

Name: _____

Period: _____ Subject: _____

Date: _____

AP Chem Summer Homework Packet

I. Significant Figures

1. Determine the number of significant digits for each of the following:

a. _____ 2.4081

f. _____ 7200.

j. _____ 8 000 000

b. _____ 374.0

g. _____ 0.0019

k. _____ 8.00×10^6

c. _____ 374

h. _____ 0.001900

l. _____ 8.0000×10^6

d. _____ 1.900

i. _____ 9300.11

e. _____ 7200

2. Solve the following equations. Be sure to express your answer with the correct number of significant figures.

a. _____ $13.8 + 7 + 2.14$

f. _____ $5.27 - 11.0$

b. _____ $8 \cdot 2.125 \cdot 1.4$

g. _____ $0.2 \cdot 12.4$

c. _____ $23 - 1.324$

h. _____ $2.00 \div 8.000$

d. _____ $0.0750 \div 3.000$

i. _____ $1.5 + 2.25 - 3.85$

e. _____ $1200 + 8 + 3.5$

j. _____ $2.0 \cdot 3.750 \div 1.5$

II. Chemical Formulae:

3. Write formulas for the following:

- a. barium sulfate _____
- b. ammonium chloride _____
- c. chlorine monoxide _____
- d. silicon tetrachloride _____
- e. magnesium fluoride _____
- f. sodium oxide _____
- g. sodium peroxide _____
- h. copper(I) oxide _____
- i. zinc sulfide _____
- j. potassium carbonate _____
- k. hydrobromic acid _____
- l. perchloric acid _____
- m. lead(II) acetate _____
- n. sodium permanganate _____
- o. lithium oxalate _____
- p. potassium cyanide _____
- q. iron(III) hydroxide _____
- r. silicon dioxide _____
- s. nitrogen trifluoride _____
- t. chromium(III) oxide _____
- u. calcium chlorate _____
- v. sodium thiocyanate _____
- w. nitrous acid _____
- x. barium nitrate dihydrate _____

4. Name each of the following:

- a. CuSO_4 _____
- b. PCl_3 _____
- c. Li_3N _____
- d. BaSO_3 _____
- e. N_2F_4 _____
- f. KClO_4 _____
- g. NaH _____
- h. $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ _____
- i. HNO_2 _____
- j. Sr_3P_2 _____
- k. $\text{Mg}(\text{OH})_2$ _____
- l. Al_2S_3 _____
- m. AgBr _____
- n. P_4O_{10} _____
- o. $\text{HC}_2\text{H}_3\text{O}_2$ _____
- p. CaI_2 _____
- q. MnO_2 _____
- r. Li_2O _____
- s. FeI_3 _____
- t. Cu_3PO_4 _____
- u. PCl_5 _____
- v. NaCN _____
- w. HF _____
- x. $\text{CaCO}_3 \cdot 4\text{H}_2\text{O}$ _____

III. Trends and the Periodic Table

5. Name the family (ex: *alkaline earth metals*) that each of the following elements belongs to:

- | | |
|--------------------|--------------------|
| a. bromine _____ | e. magnesium _____ |
| b. strontium _____ | f. sodium _____ |
| c. potassium _____ | g. krypton _____ |
| d. chlorine _____ | h. neon _____ |

6. Arrange according to increasing electronegativity: *aluminum, cesium, oxygen, molybdenum*.

7. Classify the following as: *alkali metal, alkaline earth metal, transition metal, inner transition metal, nonmetal, or metalloid.*

a. potassium _____

b. plutonium _____

c. phosphorus _____

d. platinum _____

e. silicon _____

f. sulfur _____

g. sodium _____

h. silver _____

8. Arrange according to increasing atomic radius: *tin, neon, silver, xenon.*

9. Name three elements that belong to the same family or group as *barium.*

10. Name three elements that belong to the same period as *silicon.*

11. Which would require the most energy and why: taking away a second electron from sodium or taking away a second electron from calcium.

IV. Atomic Structure

12. Fill in the following table:

element	symbol	# protons	# electrons	# neutrons
a. calcium				
b. bromine				
c. sodium ion				
d. oxide ion				
e. fluoride ion				
f. uranium-234				
g. carbon-14				
h. barium-135				

13. For each of the following elements, calculate the average mass to the nearest hundredth:

- a. _____ Boron: 20% Boron-10, 80% Boron-11
- b. _____ Titanium: 8.25% Titanium-46, 7.44% Titanium-47, 73.72% Titanium-48,
5.41% Titanium-49, 5.18% Titanium-50
- c. _____ Magnesium: 79% Magnesium-24, 10% Magnesium-25, 11% Magnesium-26
- d. _____ Carbon: 98.89% Carbon-12, 1.11% Carbon-13
- e. _____ Chlorine: 75.77% Chlorine-35, 24.23% Chlorine-37

V. Chemical Reactions

14. In the chemical formula $5\text{H}_2\text{SO}_4$, what does the number "5" represent?

What does the number "2" represent?

15. In the chemical formula $2\text{Al}(\text{NO}_3)_3$, how many total nitrogen atoms are there?

How many total oxygen atoms are there?

16. Balance the following chemical equations by using the appropriate coefficients for the various compounds. (Note: not every compound will need a coefficient.)

- a. _____ P_4O_{10} + _____ H_2O \rightarrow _____ H_3PO_4
- b. _____ C_3H_8 + _____ O_2 \rightarrow _____ CO_2 + _____ H_2O
- c. _____ KClO_3 \rightarrow _____ KCl + _____ O_2
- d. _____ Al + _____ CuCl_2 \rightarrow _____ AlCl_3 + _____ Cu
- e. _____ NH_4NO_3 \rightarrow _____ N_2O + _____ H_2O
- f. _____ MgBr_2 + _____ NaNO_3 \rightarrow _____ $\text{Mg}(\text{NO}_3)_2$ + _____ NaBr
- g. _____ P + _____ O_2 \rightarrow _____ P_4O_{10}
- h. _____ C_2H_6 + _____ O_2 \rightarrow _____ CO_2 + _____ H_2O
- i. _____ Ag + _____ H_2SO_4 \rightarrow _____ Ag_2SO_4 + _____ H_2

17. For each of the following, give the reaction type (synthesis, single displacement, etc.) for the chemical reaction listed in the indicated question from above.

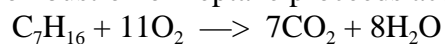
- a. Question #16e _____
- b. Question #16f _____
- c. Question #16g _____
- d. Question #16h _____
- e. Question #16i _____

VI. Stoichiometry

18. What is the mass of 0.310 mol of Al_2O_3 ?

19. How many moles are contained in a 187 g sample of KNO_3 ?

20. The combustion of heptane proceeds according to the balanced equation:



If you burn enough heptane to produce 3.12 mol of water, how many moles of carbon dioxide are produced?

21. Aluminum and manganese oxide react in a single displacement reaction to form aluminum oxide and manganese according to the reaction: $2\text{Al} + 3\text{MnO} \longrightarrow \text{Al}_2\text{O}_3 + 3\text{Mn}$

How many grams of aluminum are required to yield 78.5 g of manganese?

22. What is the percent composition by mass of the compound potassium nitrite (KNO_2)? (Please give percentages to the nearest one tenth of a percent).

23. You are a forensic consultant called to the scene of The Great Ice Cream Robbery of 2011. A purplish-green unknown substance is found on the knob of the ice cream shop's back door which leads into the alley. You analyze this substance on your North Thurston Super Mass Spectrometer 3000 and find that it is a compound made up of the following elements:

47.3 % carbon
10.6 % hydrogen
42.1 % sulfur

What is the empirical formula of the purplish-green goop you analyzed?

24. Walking out to the North Thurston Forensi-Van with your purplish-green sample, you step in a puddle of orange ooze. Being the ~~complete science nerd~~ well-respected scientist you are, you decide to analyze the orange stuff as well. Popping the orange stuff into the NTHS SMS3000, you find that your orange compound has a molecular weight of 229.58 g/mol and is made up of:

47.1 % carbon
6.6 % hydrogen
46.3 % chlorine

What are the empirical formula and the molecular formula for the orange ooze?

25. In the reaction $2\text{BiCl}_3 + 3\text{H}_2\text{S} \rightarrow \text{Bi}_2\text{S}_3 + 6\text{HCl}$ bismuth chloride and hydrogen sulfide undergo a double displacement reaction to form bismuth sulfide and hydrochloric acid. Initially you have 0.28 mol of BiCl_3 and 0.41 mol of H_2S . Which reactant is in excess and how many extra moles of that reactant are left over after the reaction is complete?

26. In the reaction $\text{CH}_4 + 4\text{Cl}_2 \longrightarrow 4\text{HCl} + \text{CCl}_4$ methane and chlorine gas react to form hydrogen chloride and carbon tetrachloride. Given initial samples of 37.5 g of methane and 563.0 g of chlorine gas, determine which reactant is in excess and how many moles of that reactant remain after the reaction is complete.
27. A 96.144 g sample of a copper sulfate hydrate is heated over a Bunsen burner. After sufficient heating, the sample is found to contain 71.824 g of copper sulfate (CuSO_4). What is the correct chemical formula for the copper sulfate hydrate before heating?
28. In a chemical reaction, phosphorus pentachloride and water react to form phosphoric acid and hydrochloric acid. Given initial amounts of 68.72 g of phosphorus pentachloride and 26.75 g of water, determine **a)** which reactant is in excess; **b)** how many grams of that reactant remain after the reaction is complete; **c)** what mass of phosphoric acid *should* be produced; and **d)** what the percent yield is if only 25.0 g of phosphoric acid are produced.