Name _____ Average Atomic Mass POGIL Activity

Isotopes Introduction

1. Fill in the following table.

Isotope Symbol	Atomic Number	Mass Number	Protons	Neutrons
$_{7}Li_{3}$				
$_{6}Li_{3}$				
$_{19}F_{9}$				
$_{20}Ne_{10}$				
$_{21}Ne_{10}$				
$_{22}Ne_{10}$				

VOCABULARY:

Atoms with the same number of protons but different number of neutrons are called *ISOTOPES* of an element.

2. Do all isotopes of an element have the same atomic number? Explain your answer.

3. Do all isotopes of an element have the same mass number? Explain your answer.

4. Consult the following list of isotope symbols:

$$^{204}_{82}Pb,\ ^{82}_{35}Br,\ ^{78}_{35}Br,\ ^{208}_{82}Pb,\ ^{204}_{78}Pt,\ ^{205}_{82}Pb$$

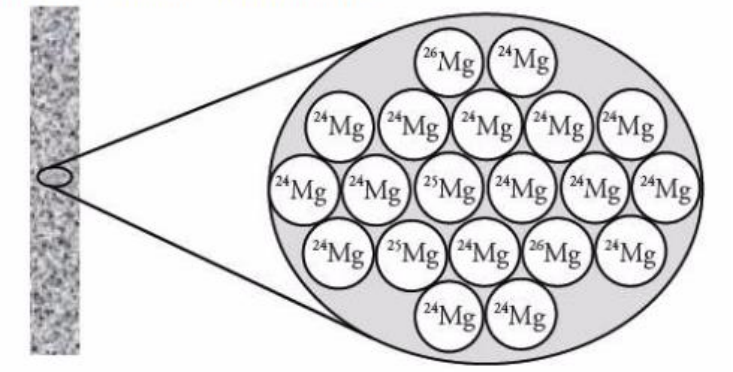
   Which are isotopes of one another?

5. What part of the isotope symbols is most helpful in determining which ones are isotopes of one another?

Weighted Average Atomic Mass (W.A.A.M.)

Background: Most elements have more than one naturally occurring isotope. As you learned previously, the atoms of those isotopes have the same atomic number (number of protons), making them belong to the same element. However, they have different mass numbers (total number of protons and neutrons), giving them different atomic masses. So which mass is put on the periodic table for each element? Is it the most common isotope's mass? The heaviest mass? This activity is meant to help answer that question.

MODEL 1: A Strip of Magnesium Metal



6. There are three different naturally occurring isotopes of Magnesium shown in the atomic view in Model 1. Color all the atoms in the model so that all atoms of each isotope is a different color. You should use three different colors.

7. List the mass numbers of magnesium's naturally occurring isotopes shown in Model 1.

8. What are the atomic numbers of magnesium's naturally occurring isotopes shown in Model 1?

9. For the 20 atoms of magnesium shown in Model 1, fill in the table below that indicates the mass numbers of the three isotopes and how many atoms of each isotope are present.

	Mass Number	Number of Atoms
Isotope 1		
Isotope 2		
Isotope 3		

10. Which isotope is most common in Model 1?

11. Based on Model 1 and the table in #9, if the sample only contained 10 atoms, how many atoms of each isotope would be present?

Model 2 – Natural Abundance Information for Magnesium

Isotope	Natural Abundance on Earth (%)	Atomic Mass (amu)
^{24}Mg	78.99	23.9850
^{25}Mg	10.00	24.9858
^{26}Mg	11.01	25.9826

Model 2 shows the abundance, or the percentage of each isotope found in a naturally-occurring sample. It also shows the exact atomic mass, in amu, of each isotope.

12. If there are 20 atoms in a sample, calculate how many atoms of each isotope are present in that sample (based on the percent abundance of each isotope). All answers should be reported as a whole number (you can't have part of an atom!).

13. If you could pick up a single atom of magnesium and put it on a balance, it would most like have an atomic mass of _____ amu. Explain your answer.

14. Look at your periodic table. What mass is listed for magnesium?

15. Does the value listed on the periodic table match exactly any of the atomic masses in Model 2?

16. What would be a practical way of showing the mass of magnesium on the periodic table given that every sample is a mix of the isotopes?

17. Propose a way to calculate the average atomic mass of 100 atoms of magnesium. You can show a mathematical equation, but it is not required.

Model 3 – Proposed Average Atomic Mass Calculations

Mary's Method

$$\frac{(78.99)(23.9850\ \text{amu}) + (10.00)(24.9858\ \text{amu}) + (11.01)(25.9826\ \text{amu})}{100} = \_\_\_\_\_$$

Alan's Method

$$\frac{23.9850\ \text{amu} + 24.9858\ \text{amu} + 25.9826\ \text{amu}}{3} = \_\_\_\_\_$$

18. Complete the calculations above and report your answer on the line provided.

19. Which method shown in Model 3 gives an answer for average atomic mass that matches the value listed on the periodic table?

20. Explain why the mathematical reasoning was incorrect for the method in Model 3 that did not match the value listed on the periodic table.

21. Use the method for Model 3 that gave the correct answer to calculate the average atomic mass for oxygen based on the information listed below. Show all of your work

Isotope	Natural Abundance on Earth (%)	Atomic Mass (amu)
^{16}O	99.76	15.9949
^{17}O	0.04	16.9991
^{18}O	0.20	17.9992