

## Unit 2: Atomic Structure and Nuclear Chemistry

### - Section 2: Isotopes, Decay, and Average Atomic Mass

Topic(s):	Details:
Isotopes	<ul style="list-style-type: none"> <li>• Formed when an atom loses or gains _____ (often during _____).</li> <li>• Affects the _____ of the atom but not the _____.               <ul style="list-style-type: none"> <li>○ Average atomic mass is the _____ average mass of all of the naturally occurring _____ of that _____.</li> <li>○ It factors in the _____ of each isotope.</li> </ul> </li> </ul> <div data-bbox="516 659 1425 1108" style="border: 2px solid red; padding: 10px; margin: 10px auto; width: fit-content;"> </div>
Isotopes - Radioactive Decay	<ul style="list-style-type: none"> <li>• When isotopes are _____, they can undergo _____.</li> <li>• When this happens, they can emit _____ or _____ In order to reach a more _____ state.</li> </ul> <p><b>Alpha decay</b></p> ${}_{92}^{235}\text{U} \longrightarrow {}_{90}^{231}\text{Th} + {}_2^4\text{He}$ <p><b>Beta decay</b></p> ${}_{92}^{235}\text{U} \longrightarrow {}_{93}^{235}\text{Np} + {}_{-1}^0\text{e}$ <p><b>Gamma decay</b></p> ${}_{92}^{235}\text{U} \longrightarrow {}_{92}^{235}\text{U} + {}_0^0\text{Y}$ <div data-bbox="1122 1482 1487 1829" style="border: 1px solid black; padding: 10px; margin: 10px auto; width: fit-content;"> <p style="text-align: center;"><i>Copy down the table of Radioactive Decay on a separate sheet of paper and attach to your notes!</i></p> </div>

<b>Average Atomic Mass</b>	<p>Average Atomic Mass is calculated by multiplying the _____ of each _____ by its respective _____ and _____ the totals.</p> <p><b>Using the data below, calculate the average atomic mass of Carbon:</b></p> <table border="1" data-bbox="375 302 1573 527"> <thead> <tr> <th>Isotope</th> <th>Mass</th> <th>Percent Abundance</th> </tr> </thead> <tbody> <tr> <td>Carbon-12</td> <td>12.000</td> <td>98.90%</td> </tr> <tr> <td>Carbon-13</td> <td>13.003</td> <td>1.10%</td> </tr> </tbody> </table>	Isotope	Mass	Percent Abundance	Carbon-12	12.000	98.90%	Carbon-13	13.003	1.10%
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<b>AAM Practice</b>	<ol style="list-style-type: none"> <li>Naturally occurring chlorine consists of 75.00% Cl-35 and 25.00% Cl-37. Find the average atomic mass.</li>   <li>Calculate the atomic mass of an element with isotope A occurring 70.0% of the time with a mass of 13.0 amu and isotope B occurring 30.0% of the time with a mass of 15.0 amu.</li> </ol>									
<p><b>SUMMARY:</b> Re-read your notes from today and summarize them in 2 or more sentences.</p>										

Practice Problems:

- How do atoms become isotopes?
  
- Why do nuclei emit particles or rays of energy?
  
- Explain the difference between beta positive and beta negative decay.

4. The term “average atomic mass” is a \_\_\_\_\_ average, and so is calculated differently from a “normal” average. Explain how this is used in the calculation.
5. The element copper has naturally occurring isotopes. The relative abundance and atomic masses are 69.2% for a mass of 63 amu and 30.8% for a mass of 65 amu. Calculate the average atomic mass of copper. **Show all work!**
6. The four isotopes of lead are shown below, each with its percent by mass abundance and the composition of its nucleus. Using the following data, first calculate the approximate atomic mass of each isotope. (Assume that each proton and neutron has a mass of 1.00 amu. Disregard the mass of the electrons.) Finally, calculate the average atomic mass of lead.

82p  
122n  
1.37%

82p  
124n  
26.26%

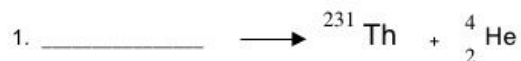
82p  
125n  
20.82%

82p  
126n  
51.55%

7. There are three isotopes of silicon. They have mass numbers of 28, 29 and 30. The average atomic mass of silicon is 28.086amu. What does this say about the relative abundances of the three isotopes?

### Decay Practice:

Fill in the missing details from the equations:



Write the equation for each:

- The alpha decay of Radon-198
- The beta positive decay of Uranium-237
- Plutonium-244 undergoes gamma decay