Name _____ Date _____ Class _____

CHAPTER 7 REVIEW

Chemical Formulas and Chemical Compounds

SECTION 1

SHORT ANSWER **Answer the following questions in the space provided.**

1. _____ In a Stock system name such as iron(III) sulfate, the Roman numeral tells us

(a) how many atoms of Fe are in one formula unit.
(b) how many sulfate ions can be attached to the iron atom.
(c) the charge on each Fe ion.
(d) the total positive charge of the formula unit.

2. _____ Changing a subscript in a correctly written chemical formula

(a) changes the number of moles represented by the formula.
(b) changes the charges on the other ions in the compound.
(c) changes the formula so that it no longer represents the compound it previously represented.
(d) has no effect on the formula.

3. The explosive TNT has the molecular formula $C_7H_5(NO_2)_3$.

_____ **a.** How many elements make up this compound?

_____ **b.** How many oxygen atoms are present in one molecule of $C_7H_5(NO_2)_3$?

_____ **c.** How many atoms in total are present in one molecule of $C_7H_5(NO_2)_3$?

_____ **d.** How many atoms are present in a sample of 2.0×10^{23} molecules of $C_7H_5(NO_2)_3$?

4. How many atoms are present in each of these formula units?

_____ **a.** $Ca(HCO_3)_2$

_____ **b.** $C_{12}H_{22}O_{11}$

_____ **c.** $Fe(ClO_2)_3$

_____ **d.** $Fe(ClO_3)_2$

5. _____ **a.** What is the formula for the compound dinitrogen pentoxide?

_____ **b.** What is the Stock system name for the compound FeO?

_____ **c.** What is the formula for sulfurous acid?

_____ **d.** What is the name for the acid H_3PO_4?

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SECTION 1 continued

6. Some binary compounds are ionic, others are covalent. The type of bond favored partially depends on the position of the elements in the periodic table. Label each of these claims as True or False; if False, specify the nature of the error.

a. Covalently bonded binary molecular compounds are typically composed of nonmetals.

_____

_____

b. Binary ionic compounds are composed of metals and nonmetals, typically from opposite sides of the periodic table.

_____

_____

7. Refer to **Table 2** on page 226 of the text and **Table 5** on page 230 of the text for examples of names and formulas for polyatomic ions and acids.

a. Derive a generalization for determining whether an acid name will end in the suffix *-ic* or *-ous*.

_____

_____

_____

b. Derive a generalization for determining whether an acid name will begin with the prefix *hydro-* or not.

_____

_____

_____

8. Fill in the blanks in the table below.

Compound name	Formula
Aluminum sulfide	
Cesium carbonate	
	$PbCl_2$
	$(NH_4)_3PO_4$
Hydroiodic acid	

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CHAPTER 7 REVIEW

Chemical Formulas and Chemical Compounds

SECTION 2

SHORT ANSWER **Answer the following questions in the space provided.**

1. Assign the oxidation number to the specified element in each of the following examples:

_____ **a.** S in H_2SO_3

_____ **b.** S in $MgSO_4$

_____ **c.** S in K_2S

_____ **d.** Cu in Cu_2S

_____ **e.** Cr in Na_2CrO_4

_____ **f.** N in HNO_3

_____ **g.** C in $(HCO_3)^-$

_____ **h.** N in $(NH_4)^+$

2. _____ **a.** What is the formula for the compound sulfur(II) chloride?

_____ **b.** What is the Stock system name for NO_2?

3. _____ **a.** Use electronegativity values to determine the one element that always has a negative oxidation number when it appears in any binary compound.

_____ **b.** What is the oxidation number and formula for the element described in part **a** when it exists as a pure element?

4. Tin has possible oxidation numbers of +2 and +4 and forms two known oxides. One of them has the formula SnO_2.

_____ **a.** Give the Stock system name for SnO_2.

_____ **b.** Give the formula for the other oxide of tin.

5. Scientists think that two separate reactions contribute to the depletion of the ozone, O_3, layer. The first reaction involves oxides of nitrogen. The second involves free chlorine atoms. The equations that represent the reactions follow. When a compound is not stated as a formula, write the correct formula in the blank beside its name.

a. _____ (nitrogen monoxide) + O_3 → _____ (nitrogen dioxide) + O_2

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SECTION 2 continued

b. $Cl + O_3 \rightarrow$ _____ (chlorine monoxide) + O_2

6. Consider the covalent compound dinitrogen trioxide when answering the following:

_____ **a.** What is the formula for dinitrogen trioxide?

_____ **b.** What is the oxidation number assigned to each nitrogen atom in this compound? Explain your answer.

_____

_____

_____

_____ **c.** Give the Stock name for dinitrogen trioxide.

7. The oxidation numbers assigned to the atoms in some organic compounds have unexpected values. Assign oxidation numbers to each atom in the following compounds: (Note: Some oxidation numbers may not be whole numbers.)

a. CO_2

_____

b. CH_4 (methane)

_____

c. $C_6H_{12}O_6$ (glucose)

_____

d. C_3H_8 (propane gas)

_____

8. Assign oxidation numbers to each element in the compounds found in the following situations:

a. Rust, Fe_2O_3, forms on an old nail.

_____

b. Nitrogen dioxide, NO_2, pollutes the air as a component of smog.

_____

c. Chromium dioxide, CrO_2, is used to make recording tapes.

_____

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CHAPTER 7 REVIEW

Chemical Formulas and Chemical Compounds

SECTION 3

SHORT ANSWER **Answer the following questions in the space provided.**

1. Label each of the following statements as True or False:

_____ **a.** If the formula mass of one molecule is x amu, the molar mass is x g/mol.

_____ **b.** Samples of equal numbers of moles of two different chemicals must have equal masses as well.

_____ **c.** Samples of equal numbers of moles of two different molecular compounds must have equal numbers of molecules as well.

2. How many moles of each element are present in a 10.0 mol sample of $Ca(NO_3)_2$?

_____

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

3. Consider a sample of 10.0 g of the gaseous hydrocarbon C_3H_4 to answer the following questions.

_____ **a.** How many moles are present in this sample?

_____ **b.** How many molecules are present in the C_3H_4 sample?

_____ **c.** How many carbon atoms are present in this sample?

SECTION 4 continued

_____ **b.** The compound has the formula $CuSO_4 \cdot xH_2O$. Determine the value of x.

c. What might be the purpose of the second heating?

_____

_____

_____

_____

5. Gas X is found to be 24.0% carbon and 76.0% fluorine by mass.

_____ **a.** Determine the empirical formula of gas X.

_____ **b.** Given that the molar mass of gas X is 200.04 g/mol, determine its molecular formula.

6. A compound is found to contain 43.2% copper, 24.1% chlorine, and 32.7% oxygen by mass.

_____ **a.** Determine its empirical formula.

b. What is the correct Stock system name of the compound in part **a**?

_____

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CHAPTER 7 REVIEW

Chemical Formulas and Chemical Compounds

MIXED REVIEW

SHORT ANSWER Answer the following questions in the space provided.

1. Write formulas for the following compounds:

_____ **a.** copper(II) carbonate

_____ **b.** sodium sulfite

_____ **c.** ammonium phosphate

_____ **d.** tin(IV) sulfide

_____ **e.** nitrous acid

2. Write the Stock system names for the following compounds:

_____ **a.** $Mg(ClO_4)_2$

_____ **b.** $Fe(NO_3)_2$

_____ **c.** $Fe(NO_2)_3$

_____ **d.** CoO

_____ **e.** dinitrogen pentoxide

3. _____ **a.** How many atoms are represented by the formula $Ca(HSO_4)_2$?

_____ **b.** How many moles of oxygen atoms are in a 0.50 mol sample of this compound?

_____ **c.** Assign the oxidation number to sulfur in the HSO_4^- anion.

4. Assign the oxidation number to the element specified in each of the following:

_____ **a.** hydrogen in H_2O_2

_____ **b.** hydrogen in MgH_2

_____ **c.** sulfur in S_8

_____ **d.** carbon in $(CO_3)^{2-}$

_____ **e.** chromium in $Na_2Cr_2O_7$

_____ **f.** nitrogen in NO_2

Name _____ Date _____ Class _____

MIXED REVIEW continued

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

5. _____ Following are samples of four different compounds. Arrange them in order of increasing mass, from smallest to largest.

a. 25 g of oxygen gas
b. 1.00 mol of H_2O
c. 3×10^{23} molecules of C_2H_6
d. 2×10^{23} molecules of $C_2H_6O_2$

6. _____ **a.** What is the formula for sodium hydroxide?

_____ **b.** What is the formula mass of sodium hydroxide?

_____ **c.** What is the mass in grams of 0.25 mol of sodium hydroxide?

7. _____ What is the percentage composition of ethane gas, C_2H_6, to the nearest whole number?

8. _____ Ribose is an important sugar (part of RNA),with a molar mass of 150.15 g/mol. If its empirical formula is CH_2O, what is its molecular formula?

Name _____ Date _____ Class _____

MIXED REVIEW continued

9. Butane gas, C_4H_{10}, is often used as a fuel.

_____ **a.** What is the mass in grams of 3.00 mol of butane?

_____ **b.** How many molecules are present in that 3.00 mol sample?

_____ **c.** What is the empirical formula of the gas?

10. _____ Naphthalene is a soft covalent solid that is often used in mothballs. Its molar mass is 128.18 g/mol and it contains 93.75% carbon and 6.25% hydrogen. Determine the molecular formula of napthalene from this information.

11. Nicotine has the formula $C_xH_yN_z$. To determine its composition, a sample is burned in excess oxygen, producing the following results:

1.0 mol of CO_2
0.70 mol of H_2O
0.20 mol of NO_2

Assume that all the atoms in nicotine are present as products.

_____ **a.** Determine the number of moles of carbon present in the products of this combustion.

MIXED REVIEW continued

_____ **b.** Determine the number of moles of hydrogen present in the combustion products.

_____ **c.** Determine the number of moles of nitrogen present in the combustion products.

_____ **d.** Determine the empirical formula of nicotine based on your calculations.

_____ **e.** In a separate experiment, the molar mass of nicotine is found to be somewhere between 150 and 180 g/mol. Calculate the molar mass of nicotine to the nearest gram.

12. When $MgCO_3(s)$ is strongly heated, it produces solid MgO as gaseous CO_2 is driven off.

_____ **a.** What is the percentage loss in mass as this reaction occurs?

_____ **b.** Assign the oxidation number to each atom in $MgCO_3$.

_____ **c.** Does the oxidation number of carbon change upon the formation of CO_2?