Early Booklet E.C.:	**/ 2**
Unit 3 Hwk. Pts:	**/ 24**
Unit 3 Lab Pts:	**/ 16**
Late, Incomplete, No Work, No Units Fees?	Y / N

Unit 3 – Atomic Structure

Chapter 3 of your book.

Learning Targets for Unit 3

1.1 I can compare and contrast the atomic models of Democritus, Aristotle and Dalton.
1.2 I understand how Dalton's theory explains the conservation of mass
1.3 I can distinguish between subatomic particles in terms of relative charge and mass
1.4 I can describe the structure of the atoms, including the locations of the subatomic particles
1.5 I can explain the role of atomic number in determining the identity of an atom
1.6 I can explain why atomic masses are not whole numbers
1.7 I can calculate the number of electrons, protons and neutrons in an atom given its mass number and atomic number
1.8 I can explain the relationship between unstable nuclei and radioactive decay
1.9 I can characterize alpha, beta and gamma radiation in terms of mass and change
1.10 I can balance nuclear reactions

Unit Vocabulary for Unit 3

Dalton's atomic theory	Atom	Cathode Ray	Electron
Neutron	Proton	Nucleus	Atomic mass
Atomic mass unit (amu)	Atomic number	Mass number	Isotope
John Dalton	Aristotle	Gamma ray	Alpha particle
Beta particle	Nuclear reaction	Radioactivity	Radiation
Radioactive decay	Nuclear equation	Greek Elements	Nuclear Model

Plumb Pudding Model Alchemiststs

Possible 3.1 Pts.:	5
Late, Incomplete, No work, No Units Fee: - 1 - 2 - 3	
Final Score:	**/ 5**

3.1 Problems – Early Ideas About Matter
Section 4.1 of your book.

1. Who originally proposed the concept that matter is composed of tiny, indivisible particles?

2. Distinguish between Democritus' ideas and Dalton's atomic theory.

3. Was Democritus' proposal of the existence of atoms based on scientific methods or ideas? Explain.

4. What was Aristotle's objection to Democritus' atomic theory?

5. State the main points of Dalton's atomic theory using your own words. Which parts of Dalton's theory were later found to be erroneous? Why?

Possible 3.2 Pts.:	7
Late, Incomplete, No work, No Units Fee:	- 1 - 2 - 3
Final Score:	**/ 7**

3.2 Problems – Defining the Atom
Section 4.2 of your book.

1. How was the overall charge distributed in the plum pudding model?

2. Arrange the following subatomic particles in order of increasing mass: neutron, proton, and electron.

3. Explain why atoms are electrically neutral.

4. What is the charge of the nucleus of element 89?

5. Which particles account for most of an atom's mass?

6. If you had a balance that could determine the mass of a proton, how many electrons would you need to weigh on the same balance to measure the same mass as that of a single proton? Show your work for credit.

7. Explain what caused the deflection of the alpha particles in Rutherford's gold foil experiment.

Possible 3.3 Pts.:	6
Late, Incomplete, No work, No Units Fee:	- 1 - 2 - 3
Final Score:	/ 6

3.3 Problems – How Atoms Differ

Section 4.3 of your book.

1. How do isotopes of a given element differ? How are they similar?

2. How is the mass number related to the number of protons and neutrons an atom has?

3. What do the superscript and subscript in the notation ${}^{40}_{19}K$ represent?

4. An isotope of xenon has an atomic number of 54 and contains 77 neutrons. What is the xenon isotope's mass number?

5. How many electrons, protons, and neutrons are contained in the following four atoms?

a. ${}^{132}_{55}Cs$

b. ${}^{59}_{27}Co$

c. ${}^{163}_{69}Tm$

d. ${}^{70}_{30}Zn$

6. Gallium, which has an atomic mass of 69.723 amu, had two naturally occurring isotopes, Ga-69 and Ga-71. Which isotope occurs in greater abundance? Explain.

Possible 3.4 Pts.:	6
Late, Incomplete, No work, No Units Fee: - 1 - 2 - 3	
Final Score:	/ 6

3.4 Problems –Radioactive Decay
Section 4.4 of your book.

1. What change in mass number occurs when a radioactive atom emits an alpha particle? A beta particle? Gamma?

Write balanced nuclear reactions for the following two radioactive decays by filling in the missing atom:

2. Boron-10 emits alpha particles: $^{10}_{5}B \rightarrow$ _______ + $^{4}_{2}He$

3. cesium-137 emits beta particles: $^{137}_{55}Cs \rightarrow$ ________ + $^{0}_{-1}e$

4. An atom's nucleus has 92 protons and its mass number is 235. How many neutrons are in the nucleus? What is the name of this atom?

5. Is the charge of a nucleus positive, negative, or zero? The charge of an atom?

6. A nuclear chemist has 250 grams of a radioactive sample with a half-life of 15 days. How much of the original isotope would be expected to remain after 15 days? How about after 75 days? Show your work for full credit.

Chemistry	Lab 3.1 - Isotope Modeling (Pennium Lab)				
Name:					Correction Credit: Half
Lab Points:	Missed:	Late, No Units, No Work Fee:	First Score:	Corrections:	Final Score:
16		-1 -2 -3 -4			

How can you calculate the atomic mass of an element using the percentage abundance of its isotopes? Easy! Use old and new pennies as an analogous substance! The two "isotopes" of penny have different masses, and can be calculated in the same way that elements are.

How are they different? Old pennies minted before 1983 are 97% copper and 3% zinc. Pennies minted in 1983 or more recently are 97% zinc with a copper coating.

Data Gathering = 1 pt per value. Include units on all values.

Procedure:

1. Count the total number of pennies in your sample, then separate them into two groups: pennies that were minted before 1983, and pennies minted in 1983 or after.

Total number of pennies in your sample _______________

Total number of pennies minted before 1983 (old pennies) ____________

Total number of pennies minted in 1983 or after (new pennies) ____________

2. Determine the relative abundance of your old and new pennies. In other words, what percent of your penny sample is old, and what percent is new?

% abundance of old pennies ______________

% abundance of new pennies ______________

3. Calculate the mass of an average old and new penny. To do so, obtain the mass of ten old pennies, and divide that mass by 10. Do the same for the new pennies.

Mass of 10 old pennies _____________

Average mass of each old penny ___________

Mass of 10 new pennies _____________

Average mass of each new penny ___________

4. Determine the mass contribution of each “isotope” of penny, by multiplying the percent abundance by its average mass.

Mass contribution of old pennies: (% abundance)(average mass) = __________

Mass contribution of new pennies: (% abundance)(average mass) = __________

5. Finally, add your contributions together, and that is your average mass.

Add the two mass contributions for the average penny mass = ______________

<u>Questions</u>: (2 pts each – Write at least two good sentences per question for full credit – grammar, spelling, and content will be assessed)

1. Would the average mass of a penny be different if you got another sample of pennies containing a different mixture of old/new pennies? Why or why not?

2. Explain why the average mass of each type of penny was determined by measuring 10 pennies instead of by measuring and using the mass of a single penny from each group.

Chemistry	Essential Skill - Isotopes
Name:	**Period:**
This serves as a practice worksheet to prepare you in the short term for the Isotopes Quiz, and for the long term by reinforcing an essential skill in chemistry.	

Determine the numbers of electrons, neutrons, and protons for the following isotopes.
While this is not worth points, you can use it on your Isotope Essential Skills quiz.

1. Copper–64

e^- =

n^0 =

p^+ =

2. Thallium–201

e^- =

n^0 =

p^+ =

3. Uranium–238

e^- =

n^0 =

p^+ =

4. Calcium-43

e^- =

n^0 =

p^+ =

5. $^{204}_{80}Hg$

e^- =

n^0 =

p^+ =

6. $^{52}_{25}Mn$

e^- =

n^0 =

p^+ =

7. $^{141}_{56}Ba$

e^- =

n^0 =

p^+ =

8. $^{133}_{53}I$

e^- =

n^0 =

p^+ =

(2 pts each) Write the name (example. Uranium-236) **and** symbol (example: $^{236}_{92}U$) for the following neutrally charged elements:

9. Protons = 76
   Neutrons = 111

10. Electrons = 38
    Neutrons = 49

11. Atomic Number = 27
    Mass Number = 56

12. Protons = 44
    Neutrons = 51

Points Possible:	10
Late/Inc. Fee: -1 -2 - 3	
Final Score:	/ 10

Unit 3 Review – Atomic Structure

This serves as test preparation for the Unit 3 exam. Points earned are based on completion, and we will go over any questions you have during the review. Additionally, you may be called upon to present a selection of these problems to the class.

1. If the average atomic mass of tantalum is 180.95, which of the following isotopes is likely to be the most abundant: Ta-175, Ta-176, or Ta-181? Explain why.

2. How is nuclear decay different from a chemical reaction?

3. Compare and contrast the ideas of Democritus and Aristotle.

4. What were the four earthly elements of the ancient Greeks? What elements of the Greeks would you expect to find in a piano? Explain yourself.

5. Compare and contrast the three different types of radiation.

6. Of John Dalton's six points of atomic theory, which were later shown to be false, and which are still correct?

7. What is the weighted average mass of the following isotopes of lead? Show your work.
   Lead - 205: Mass = 204.5 amu   Abundance = 18.2%
   Lead - 208: Mass = 207.8 amu   Abundance = 81.8 %

8. Solve the following nuclear decay problems:
   a. ______ $\rightarrow$ $^{228}_{90}Th + ^{4}_{2}He$ b. ______ $\rightarrow$ $^{214}_{83}Bi + ^{0}_{-1}e$

9. How many protons, neutrons and electrons are in the following:
   a. sodium-35?   b. $^{91}_{42}In$
   c. radon-222   d. $^{115}_{54}Xe$

10. Describe in detail how Rutherford's gold foil experiment worked.

11. Describe how Millikan's oil drop experiment worked.

12. If the half-life of a radioactive sample is 20 days, how many grams of an original sample of 50 grams would you expect to have after 60 days have elapsed?