CONCEPT: MASS DEFECT

Calculating Predicted Mass

- **Predicted Mass** represents the mass of _____ subatomic particles within a given element.
  - □ Recall, 1 AMU = _____ kg

Subatomic Particle	Actual Mass (kg)	Relative Mass (amu)
Neutron	1.67493×10^{-27}	
Proton	1.67262×10^{-27}	
Electron	0.00091×10^{-27}	

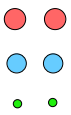
EXAMPLE: Calculate the predicted mass for a helium-4 isotope.

Energy to Mass Conversion

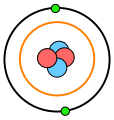
- The ____ **Law** states that energy cannot be created nor destroyed, but instead changes forms.
  - □ **Mass Defect (__):** the _____ lost from combining subatomic particles in the formation of an isotope.
  - □ Recall that bond formation involves the _____ of energy which is why it is to the right of the equation.
    - Seen in the opposite direction, energy is _____ to break up the isotope.
  - □ **Nuclear Mass:** the _____ mass (atomic mass) of a given isotope.

Energy–Mass Conversion

Predicted Mass — Mass = Mass Defect = $E = m \cdot c^2$ — Nuclear Mass + Energy



Sum = **4.03296 amu** — Sum = **0.030358 amu**



Sum = **4.002602 amu**

- □ As a result of energy being converted to mass: _____ mass is always greater than _____ mass.

EXAMPLE: What is the mass defect (in kg) of calcium-42 if its atomic mass is 41.958618 amu?

CONCEPT: MASS DEFECT

Calculating Mass Defect

- If the nuclear mass of an isotope is not given then more extensive calculations will be needed to calculate mass defect.
  - □ In these instances, nuclear mass is the difference between _____ number of the isotope and mass of all ____.

Nuclear Mass Formula

Nuclear Mass = [_____ Number – (# e^-)•(_____ amu)]

EXAMPLE: Calculate the mass defect (in amu) for oxygen-16. (1 neutron = 1.00866 amu, 1 proton = 1.00727 amu, & 1 electron = 0.00055 amu).

STEP 1: To find predicted mass, find the number of _____ within the isotope and add their masses together.

STEP 2: To find nuclear mass, subtract the mass number by the combined mass of all _____.

STEP 3: Use the calculated masses from STEPS 1 and 2 to determine the mass defect.

PRACTICE: Calculate the mass defect (in mg) for the following isotope. (1 neutron = 1.00866 amu, 1 proton = 1.00727 amu, & 1 electron = 0.00055 amu).

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