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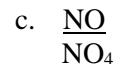
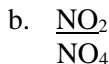
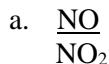
Atom Topic #4

WS#1: The Atom: From Philosophical Idea to Scientific Theory

- Why is Democritus's view of matter considered only an idea, while Dalton's view is considered a theory?
- Give an example of a chemical or physical process that illustrates the law of conservation of mass.
- State two principles from Dalton's atomic theory that have been revised as new information has become available.
- The formation of water according to the equation: $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ shows that 2 molecules (made of 4 atoms) of hydrogen and 1 molecules (made of 2 atoms) of oxygen produce two molecules of water. The total mass of the product, water, is equal to the sum of the masses of each of the reactants, hydrogen and oxygen. What parts of Dalton's atomic theory are illustrated by this reaction? What law does this reaction illustrate?
- If 3 grams of element C combine with 8 grams of element D to form compound CD, how many grams of D are needed to form compound CD_2 ?
- A sample of baking soda, NaHCO_3 , always contains 27.37% by mass of sodium, 1.20% of hydrogen, 14.30% of carbon, and 57.14% of oxygen.
 - Which law does this illustrate?
 - State the law.
- Nitrogen and oxygen combine to form several compounds, as shown by the following table:

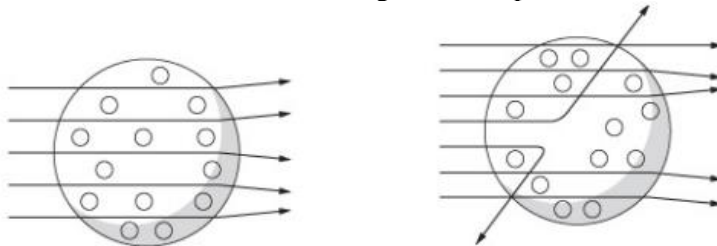
Compound	Mass of nitrogen that combines with 1 gram of oxygen (g)
NO	1.70
NO_2	0.85
NO_4	0.44

Calculate the ratio of the masses of nitrogen in each of the following:

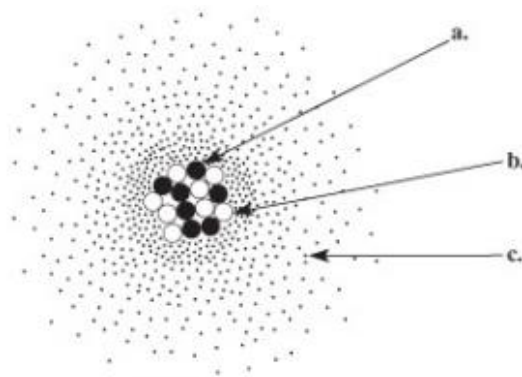


WS#2: The Structure of the Atom

- In the cathode-ray tubes, the cathode ray emitted from the negative electrode, which is called _____.
- The smallest unit of an element that can exist wither alone or in molecules containing the same or different elements is the _____.
- A positively charged particle found in the nucleus is called a(n) _____.
- A nuclear particle that has no electrical charge is called a(n) _____.
- The subatomic particles that are least massive and most massive, respectively, are the _____ and _____.
- A cathode ray produced in a gas-filled tube is deflected by a magnetic field. A wire carrying an electric current can be pulled by a magnetic field. A cathode ray is deflected away form a negatively charged object. What property of the cathode ray is shown by these phenomena?
- How would the electrons produced in a cathode-ray tube filled with neon gas compare with the electrons produced in a cathode-ray tube filled with chlorine gas?
- Is an atom positively charged, negatively charged, or neutral?
 - Explain how an atom can exist in this state?
- Below are illustrations of two scientist's conceptions of an atom. Label the electrons in both illustrations with a (-) sign and the nucleus in the illustration to the right with a (+) sign. On the lines below the figures, identify which illustration was believed to be correct after Rutherford's gold-foil experiment.



- In the space provided, describe the locations of the subatomic particles in the labeled model of an atom of nitrogen below, and give the charge and relative mass of each particle.



- a. proton
 b. neutron
 c. electron
 d. How many protons does the atom have?
 e. How many electrons does the atom have?
 f. How many neutrons does the atom have?
 g. What is the mass number (number of nucleons) of the atom?

WS#3: Counting Atoms

- Explain the difference between mass number and atomic number of a nuclide.
- Why is it necessary to use average atomic mass of all isotopes, rather than the mass of the most commonly occurring isotope, when referring to the atomic mass of an element?
- Explain what happens to each of the following as the atomic masses of the elements in the periodic table increase:
 - the number of protons
 - the number of electrons
- Use the periodic table to complete the following chart:

Element	Symbol	Atomic Number	Mass Number
europium – 151			
	$^{109}_{47}\text{Ag}$		
tellurium - 128			

- List the number of protons, neutrons, and electrons found in zinc-66.

WS#4: Problem Solving WS

Part A – Nuclear (Atomic) Symbols and Complete Nuclear (Atomic) Symbols

- For the isotope lead – 207, identify the mass number, atomic number, symbol, number of protons, number of electrons, and number of neutrons.

Determine how many protons, neutrons, and electrons are present in each of the following isotopes.

Isotope	p^+	n^0	e^-	Isotope	p^+	n^0	e^-
2. iodine-125	_____	_____	_____	5. $^{45}_{21}\text{Sc}$	_____	_____	_____
3. potassium-39	_____	_____	_____	6. $^{12}_6\text{C}$	_____	_____	_____
4. iron-56	_____	_____	_____	7. $^{184}_{74}\text{W}$	_____	_____	_____

Based on the hyphen notation, write the nuclear symbol for the following isotopes.

- carbon – 14
- cesium – 133
- uranium – 235
- iron – 58

Bases upon the nuclear symbol, write the isotope in hyphen notation.

- $^{15}_7\text{N}$
- $^{122}_{51}\text{Sb}$
- $^{200}_{80}\text{Hg}$
- $^{247}_{97}\text{Bk}$

Determine the number of protons and electrons in each of the following ions.

Ion	p^+	e^-	Ion	p^+	e^-
16. Cu^{2+}	_____	_____	18. F^-	_____	_____
17. H^+	_____	_____	19. Na^+	_____	_____

How many protons, neutrons, and electrons are present in the following ions.

- $^{59}_{28}\text{Ni}^{2+}$
- $^{140}_{58}\text{Ce}^{3+}$
- $^{79}_{34}\text{Se}^{2-}$

Write the complete chemical (nuclear) symbol for each of the ions described below ($^A_Z\text{X}^C$)

- 17 protons/20 neutrons/18 electrons
- 8 protons/10 neutrons/10 electrons
- 3 protons/4 neutrons/2 electrons
- 85 protons, 125 neutrons, and 86 electrons
- 12 protons/12 neutrons/10 electrons
- 52 protons, 76 neutrons, and 54 electrons

Part B – Average Atomic Mass

Calculate the average atomic mass of the following atoms.

- Rubidium is a soft, silvery-white metal that has two common isotopes, ^{85}Rb and ^{87}Rb . If the abundance of rubidium – 85 is 72.2% and the abundance of rubidium – 87 is 27.8%, what is the average atomic mass of rubidium?
- Uranium is used in nuclear reactors and is a rare Earth metal. Uranium has three common isotopes. If the abundance of uranium – 234 is 0.01%, the abundance of uranium – 235 is 0.71%, and the abundance of uranium – 238 is 99.28%, what is the average atomic mass of uranium?
- Naturally occurring chlorine contains 75.53 percent of chlorine – 35 (mass is 34.969amu) by mass and 24.47 percent chlorine – 37 (mass of 36.966amu) by mass. Calculate the average atomic mass of chlorine.
- Copper used in electrical wires comes in two flavors: ^{63}Cu and ^{65}Cu . ^{63}Cu has an atomic mass of 62.9298amu and an abundance of 69.09% while ^{65}Cu has an abundance of 30.91%. The average atomic mass of copper is 63.546amu. Calculate the atomic mass of copper – 65.
- Complete the table

Isotope	Mass (amu)	Relative Abundance
neon – 20	19.992	90.51
neon – 21	20.994	
neon – 22		9.22
Average atomic mass is _____.		Total %: _____

WS#5: Mixed Review

- The element boron, B, has an atomic mass of 10.81amu according to the periodic table. However, no single atom of boron has a mass of exactly 10.81amu. How can you explain this difference?
- How did the outcome of Rutherford's gold-foil experiment indicate the existence of a nucleus?
- Ibuprofen, $\text{C}_{13}\text{H}_{18}\text{O}_2$, when manufactured in Michigan contains 75.69% by mass carbon, 8.80% hydrogen, and 15.51% oxygen. If you buy some ibuprofen for a headache while you are on vacation in Germany, how do you know that it has the same percentage composition as the ibuprofen you bought in Michigan?
- Complete the following chart, using the atomic mass values from the periodic table:

Compound	Mass of Fe(g)	Mass of O(g)	Ration of O:Fe
FeO			
Fe ₂ O ₃			
Fe ₃ O ₄			

- Complete the following table:

Element	Symbol	Atomic Number	Mass Number	Number of Protons	Number of Neutrons	Number of Electrons
sodium			22			
	F	9	19			
			80		45	
			40	20		
		1			0	
			222			86

- A certain element exists as three natural isotopes, as shown in the table below.

Isotope	Mass(amu)	Percent Abundance	Mass Number
1	19.99244	90.51	20
2	20.99395	0.27	21
3	21.99138	9.22	22

- Calculate the average atomic mass of this element.
- Identify the element bases on its average atomic mass and the periodic table.