Island of Stability

Name: ________________________
Period: _______ Date: __________

Purpose: Some combinations of neutrons, electrons, and protons are not stable enough to be called elements. This lesson shows you how to predict the numbers of neutrons, electrons, and protons of the isotopes commonly found in nature.

Isotopes found in nature are all located within the gray area on the graph below. This gray area is called the band of stability.

Instructions: Locate where the following atoms would be on the graph below. Pay careful attention to your calculations. Label each atom after it has been plotted. Note: Potassium-41 has been plotted for you.

- Mg (24, 12)
- Nd (142, 60)
- Ir (195, 77)
- Br (81, 35)
- U (238, 92)
- Ir (191, 77)

Band of stability

Number of protons

Number of neutrons

20 40 60 80 100 120 140 160 180

0 20 40 60 80 100 120
Investigation IV – A Subatomic World

Lesson 1 – Island of Stability

Answer the following questions:
1. Did any of your atoms land outside the gray area? Explain why or why not.

2. How can there be two different atoms of iridium?

3. What does the line on the graph represent?

4. If an atom has the same number of neutrons as it does protons, will it be an isotope found in nature? Explain.

5. Two of the atoms you plotted are radioactive, that is, their nuclei fall apart over time. Which two do you think they are? What is your reasoning?

6. Imagine a chemist was trying to create an atom with 60 protons and a mass number of 155. Would this be possible? Why or why not?

7. Where on the graph would you expect the other isotopes of magnesium to be located (magnesium-25 and magnesium-26)? Explain.

8. If an element had 90 protons, how many neutrons would be a good number for it to have in order to be considered a stable element? What element would this be?

9. What do you suppose that little island of gray on the graph represents?

10. Which of the following isotopes are you likely to find? Identify the element by name if it is an isotope that you might find in nature.

   \[
   \begin{array}{ccccccc}
   162^\text{0} & 75^\text{0} & 112^\text{0} & 260^\text{0} & 300^\text{0} \\
   63^\text{3} & 33^\text{3} & 56^\text{3} & 88^\text{3} & 115^\text{3}
   \end{array}
   \]

Making Sense:
What kind of generalization can you make about how the number of protons and neutrons are related to each other in the elements?

If you finish early...
If you were going to try to “look for” or create new elements in the laboratory, what would be a good place to start? Explain.