Unit: Atomic Structure

Details

MA Curriculum Frameworks (2016): N/A

Mastery Objective(s): (Students will be able to...)

• Calculate the average atomic mass of an atom from percent abundance data.

#### **Success Criteria:**

- Solutions correctly turn masses into percentages.
- Algebra and rounding to appropriate number of significant figures is correct.

#### Tier 2 Vocabulary: abundance

#### Language Objectives:

• Explain the laws of conservation of mass, definite proportions, and multiple proportions.

#### Notes:

<u>mass number</u>: the mass of *one individual atom* (protons + neutrons). Always a whole number.

<u>abundance</u>: the percentage of atoms of an element that are one specific isotope.

<u>average atomic mass</u>: the estimated weighted *average* of the mass numbers *of all of the atoms* of a particular element on Earth.

Analogy: average atomic mass works the same way as class average on a test.

- 1. Multiply each score times the number of students who got it.
- 2. Add up the number for each score to get the total points.
- 3. Divide the total by the number of students to get class average.

Use this space for summary and/or additional notes:

Details Unit: Atomic Structure						
Problem:						
The atomic mass and abundance of the two stable isotopes of carbon are:						
Isotope	Atomic Mass (amu)	Relative Abundance				
carbon-12	12.000 000	98.93 %				
carbon-13	13.003 355	1.07 %				
What is the average atomic mass of carbon? How to solve:						
						<ol> <li>Convert percent abundances to fractions (divide by 100).</li> <li>Multiply the fractional abundance times the atomic mass for each isotope.</li> <li>Add up the sub-total from each isotope to get the total atomic mass.</li> <li>Check that your average atomic mass is in between the smallest and largest.</li> </ol>
Answer:						
1. Convert abundances to fractions						
98.93 % ÷ 10	00 = 0.9893 1.07	% ÷ 100 = 0.0107				
<ol> <li>Multiply abundance x mass # for each isotope</li> <li>0.9893 x 12.000 000 = 11.8716</li> </ol>						
0.0107 X 13.003 3	0.0107 × 13.003 355 = 0.1391					
3. Add up the number from each isotope to get the total						
11.8716 + 0.1391	<ul> <li>11.8716 + 0.1391 = 12.0107</li> <li>4. Check that your answer is in between the mass number of the smallest isotope and the mass number of the largest one. Yes, 12.0107 is between 12 and 13.</li> </ul>					
4. Check that your a isotope and the n Yes, 12.0107 is be						
	Details         Problem:         The atomic mass and abuters         Isotope         carbon-12         carbon-13         What is the average atom         How to solve:         1. Convert percent at         2. Multiply the fract         3. Add up the sub-tom         4. Check that your at         98.93 % ÷ 10         2. Multiply abundant         0.9893 x 12.0000         0.0107 x 13.003 3         3. Add up the numb         11.8716 + 0.1391         4. Check that your at         isotope and the m         Yes, 12.0107 is bether	DetailsProblem:The atomic mass and abundance of the two stateIsotopeAtomic Mass (amu)carbon-1212.000 000carbon-1313.003 355What is the average atomic mass of carbon?How to solve:1. Convert percent abundances to fractions2. Multiply the fractional abundance times to3. Add up the sub-total from each isotope to4. Check that your average atomic mass is inAnswer:1. Convert abundances to fractions98.93 % ± 100 = 0.98931.072. Multiply abundance x mass # for each iso0.9893 x 12.000 000 = 11.87160.0107 x 13.003 355 = 0.13913. Add up the number from each isotope to11.8716 + 0.1391 = 12.01074. Check that your answer is in between the isotope and the mass number of the larger Yes, 12.0107 is between 12 and 13.				

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**Big Ideas** Details **Homework Problems** Calculate the average atomic mass of each of the following elements, based on the percent abundance of their isotopes. For each element, your answers should agree with the atomic mass listed on the periodic table. Because you can look up the answers, you must show how to set up the calculations in order to receive credit. 1. bromine atomic mass relative isotope (amu) abundance <sup>79</sup><sub>35</sub>Br 78.9184 50.69%  $^{81}_{35}{\rm Br}$ 80.9163 49.31% 2. boron atomic mass relative isotope abundance (amu) <sup>10</sup><sub>5</sub>B 10.0129 19.9% <sup>11</sup><sub>5</sub>B 11.0093 80.1%

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Big Ideas	Details	•		Unit: Atomic S
	3. chlorine			
	isotope	atomic mass (amu)	relative abundance	_
	<sup>35</sup> <sub>17</sub> Cl	34.9689	75.78%	
	<sup>37</sup> <sub>17</sub> Cl	36.9659	24.22%	
	4 magnesium	2		
	4. magnesium	atomic mass	relative	
	isotope	(amu)	abundance	
	<sup>24</sup> <sub>12</sub> Mg	23.9850	78.99%	
	<sup>25</sup> <sub>12</sub> Mg	24.9858	10.00 %	
	<sup>26</sup> <sub>12</sub> Mg	25.9826	11.01%	
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