Week 4 Packet – Honors Chem

This is *hopefully* all the handouts we will use this week in Honors Chem. Due to the challenging logistics of this year, please offer grace if I miss a handout or if things change during the week. **Please note** – You do not *have* to print. I am just providing the option to make things easier for those who want to print. All of these pages are on the class website, always! www.mychemistryclass.net

***I will put the glue ins for the notes on the front and/or back of the packet cover page like this – since you don't need the cover page for anything you can always just cut these out and glue them in. Trying to save some paper for those of you who are printing! ☺**

Dougherty Valley HS Chemistry
Atomic Numbers and Isotopes 2

Worksheet #11

Name: **Period:** **Seat#:**

Complete the following chart and answer the questions below:

1) The 3 particles of the atom are: ________________ ________________ ________________

2) Their respective charges are: ________________ ________________ ________________

3) The number of protons in one atom of an element determines the atom's ____________________________, and the number of electrons determines the ______________________ of an element.

4) The atomic number tells you the number of ______________________ in one atom of an element. It also tells you the number of ______________________ in a neutral atom of that element. The atomic number gives the "identity" of an element as well as its location on the Periodic Table. No two different elements will have the same ______________________ number.

5) The ______________________________ of an element is the average mass of an element's naturally occurring atom, or isotopes, taking into account the ______________________________________ of each isotope.

6) The ___________________ of an element is the total number of protons and neutrons in the ______________________ of the atom.

7) The mass number is used to calculate the number of ______________________ in one atom of an element. In order to calculate the number of neutrons you must subtract the ______________________ from the ______________________.

Give the symbol and number of protons in one atom of:

8) Lithium	**9)** Iron	**10)** Oxygen	**11)** Kyrpton
12) Bromine	**13)** Copper	**14)** Mercury	**15)** Helium

Give the symbol and number of electrons in one atom of:

16) Uranium	**17)** Boron	**18)** Antimony
19) Chlorine	**20)** Iodine	**21)** Xenon

Give the symbol and number of neutrons in one atom of:

22) Barium	**23)** Bismuth	**24)** Carbon	**25)** Mercury
26) Magnesium	**27)** Hydrogen	**28)** Fluorine	**29)** Europium

Dougherty Valley HS Chemistry
Atomic Numbers and Isotopes 2

Name the element which has the following number of particles

30) 26e, 29n, 26p	**31)** 53p, 74n	**32)** 2e (neutral atom)
33) 20p	**34)** 86e, 125n, 82p (charged atom)	**35)** Zero neutrons

How many protons, electrons, and neutrons does each element or ion have (list in that order). Assume the most abundant isotope (use the rounded mass from the periodic table).

36) Ca^{2+}	**37)** F^{-}	**38)** Fe^{3+}
39) O^{2-}	**40)** N^{3-}	**41)** Br^{-}

If you know ONLY the following information, can you always determine what the element is? Yes or No?

42) The number of protons	**43)** The number of neutrons	**44)** The number of electrons in a neutral atom	**45)** The number of electrons

A typical isotopic symbol takes this form:

$${}^{A}_{Z}X$$

Example: Fluorine

$${}^{19}_{9}F$$

Key:
X = element symbol
A = mass number [# of protons (p) + # neutrons (n)]
Z = atomic number [# of protons]
N = # of neutrons
A - Z = N

Fill in the missing items in the table below:

	Name	Symbol	#'s		Isotopic Symbol
46)		Na	Z		
			A		
			# p		
			# e		
			# n		
47)			Z		
			A		
			# p	**75**	
			# e		
			# n		
48)	Potassium		Z		
			A		
			# p		
			# e		
			# n		

Dougherty Valley HS Chemistry
Average Atomic Mass Calculations

Worksheet #12

Name: **Period:** **Seat#:**

AVERAGE ATOMIC MASS READING:
Look at the atomic masses of a few different elements on your periodic table. Do you notice that very few of the elements have atomic masses that are close to being nice whole numbers? Do you know why this is? After all, for our purposes, the mass of both the proton and the neutron are almost exactly 1, and in chemistry we usually ignore the mass of the electron because it is so very small. Why then, if the mass of the atom comes mainly from the protons and neutrons it contains, don't the atomic masses of the all come out to be nice whole numbers?

The reason is this; the atomic masses given on your tables are "weighted averages" of the masses of the different naturally occurring isotopes of the element.

Let's look at an example.
Approximately 75% of the chlorine atoms found in nature have a mass of 35. The other 25% have a mass of 37. What should we report as the average atomic mass for chlorine?

What we do is to take the "weighted average" of these isotopes.

- You multiply the "relative abundance" percentage of an isotope by its specific isotope mass. Then you add to that number the next isotopes relative abundance percentage by its specific isotope mass. You keep doing that for each isotope that exists. The sum is the average atomic mass!
  - We multiply 75% times 35 and then add that to 25% times 37...

$$(0.75\ x\ 35) + \ (0.25\ x\ 37) = 26.25 + 9.25 = 35.5\ amu$$

- So generally speaking we end up with the following equation:

$$Average\ Atomic\ Mass = \ (\%_1\ x\ \ mass_1) + \ (\%_2\ \ x\ mass_2\ ) \ldots$$

GUIDED PRACTICE
NOTE: The numbers in each of the following problems have been made up. If we used actual percentages and masses of isotopes then you could simply look up the atomic weight of the element on the periodic table!

Suppose that there were 4 isotopes found of a new element. It was found that there was 7% of Isotope A with a mass of 93, 18% of Isotope B with a mass of 96, 34% of Isotope C with a mass of 97, and 41% of Isotope D with a mass of 99. What is the average atomic weight of this new element?

STUDENT PRACTICE:

1) Suppose that there were two isotopes of Sodium. 28% of the naturally occurring sodium atoms had a mass of 22, and 72% atoms had a mass of 23. What would the average atomic weight of sodium be?

2) Suppose that there were two natural isotopes of Copper. 80% of the atoms had a mass of 63, and 20% of the atoms had a mass of 65. What would that average atomic weight of copper be?

3) Suppose that a new element (E) were discovered that existed as three natural isotopes. 25% of the atoms had a mass of 278, 38% had a mass of 281, and the remainder had a mass of 285. What would be listed as the atomic weight of this element?

Dougherty Valley HS Chemistry
Isotopes of Pennies Activity

Worksheet #13

Name: **Period:** **Seat#:**

Pre-Activity Questions:

1) Read the background information provided below. Which pennies have more copper? Which have less copper?

2) What is an isotope?

3) Why are the masses on the periodic table not whole numbers, why aren't the masses just protons+neutrons?

4) What is the general equation used to calculate the Average Atomic Weight of a set of isotopes?

5) Rubidium has two common isotopes, 85Rb and 87Rb. If the abundance of 85Rb is 72.2% and the abundance of 87Rb is 27.8%, what is the average atomic mass of rubidium? Show your work.

6) Read the Instructions and Procedure section of this handout. Make sure you understand what you will be doing in class so you don't waste time!

Background: In 1982, the composition of a penny was altered to contain 20% less mass by substituting the less dense element zinc (Zn), in place of some of the copper in order to save money. According to the U.S. Mint,

Pennies dated 1962-1982:
Composition: 95% copper, 5% zinc

Pennies dated 1982-present:
Composition: 97.5% zinc, 2.5% copper

In this activity, a mixture of pre- and post- 1982 pennies will represent the naturally occurring mixture of two isotopes of the imaginary element "Coinium." The pennies will allow you to learn one way that scientists can determine the relative amounts of different isotopes present in a sample of an element.

Instructions:

1) You will be given a sealed container, which holds a mixture of ten pre-1982 and post-1982 pennies. You container might hold any particular combination of the two "isotopes." Your task is to determine the isotopic composition of the element "Coinium" ***without*** opening the container. In other words, what % of the sample is pre-1982 pennies and what % of the sample is post-1982 pennies?

2) An obvious, but important, notion is that the mass of the entire mixture equals the sum of the masses of all the pre-1982 and post-1982 pennies. The idea can be expressed mathematically as follows:

Total mass of pennies = (Number of pre-1982 pennies) * (Mass of one pre-1982 penny)
+ (Number of post-1982 pennies) * (Mass of one post-1982 penny)

The problem is that we don't know how many of each type of penny we have! That is what you are solving for. We know that we are using ten pennies total so:

Your goal is to find the value of:

x = the number of pre-1982 pennies
(10-x) = the number of post-1982 pennies

3) Using the information above we can substitute in "x" and "10-x" to make a useful equation for us to use.

Total mass of pennies = (x * mass of pre-1982 penny) + ((10-x) * mass of post-1982 penny)

Procedure:

1) Obtain a pre- and post-1982 penny and record their masses. Obtain and record the code number of a sealed container containing a total of 10 pennies. Weigh it and get the mass of an empty container from Mrs. Farmer.

2) Calculate the values of the number of pre-1982 pennies (x), and the number of post-1982 pennies (10-x)

Dougherty Valley HS Chemistry
Isotopes of Pennies Activity

Unknown Sample # _____

Mass of Empty Container		**Mass of Post-1982 Penny**	
Mass of Container + Pennies		**Mass of Pre-1982 Penny**	
Total Mass of just Pennies *Show work*			
How many pre-1982 pennies are in your sample? *Show work*			
How many post-1982 pennies are in your sample? *Show work*			

Conclusion Questions Set

1) In what ways is the penny mixture a good analogy or model for actual element isotopes? Explain.

2) In what ways is the analogy misleading or incorrect? Explain.

3) Name at least one other familiar item that could serve as a model for isotopes. Support.

4) Using the following information, calculate the AVERAGE molar mass of naturally occurring copper. Naturally occurring copper consists of 69.1% copper-63 and 30.9% copper-65. The molar masses of the pure isotopes are:

copper-63 = 62.93 g/mol
copper-65 = 64.93 g/mol

Dougherty Valley HS Chemistry
Changes, Properties, Types of Matter, The Atom, and Avg. Atomic Masses
Extra Practice

Worksheet #14*

Name: **Period:** **Seat#:**

Directions: Any worksheet that is labeled with an * means it is suggested extra practice. We do not always have time to assign every possible worksheet that would be good practice for you to do. You can do this worksheet when you have extra time, when you finish something early, or to help you study for a quiz or a test. If and when you choose to do this Extra Practice worksheet, please do the work on binder paper. You will include this paper stapled into your Rainbow Packet when you turn it in, even if you didn't do any of this. We want to make sure we keep it where it belongs so you can do it later if you want to (or need to). If you did the work on binder paper you can include that in your Rainbow Packet after this worksheet. If we end up with extra class time then portions of this may turn into required work. If that happens you will be told which problems are turned into required. Remember there is tons of other extra practice on the class website…and the entire internet! See me if you need help finding practice on a topic you are struggling with.

Identify each as either a chemical or a physical change

1) Burning a log	**2)** Bending a wire of Aluminum	**3)** Boiling water	**4)** Melting copper
5) Water evaporating from sugar water	**6)** Digesting your lunch	**7)** Grinding sand	**8)** freezing water to make ice
9) Water is absorbed by a paper towel	**10)** A piece of Li is dropped into water and catches fire producing LiOH	**11)** A pellet of sodium hydroxide is sliced in two	**12)** Salt dissolves in water
13) Milk sours	**14)** zinc reacting with hydrochloric acid producing a gas	**15)** Iron rusting	**16)** A decaying tree trunk

Identify each as either a chemical or physical property

17) Magnetic	**18)** Red color	**19)** Dissolves in water	**20)** Density
21) Malleable	**22)** Reacts violently with Na	**23)** Soluble in alcohol	**24)** Mass
25) Temperature	**26)** Length	**27)** Odor	**28)** Flammable

Identify each as either a pure substance, homogeneous mixture, or heterogeneous mixture

29) Salami	**30)** Dirt	**31)** A burrito	**32)** Iron filings
33) Steam	**34)** Pepsi	**35)** Italian Dressing	**36)** The gas inside a balloon blown up by mouth
37) Salt water	**38)** Silver	**39)** Chicken soup	**40)** The gas inside a balloon filled with helium
41) Graphite in a pencil (carbon)	**42)** Orange juice with pulp	**43)** Kool-aid	**44)** Blood

Fill in the missing items in a table like the one below

	Name	Symbol	Z, A, # p, # e, # n	Isotopic Symbol
45)		P^{3-}		
46)	Iron			
47)			#p = 53	
48)	Silver			
49)			Z = 36	
50)		W		
51)	Magnesium Ion (+2 charge)			
52)			#p = 2	
53)		Mn		
54)	Bromine			

Dougherty Valley HS Chemistry
Changes, Properties, Types of Matter, The Atom,
and Avg. Atomic Masses
Extra Practice

Solve the following problems related to average atomic masses:

55) What is the generic equation for calculating average atomic masses?

56) Argon has three naturally occurring isotopes: argon-36, argon-38, and argon-40. Based on argon's reported atomic mass, which isotope exist as the most abundant in nature? Explain

57) An unknown element has three naturally occurring isotopes in the universe with masses of 201.97 (71.6%), 200.76 (14.4%) and 199.99 (14.0%). What is the atomic mass of the element?

58) Strontium consists of four isotopes with masses of 84 (abundance 0.50%), 86 (abundance of 9.9%), 87 (abundance of 7.0%), and 88 (abundance of 82.6%). Calculate the atomic mass of strontium.

59) Naturally occurring europium (Eu) consists of two isotopes was a mass of 151 and 153. Europium-151 has an abundance of 48.03% and Europium-153 has an abundance of 51.97%. What is the atomic mass of europium?

60) Calculate the average atomic mass of magnesium using the following data for three magnesium isotopes.

Isotope	***mass (amu)***	***relative abundance***
Mg-24	23.985	78.70%
Mg-25	24.986	10.13%
Mg-26	25.983	11.17%

61) Calculate the average atomic mass of sulfur if 95.00% of all sulfur atoms have a mass of 31.972 amu, 0.76% has a mass of 32.971amu and 4.22% have a mass of 33.967amu.

62) 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	82p	82p	82p
122n	124n	125n	126n
1.37%	26.26%	20.82%	51.55%

63) 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?

64) Calculate the average atomic mass of bromine. One isotope of bromine has an atomic mass of 78.92amu and a relative abundance of 50.69%. The other major isotope of bromine has an atomic mass of 80.92amu and a relative abundance of 49.31%.

65) Calculate the atomic mass of an element if 60.4% of the atoms have a mass of 68.9257 amu and the rest have a mass of 70.9249 amu. Identify the element in the periodic table.