AP Chemistry

Exercise 3.3

Atomic Masses & the Mole

Name: _____

Date: _____ Per: _____

1. An element consists of 1.40% of an isotope with mass 203.9730 u, 24.10% of an isotope with a mass 205.9745 u, 22.10% of an isotope with mass 206.9759 u, and 52.40% of an isotope with mass 207.9766 u. Calculate the average atomic mass and identify the element.

Average atomic mass: _____
Element: _____

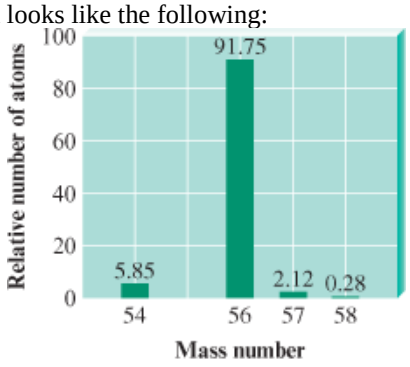
2. Assume silicon has three major isotopes in nature as shown in the table below. Fill in the missing information.

Isotope	Mass (u)	Abundance
^{28}Si	27.98	4.70%
^{29}Si		
^{30}Si	29.97	3.069%

3. The element europium exists in nature as two isotopes: ^{151}Eu has a mass of 150.9196 u and ^{153}Eu has a mass of 152.9209 u. The average atomic mass of europium is 151.96. Calculate the relative abundance of the two europium isotopes.

^{151}Eu: _____
^{153}Eu: _____

4. The stable isotopes of iron are ^{54}FE, ^{56}Fe, ^{57}Fe, and ^{58}Fe. The mass spectrum of iron looks like the following:



Use the data on the mass spectrum to estimate the average atomic mass of iron and compare it to the value on your Periodic Table.

Average atomic mass : _____

5. Complete the following table.

Mass of Sample	Moles of Sample	Molecules in Sample	Total Atoms in Sample
4.24 g C_6H_6			
	0.224 mol H_2O		
		2.71 x 10^{22} molecules CO_2	
			3.35 x 10^{22} total atoms in CH_3OH sample

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6. In using a mass spectrometer, a chemist sees a peak at a mass of 30.0106. Of the choices $^{12}C_2{}^{1}H_6$, $^{12}C^{1}H_2{}^{16}O$, and $^{14}N^{16}O$, which is responsible for this peak? Pertinent masses are $^{1}H = 1.007825$; $^{16}O = 15.994915$; $^{14}N = 14.003074$.

7. Aspartame is an artificial sweetener that is 160 times sweeter than sucrose (table sugar) when dissolved in water. It is marketed as NutraSweet. The molecular formula of aspartame is $C_{14}H_{18}N_2O_5$.
   a. Calculate the molar mass of aspartame.
   b. What amount (moles) of molecules are present in 10.0 g of aspartame?
   c. Calculate the mass in grams of 1.56 moles of aspartame.
   d. What number of molecules are in 5.0 mg of aspartame?
   e. What number of nitrogen atoms are in 1.2 g of aspartame?
   f. What is the mass in grams of 1.0×10^9 molecules of aspartame?

8. Natural rubidium has the average mass of 85.4678 u and is composed of isotopes ^{85}Rb (mass = 84.9117 u) and ^{87}Rb. The ratio of atoms $^{85}Rb/^{87}Rb$ in natural rubidium is 2.591. Calculate the mass of ^{87}Rb.