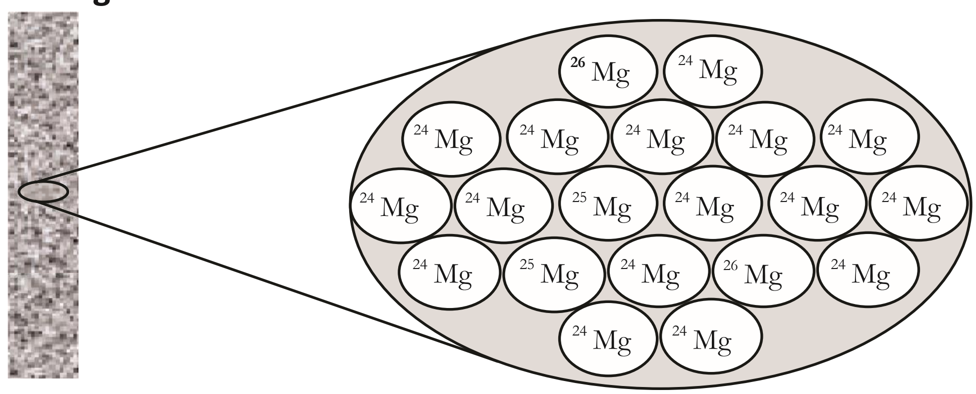
Name: ____ **Block:** _____**POGIL: Average Atomic Mass**:

How are the masses on the periodic table determined?

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, but 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 will help answer that question.

Model 1 – A Strip of Magnesium Metal



1. Write in the atomic number for each Mg atom in Model 1.__________________
2. What are the mass numbers of the naturally occurring isotopes of magnesium shown in Model 1?

3. For the sample of 20 atoms of magnesium shown in Model 1, **draw** a table indicating the mass numbers of the three isotopes and the number of atoms of each isotope present.

4. Which isotope of magnesium is the most common in Model 1?____________________________

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

5. If you could pick up a single atom of magnesium and put it on a balance, the mass of that atom would most likely be _______________ amu. **Explain** your reasoning.

6. Refer to a periodic table and find the box for magnesium.
   a. Write down the decimal number shown in that box.___________________
   b. Does the decimal number shown on the periodic table for magnesium match any of the atomic masses listed in Model 2?
7. What would be a practical way of showing the mass of magnesium atoms on the periodic table given that most elements occur as a mixture of isotopes?

Model 3 – Proposed Average Atomic Mass Calculations

8. Complete the three proposed calculations for the average atomic mass of magnesium below:

Mary's Method

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

Jack's Method

$$(0.7899)(23.9850\text{ amu}) + (0.1000)(24.9858\text{ amu}) + (0.1101)(25.9826\text{ amu}) = \underline{\qquad\qquad}$$

Alan's Method

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

9. Consider the calculations in Model 3.

a. Which methods shown in Model 3 give an answer for average atomic mass that matches the mass of magnesium on the periodic table?

b. Explain why the mathematical reasoning was incorrect for any method(s) in Model 3 that did not give the correct answer for average atomic mass (the one on the periodic table).

10. Use one of the methods in Model 3 that gave the correct answer for average atomic mass to calculate the average atomic mass for oxygen. Show all of your work and check your answer against the mass listed on the periodic table.

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

Recall that all isotopes of an element have the same physical and chemical properties, with the exception of atomic mass (and for unstable isotopes, radioactivity). Therefore, the periodic table lists a weighted **average atomic mass** for each element. In order to calculate this quantity, the natural abundance and atomic mass of each isotope must be provided.

11. Boron has two naturally occurring isotopes: boron-10 and boron-11. Which isotope is more abundant on Earth? Explain how your group determined the answer.