Name: _____

Class: _____

Due Date: _____

Physics Topic 66 – Nuclear Binding Energy and Mass Defect

Answer the following questions.

1. C: Define *isotope.*

2. C: *Isotopes* have the same _____ properties but different _____ properties.

3. C: Define *mass defect*. Units?

4. C: Which has more mass: two individual protons or two protons in the same nucleus?

5. C: Define *binding energy*. Units?

6. C: **Use a pencil and ruler!** Draw and label the *binding energy curve*. Label the horizontal and vertical axis. Label the most stable element.

7. C: Define *atomic mass unit*. Units?

8. C: Use the equation $\Delta E = \Delta m \times c^2$ to find the energy equivalent of 1 u in Joules and $\frac{\text{MeV}}{\text{c}^2}$.

9. E: Determine the binding energy per nucleon for a neutral carbon nucleus.

10. C: Define *transmutation.*

11. E: Consider an atom of $^{17}_{37}\text{Cl}$.

    a. Determine the number of protons, neutrons, and electrons that make up this atom.

    b. Determine the total mass of a Cl-37 nucleus based on the sum of its separate parts in kg and u.

c. The atomic mass of Cl-37 is approximately 36.965903 u. Subtract the mass of the electrons to determine the mass of a Cl-37 nucleus. Convert this to kg.

d. Find the difference between the mass of a single nucleus of Cl-37 and the sum of its parts in both kg and u. This is called the *mass defect*.

e. Convert this "mass defect" into the energy equivalent through $E = mc^2$.

f. Convert the resulting "energy defect" into binding energy per nucleon in $\frac{\text{MeV}}{\text{nucleon}}$.

12.C: What happens in nuclear decay if the *mass difference* is positive? Is nuclear decay possible?
https://openstax.org/books/college-physics/pages/31-4-nuclear-decay-and-conservation-laws

13.C: What happens in nuclear decay if the *mass difference* is negative? Is nuclear decay possible?

14.C: Describe the *strong nuclear force*.