

**Due on 8/17/18**

## **Sophomore AP Chem Practice Problems**

### **Scientific notation and significant figures**

Determine the number of Significant Figures in the following numbers:

00034      \_\_\_\_\_

2431.      \_\_\_\_\_

8900      \_\_\_\_\_

0.0094      \_\_\_\_\_

Convert the following into Scientific Notation:

945000      \_\_\_\_\_

.000034      \_\_\_\_\_

Convert to standard notation:

$8.2 \times 10^8$       \_\_\_\_\_

$2.0 \times 10^{-2}$       \_\_\_\_\_

### **Structure of the atom**

Complete the following table

Subatomic Particle	Location	Charge
Proton		
Neutron		
Electron		

### **Electron configurations**

Write the electron configuration for Chlorine

Write the electron configuration for Rubidium

Write the Noble Gas configuration for Silver

## Periodic table, periodic trends

- The horizontal rows of elements in the periodic table are called \_\_\_\_\_.
  - trends
  - groups
  - metals
  - periods
- Which pair of elements have similar properties? (You may use the Periodic Table included with your test.)
  - sodium and neon
  - potassium and bromine
  - potassium and rubidium
  - sulfur and chlorine
- This transition metal is a liquid at room temperature.
  - Hg
  - Cu
  - Fe
  - Ag
- To which group on the periodic table does sodium (Na) belong?
  - 4
  - 3
  - 2
  - 1
- In general, one would find the metals on the \_\_\_\_\_ of the periodic table.
  - right of the stairstep line
  - left of the stairstep line
  - bottom two rows only
  - last family
- Elements in the same group have the same \_\_\_\_\_.
  - number of valence electrons
  - energy level of outer electrons
  - nuclear charge
  - atomic radius
- Which group of elements has similar properties?
  - Ca and Ge
  - P and Br
  - He and Al
  - Mg and Sr
- Phosphorus (P) is considered to be a/an \_\_\_\_\_.
  - metal
  - nonmetal
  - metalloid
- How many electrons does an atom generally need in its outer level to be most stable?
  - 4
  - 8
  - 10
  - 12
- As you move down the periodic table from oxygen through tellurium, atomic radii \_\_\_\_\_.
  - generally increase
  - generally decrease
  - do not change
  - vary unpredictably
- On the periodic table, the atomic radius of a metal \_\_\_\_\_.
  - increases for elements across the period from left to right
  - stays the same for elements across the period
  - decreases for elements across the period from left to right
- Ionization energy \_\_\_\_ as you move across a period.
  - decreases
  - increases
  - remains the same

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13. Which is the most electronegative?  
a. Cr  
b. Po  
c. Ba  
d. F
14. Which of the following has the elements in order from smallest to largest atomic radius? (increasing)  
a. Al, Ga, B, In  
b. In, B, Ga, Al  
c. B, Al, Ga, In  
d. In, Ga, Al, B
15. Which of the following has the elements in order from smallest to largest atomic radius? (increasing)  
a. Zr, Ag, Sn, Te  
b. Te, Sn, Ag, Zr  
c. Ag, Sn, Te, Zr  
d. Zr, Te, Sn, Ag
16. Which of the following has the elements in order from largest to smallest electronegativity? (decreasing)  
a. Al, Ga, B, In  
b. In, B, Ga, Al  
c. B, Al, Ga, In  
d. In, Ga, Al, B
17. Which of the following has the elements in order from largest to smallest electronegativity? (decreasing)  
a. Zr, Ag, Sn, Te  
b. Te, Sn, Ag, Zr  
c. Ag, Sn, Te, Zr  
d. Zr, Te, Sn, Ag
18. What is the most common oxidation state for calcium?  
a. 0  
b. +1  
c. +2  
d. -1  
e. -2
19. What is the most common oxidation state for chlorine?  
a. 0  
b. +1  
c. +2  
d. -1  
e. -2
20. Which is more reactive, calcium or chlorine?  
a. Calcium  
b. Chlorine
21. Which is largest?  
a. K  
b.  $K^+$   
c. Na  
d.  $Na^+$
22. Which is largest?  
a. P  
b. S  
c. Cl  
d.  $Cl^-$

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## Bonding and nomenclature

. **Identify** each of the following as an ionic or covalent compound or an oxyacid or non-oxyacid - then provide the correct **name**.

----- Check only ONE of these four -----

Compound	Ionic	Covalent	Oxyacid	Non-oxyacid	Name
RbBr					
HCl					
Co(SO <sub>3</sub> ) <sub>2</sub>					
SiO <sub>2</sub>					
KCN					
K <sub>3</sub> N					
H <sub>3</sub> PO <sub>4</sub>					
ZrO					
Ca(ClO <sub>4</sub> ) <sub>2</sub>					
CS <sub>2</sub>					
MnS <sub>2</sub>					
FeCl <sub>3</sub>					

14. Provide the correct **formula** for each of the following.

Zinc (II) sulfide

Hydrosulfuric acid

Sodium nitride

Iron (III) dichromate

Magnesium carbonate

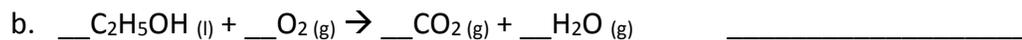
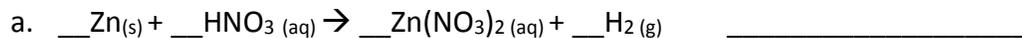
Nitrous acid

Sulfuric acid

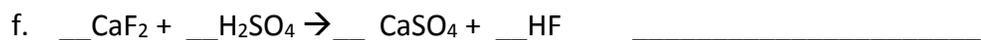
Carbon tetrahydride

## Predicting products and balancing reactions

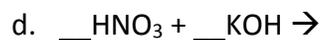
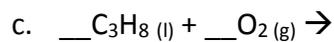
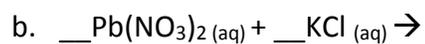
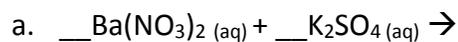
1. Balance the following skeleton equations and write whether they are synthesis, decomposition, single displacement, double displacement, or combustion:



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2. Predict the products of the following reactions and then balance the equation.



g. Silver (I) nitrate and lead (IV) phosphate

h. Propane ( $\text{C}_3\text{H}_8$ ) and oxygen

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## Stoichiometry and Dimensional Analysis

1. If I have  $4.12 \times 10^4$  moles of nitrogen trichloride, how many molecules do I have?
2. 7.24 grams of carbon dioxide is equal to how many moles?
3. How many molecules of sodium chloride are in  $2.6 \times 10^{-2}$  moles?
4. How many molecules are in 32 grams copper (II) chloride?
5. If I have  $7.35 \times 10^{25}$  atoms of calcium, what is the mass, in grams?
6. If you exhale one pound of carbon dioxide overnight (one pound is equal to 453.59 grams), how many molecules of carbon dioxide did you exhale?
7. How many grams of sodium hydroxide (NaOH) are needed to react with 22 grams of hydrosulfuric acid (H<sub>2</sub>S)?  
 $2 \text{ NaOH} + \text{H}_2\text{S} \rightarrow \text{Na}_2\text{S} + 2 \text{ H}_2\text{O}$
8. How many moles of water are produced from the combustion of 57 grams of octane (C<sub>8</sub>H<sub>18</sub>)?  
 $2 \text{ C}_8\text{H}_{18} + 25 \text{ O}_2 \rightarrow 16 \text{ CO}_2 + 18 \text{ H}_2\text{O}$
9. How many grams of sodium sulfate (Na<sub>2</sub>SO<sub>4</sub>) are produced from 3.7 moles of sodium chloride?  
 $2 \text{ NaCl} + \text{K}_2\text{SO}_4 \rightarrow 2 \text{ KCl} + \text{Na}_2\text{SO}_4$
10. How many moles of glucose are needed to react with 2.5 moles of oxygen?  
 $\text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{ O}_2 \rightarrow 6 \text{ CO}_2 + 6 \text{ H}_2\text{O}$
11. How many grams of lithium chloride are produced from 15 grams of magnesium chloride?  
 $\text{MgCl}_2 + \text{Li}_2\text{S} \rightarrow \text{MgS} + 2 \text{ LiCl}$
12. How many grams of water are produced from the combustion of 2.3 moles of octane?  
 $2 \text{ C}_8\text{H}_{18} + 25 \text{ O}_2 \rightarrow 18 \text{ H}_2\text{O} + 16 \text{ CO}_2$
13. In the fermentation of sucrose by enzymes to produce ethanol, 684 grams of sucrose are used. What is the percent yield of the reaction if only 390 grams of ethanol are produced?  
 $\text{C}_{12}\text{H}_{22}\text{O}_{11} + \text{H}_2\text{O} \rightarrow 4 \text{ C}_2\text{H}_5\text{OH} + 4 \text{ CO}_2$
14. If 32 grams of calcium carbonate are reacted with 30 grams of hydrochloric acid, what mass of calcium chloride will be produced?  
 $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$   
  
Identify the limiting reactant: \_\_\_\_\_  
Identify the excess reactant: \_\_\_\_\_
15. If 8 grams of FeCr<sub>2</sub>O<sub>4</sub> are reacted with 2 grams of carbon, what mass of FeCr<sub>2</sub> is produced? What mass of the excess reactant remains after the reaction is complete?  
 $2 \text{ C} + \text{FeCr}_2\text{O}_4 \rightarrow \text{FeCr}_2 + 2\text{CO}_2$

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### Solution calculations

1. Write out in sentences exactly how you would make 92 mL of a 0.13 M solution of KOH from solid KOH.
2. Write out in sentences exactly how you would make 100 mL of a 0.03 M solution of KOH from a 0.13M solution of KOH.
3. What is the **molality** of a solution made by the addition of 32 grams of NaF in 107 mL of water at 25°C?
4. How many mL of water at 25°C must be added to 13 g of Ca(OH)<sub>2</sub> to make a 0.1 molal solution?
5. How many grams of calcium chloride will be needed to make 750 mL of a 0.1 M CaCl<sub>2</sub> solution?
6. How many moles of solute would be needed to make a 2m solution dissolved in 500 mL of water at 25°C?
7. How much water must be added to 200 mL of a 0.5 M NaCl solution to make a 0.2 M solution?

### Simple pH and pOH calculations

pH	[ H <sub>3</sub> O <sup>1+</sup> ]	pOH	[ OH <sup>1-</sup> ]	ACID or BASE?
3.56				
	3.89 x 10 <sup>-7</sup> M			
		9.99		
			4.76 x 10 <sup>-2</sup> M	

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## **Gas laws**

1. A gas occupies 11.2 liters at 0.860 atm. What is the pressure if the volume becomes 15.0 L?
2. Determine the pressure change when a constant volume of gas at 1.00 atm is heated from 20.0 °C to 30.0 °C.
3. What change in volume results if 60.0 mL of gas is cooled from 33.0 °C to 5.00 °C?
4. What volume will 20.0 g of Argon occupy at STP?
5. How many moles of gas would be present in a gas trapped within a 100.0 mL vessel at 25.0 °C at a pressure of 2.50 atmospheres?
6. Calculate the molecular weight of a gas if 35.44 g of the gas stored in a 7.50 L tank exerts a pressure of 60.0 atm at a constant temperature of 35.5 °C
7. For the reaction  $2 \text{H}_{2(g)} + \text{O}_{2(g)} \rightarrow 2 \text{H}_2\text{O}_{(g)}$ , how many liters of water can be made from 5 L of oxygen gas and an excess of hydrogen?