Nuclear Structure

1. Identify the components of the nucleus of an atom. Describe the charge and mass of these components.

2. The radius of a nucleus is on the order of 10^{-15} m.
    a. Calculate the magnitude and direction for the electrostatic force between two protons at this distance.
    b. Calculate the magnitude and direction for the gravitational force between the same two protons.

3. Describe the nuclear strong force in terms of strength and range.

4. Describe the difference between an isotope and an ion.

5. A nuclide has 38 protons and 50 neutrons. Identify the element and write the symbol.

6. Write the symbol for the isotope of potassium with 21 neutrons.

7. Identify the number of neutrons found in the ^{35}Cl nucleus.

8. The mass of the copper-63 nucleus is 62.91367 u.
    a. Find the combined mass of the protons and neutrons in the nucleus.
    b. The difference between the value calculated and the given value is the *mass defect*. Describe what this means.
    c. Determine the binding energy of the nucleus.
    d. Determine the binding energy per nucleon.

9. Show the calculations to find the mass defect and binding energy per nucleon for the following
    a. Carbon-12
    b. ^{56}Fe
    c. Silver-107

10. Alpha (α), Beta (β) and Gamma (γ) are types of nuclear decays. Describe the properties of each.

11. Ra – 226 decays by alpha decay.
    a. Write the reaction.
    b. Find the mass loss in the reaction.
    c. Find the energy released.
    d. Write the next 3 steps in the decay chain.

12. Ba – 139 has an atomic mass of 138.908835 u and La – 139 has an atomic mass of 138.906347 u. What is the maximum possible energy of the β^- radiation in the decay?