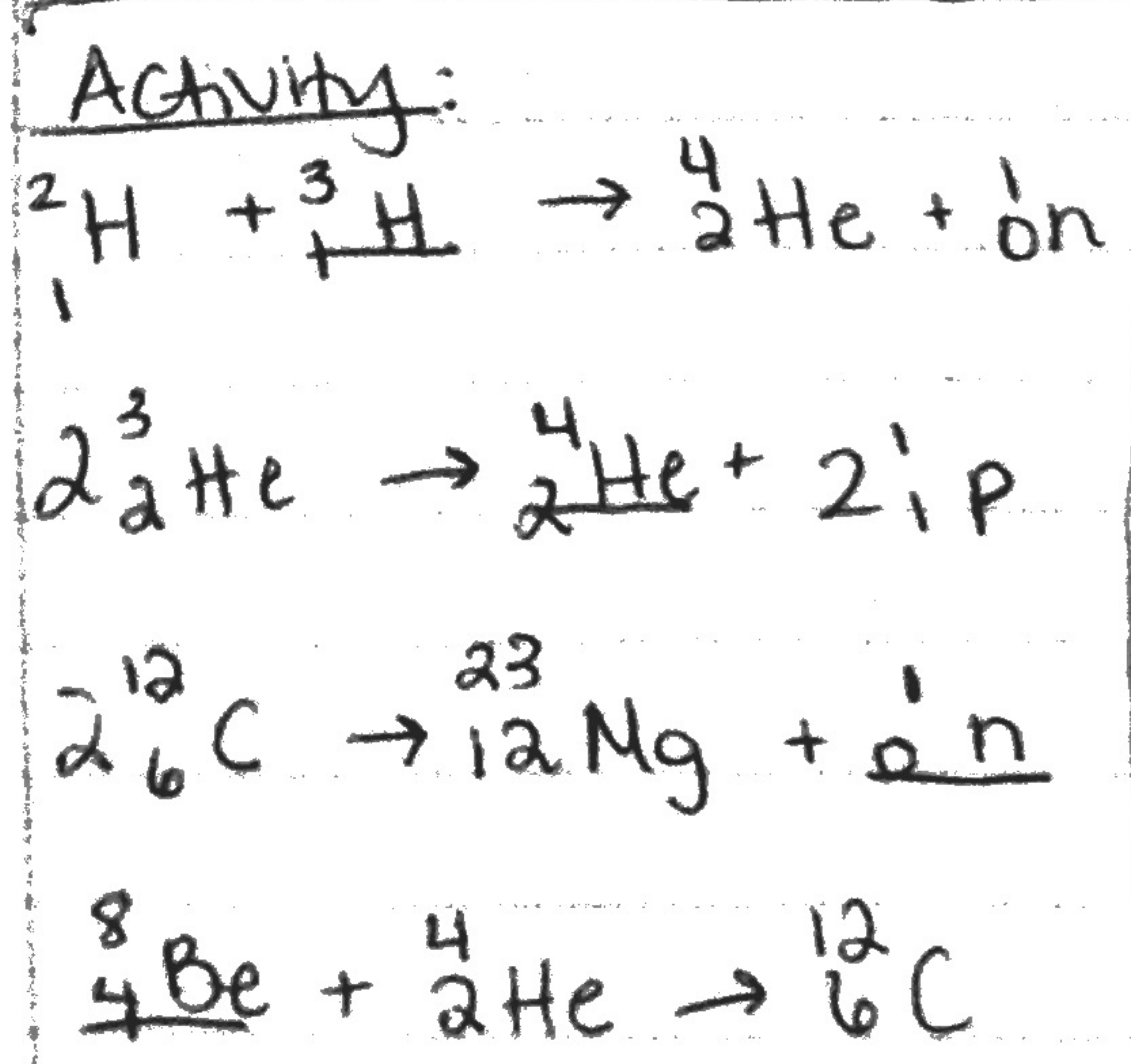
• Nuclide - bare nucleus (ignore electron)

• Chem change vs. nuclear change:

- atoms rearrange, but don't change atomic identity.

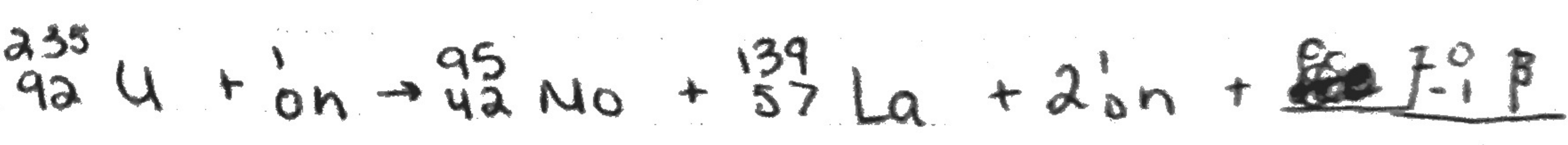
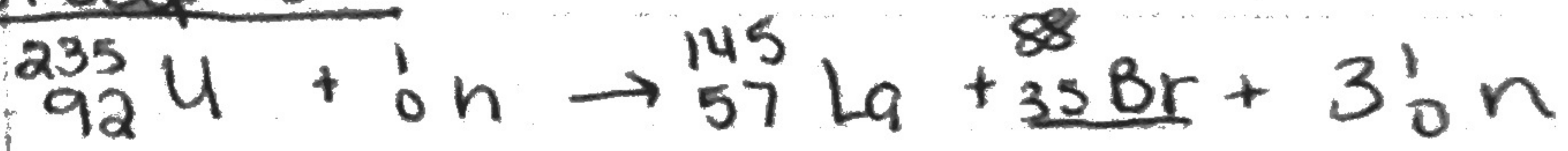
- change in atomic identity likely across nuclear change, matter converted to energy or energy converted to matter.

Group A:



- here, losing atomic identity, but generally conserving mass.  
 - add up #'s on top, both sides equal; add up #'s on bottom, both sides equal

Group B:



= proton  
 = neutron  
 = electron

## FUSION

Group A: lighter elements combining to make heavier things

## FSSION

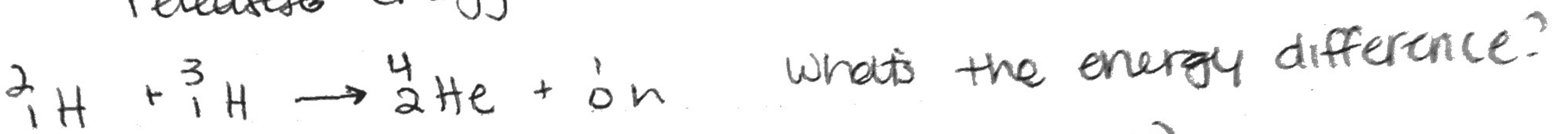
Group B: heavier combining to make light, a lot of possible products.

**TRANSMUTATION**: don't know if fusion or fission, some particles getting heavier, some getting lighter.

## Radioactive Decay:

${}^0_0\gamma \rightarrow$  no charge, no mass, it's just gamma energy

${}^0_{+1}e \rightarrow$  positive charged electron; positron; when electron and positron meet, it immediately disappears and releases energy.



• final - initial (energy for each given on ws)

•  $\Delta m$

$$\Delta E = \Delta mc^2$$

products

$$\Delta m = [1.00866 + 4.00151] - [2.01355 + 3.01605] \text{ amu}$$

reactants

$$= 5.01017 - 5.0296$$

dec in mass means dec in energy =  $-0.01949 \text{ amu}$

energy is being released (exothermic)

$1 \text{ amu} = 1.6605 \times 10^{-27} \text{ kg}$

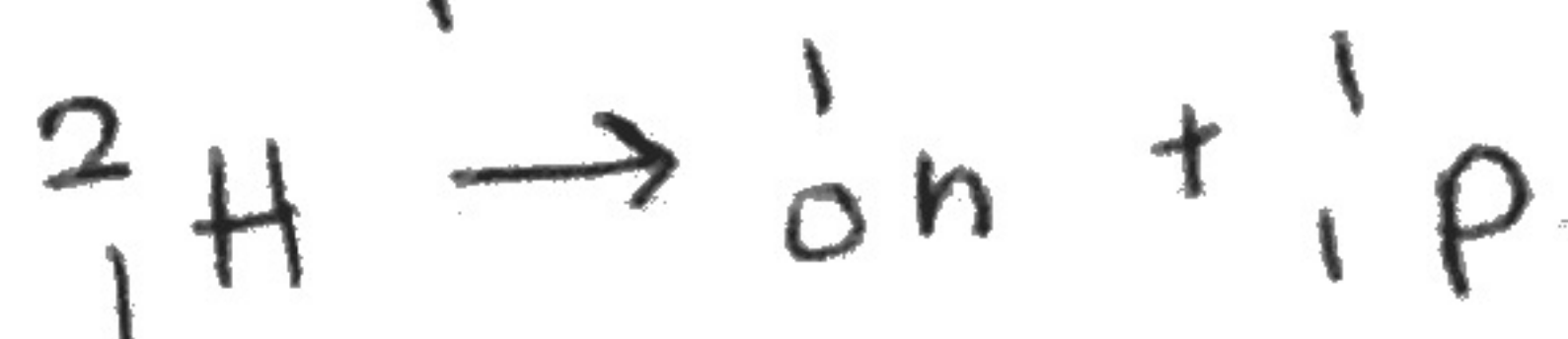
$= -3.2263515 \times 10^{-29} \text{ kg}$

A chem rxn. is about ~~1000 kg~~ 100 kg/mol.

A nuclear rxn is  $10^9 \text{ kg/mol}$ .

WHERE is energy coming from and WHY it's changing?

- energy changes b/c change in potential energy.
- For nuclear, has to do w/ stability of nucleus, there's a difference in stability - **BINDING ENERGY** (energy required to take nucleus and break up into separate parts.



Comparing thing together vs broken up

\* Always more stable together than broken up +

.... LOOK AT KEY

• change to kg, then mult. by Avogadro's # to get into moles.

- big nucleus = more binding energy b/c more particles. MOST STABLE, lowest energy thing is Fe. Making bigger and bigger nuclei until @ a certain pt no more fusion.

- In sun, H is turning to He and eventually will get higher in #s of nuclei until it gets to Fe. (Doesn't actually happen b/c a lot of things are involved like pressure, etc.)

\* on graph, one side is exothermic, one side is endo.

## ISOTOPES

### \* Stable Isotopes Graph

- stable combos are black dots.

- stable isotopes are almost linear; usually ~~1:1~~ 1:1 proton; neutron when they're small, but as  $Z$  increases, not 1:1, need more protons.

- vert. black line means more than one stable isotope for some elements.

- the graph ends  $\rightarrow$  there's a pt. where afterwards, there's no more stable isotopes; they're all falling apart making smaller parts. (after Bi stops)

- when things decay, try to get back to band of stability. ; closer to band means more stable.

- unstable things fall apart  $\rightarrow$  they're radioactive; spit out energy.