

1. What force is responsible for holding the nucleus together? What particles does it act on? Does it work over long or short distances? Draw a diagram demonstrating this force.

2. What force acts on protons that are on opposite sides of the nucleus? Is it an attractive or a repulsive force? Draw a diagram illustrating this force.

The following questions refer to the “Band of Stability” diagram (see handout).

3. What does each black dot represent? How do you determine what isotope it represents?

4. What is the most stable neutron/proton ratio for lighter elements? Why are neutrons necessary?

5. What is the most stable neutron/proton ratio (n^0/p^+) for heavier elements? Why is this ratio different from the ratio in the previous question?

6. In the region above the band of stability, are there too many protons or neutrons? What decay process occurs in this region? Write the decay equation that represents this transmutation of one nucleon into another. What direction does the nucleus “move” on the Band of Stability as a result of this decay?

7. In the region below the band of stability, are there too many protons or neutrons? What decay processes occur in this region? Write the decay equations that represent these transmutations of one nucleon into another. What direction does the nucleus “move” on the Band of Stability as a result of this decay?
8. What is the primary decay mode for atoms with $Z > 83$? What particle(s) are there too many of? Write the decay equation for the isotope Pa-231. What direction does the nucleus “move” as a result of this decay?
9. Si-30 is the heaviest stable isotope of silicon. Si-32 is unstable because it contains an excess of a certain nucleon. What nucleon is in excess, and so what is the most probable decay type would create a more stable nucleus? Explain. Write the complete decay equation for this transmutation. *Hint: what is its n/p ratio compared to Si-30? (Note: you are NOT trying to make Si-30.)*
10. V-51 is the lightest stable isotope of vanadium. V-50 is unstable because it contains an excess of a certain nucleon. What nucleon is in excess, and so what are the two possible decay types would create a more stable nucleus? Explain. Write the complete decay equation for both of these transmutations. *Hint: what is its n/p ratio compared to V-51? (Note: you are NOT trying to make V-50.)*