## CHAPTER 3 REVIEW

Atoms: The Building Blocks of Matter

SECTION 1

SHORT ANSWER Answer the following questions in the space provided.

1. Why is Democritus's view of matter considered only an idea, while Dalton's view is considered a theory?

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_____

_____

2. Give an example of a chemical or physical process that illustrates the law of conservation of mass.

_____

_____

_____

3. State two principles from Dalton's atomic theory that have been revised as new information has become available.

_____

_____

_____

4. The formation of water according to the equation

$$2H_2 + O_2 \rightarrow 2H_2O$$
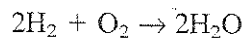
shows that 2 molecules (made of 4 atoms) of hydrogen and 1 molecule (made of 2 atoms) of oxygen produce 2 molecules of water. The total mass of the product, water, is equal to the sum of the masses of each of the reactants, hydrogen and oxygen. What parts of Dalton's atomic theory are illustrated by this reaction? What law does this reaction illustrate?

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_____

Name _____ Date _____ Class _____

PROBLEMS Write the answer on the line to the left. Show all your work in the space provided.

5. _____ If 3 g of element C combine with 8 g of element D to form compound CD, how many grams of D are needed to form compound CD_2?

6. 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.

   a. Which law do these data illustrate?

   _____

   b. State the law.

   _____

   _____

   _____

   _____

   _____

   _____

7. Nitrogen and oxygen combine to form several compounds, as shown by the following table.

Compound	Mass of nitrogen that combines with 1 g 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:

   ____ a. $\dfrac{NO}{NO_2}$ ____ b. $\dfrac{NO_2}{NO_4}$ ____ c. $\dfrac{NO}{NO_4}$

   d. Which law do these data illustrate?

   _____

Name _____ Date _____ Class _____

Atoms: The Building Blocks of Matter

SECTION 2

SHORT ANSWER Answer the following questions in the space provided.

1. In cathode-ray tubes, the cathode ray is emitted from the negative electrode, which is called the

   _____.

2. The smallest unit of an element that can exist either alone or in molecules containing the

   same or different elements is the _____.

3. A positively charged particle found in the nucleus is called a(n) _____.

4. A nuclear particle that has no electrical charge is called a(n) _____.

5. The subatomic particles that are least massive and most massive, respectively, are the

   _____ and _____.

6. 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 from a
   negatively charged object. What property of the cathode ray is shown by these phenomena?

   _____

7. 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?

   _____

   _____

   _____

8. a. Is an atom positively charged, negatively charged, or neutral?

   _____

   b. Explain how an atom can exist in this state.

   _____

   _____

   _____

   _____

SECTION 2 continued

9. Below are illustrations of two scientists' conceptions of the 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 before Rutherford's gold-foil experiment and which was believed to be correct after Rutherford's gold-foil experiment.
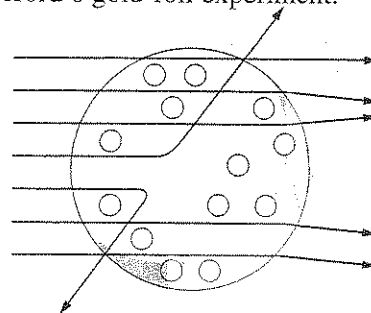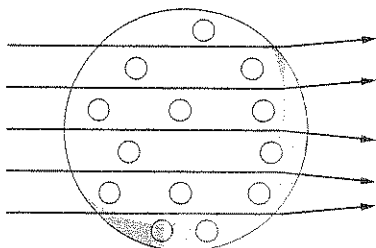
a. _____   b. _____

10. 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.
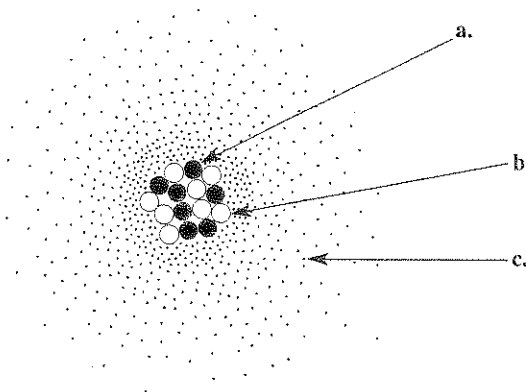
a. proton

_____

_____

b. neutron

_____

_____

c. electron (a possible location of this particle)

_____

_____

CHAPTER 3 REVIEW

Atoms: The Building Blocks of Matter

SECTION 3

SHORT ANSWER Answer the following questions in the space provided.

1. Explain the difference between the *mass number* and the *atomic number* of a nuclide.

_____

_____

_____

_____

2. Why is it necessary to use the 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?

_____

_____

_____

_____

_____

3. How many particles are in 1 mol of carbon? 1 mol of lithium? 1 mol of eggs? Will 1 mol of each of these substances have the same mass?

_____

_____

_____

4. Explain what happens to each of the following as the atomic masses of the elements in the periodic table increase:

a. the number of protons

_____

b. the number of electrons

_____

c. the number of atoms in 1 mol of each element

_____

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SECTION 3 continued

5. Use a periodic table to complete the following chart:

Element	Symbol	Atomic number	Mass number
Europium-151			
	$^{109}_{47}Ag$		
Tellurium-128			

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

_____ protons

_____ neutrons

_____ electrons

PROBLEMS   Write the answer on the line to the left. Show all your work in the space provided.

7. _____ What is the mass in grams of 2.000 mol of oxygen atoms?

8. _____ How many moles of aluminum exist in 100.0 g of aluminum?

9. _____ How many atoms are in 80.45 g of magnesium?

10. _____ What is the mass in grams of 100 atoms of the carbon-12 isotope?

MODERN CHEMISTRY

CHAPTER 3 REVIEW

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MIXED REVIEW

SHORT ANSWER Answer the following questions in the space provided.

1. The element boron, B, has an atomic mass of 10.81 amu according to the periodic table. However, no single atom of boron has a mass of exactly 10.81 amu. How can you explain this difference?

_____

_____

_____

_____

2. How did the outcome of Rutherford's gold-foil experiment indicate the existence of a nucleus?

_____

_____

_____

_____

_____

3. Ibuprofen, $C_{13}H_{18}O_2$, that is 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 buy at home?

_____

_____

_____

_____

_____

4. Complete the following chart, using the atomic mass values from the periodic table:

Compound	Mass of Fe (g)	Mass of O (g)	Ratio of O:Fe
FeO			
Fe_2O_3			
Fe_3O_4			

MIXED REVIEW continued

5. 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

PROBLEMS Write the answer on the line to the left. Show all your work in the space provided.

6. _____ a. How many atoms are there in 2.50 mol of hydrogen?

_____ b. How many atoms are there in 2.50 mol of uranium?

_____ c. How many moles are present in 107 g of sodium?

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

Isotope	Mass (amu)	Percent natural 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.