

1. (10 points) The Periodic Table. *Give the name or symbol of the element in question.*

- (a) Name an element in Group 1B _____
- (b) Name an element in the alkali metals _____
- (c) The symbol for the element magnesium is _____
- (d) The element whose symbol is As is _____
- (e) The element with the largest atomic weight in Group 2A is _____
- (f) What noble gas element is in the third period? _____
- (g) What element is in Group 5A and in the third period? _____
- (h) Give the name or symbol for an actinide element. _____
- (i) What element has the largest atomic weight in the 5th period? _____
- (j) In what region of the periodic table do you find the element Cr (*alkali metals, alkaline earth metals, transition metals, lanthanides, actinides, noble gases, main group elements*)?

2. (22 points) Naming Ionic Compounds. Supply the name of the compounds, its constituent ions, and the formula as requested.

1. NH_4^+	NO_3^-		
3. Ba^{2+}	Br^-		
4.		calcium sulfate	
5. Ag^+	I^-		
6.		Cobalt(III) oxide	
7. Fe^{3+}			$\text{Fe}(\text{CH}_3\text{CO}_2)_3$
8.		Lithium phosphate	
9.		Sodium sulfite	
10. K^+	MnO_4^-		

3. (5 points) Names of nonionic compounds. Supply the name or formula of the indicated compounds.

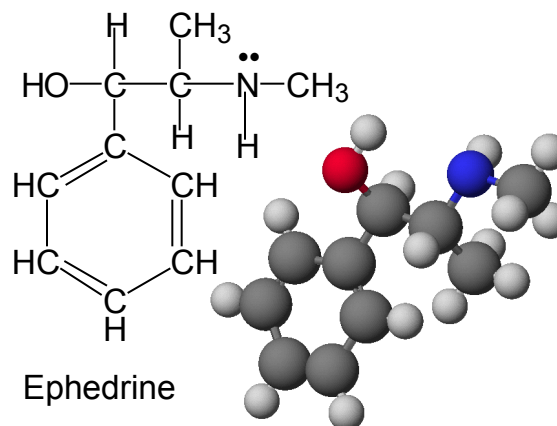
Formula	Name
NH ₃	
	Nitrogen dioxide
NF ₃	
SO ₂	
	Hydrogen bromide

4. (16 points) Atomic Structures and Isotopes. Copper has two stable isotopes, ⁶³Cu and ⁶⁵Cu.

- (a) What is the atomic weight of copper? _____
- (b) Which is the more abundant isotope of copper, ⁶³Cu or ⁶⁵Cu? _____
- (c) Is copper a metal, metalloid, or nonmetal? _____
- (d) How many protons are there in the nucleus of a copper atom? _____
- (e) How many neutrons are there in the nucleus of a ⁶³Cu atom? _____
- (f) How many electrons are there in a copper(II) ion (Cu²⁺)? _____
- (g) If you have 35.5 g of copper, how many moles does this represent?
- i. 0.559 mol iii. 63.6 mol
- ii. 35.5 mol iv. 2256 mol
- (h) If you have an object containing 1.2×10^{-3} mol of copper, how many atoms of copper do you have?
- i. 6.02×10^{23} atom
- ii. 12 atoms
- iii. 7.2×10^{20} atoms
- iv. 5.0×10^{26} atoms

MOLECULES

1. (16 points) *Ma Huang*, an extract from the ephedra species of plants, contains ephedrine. The Chinese have used it for over 5000 years to treat asthma. More recently the substance has been used in diet pills that can be purchased over the counter in herbal medicine shops. However, very serious concerns about these pills have been raised as there have been reports of serious heart problems.



(a) The *molecular* formula of ephedrine is _____

(b) Based on your formula, the molar mass of ephedrine is _____

(c) What is the *weight percent* of carbon in ephedrine?

♦ Show your work carefully and completely for parts c-f of this question. If no work is shown, no credit is given.

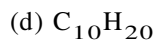
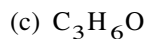
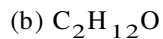
(d) If you have 0.125 g of ephedrine, what quantity of the compound do you have (in moles)?

(e) How many *molecules* of ephedrine are there in 0.125 g?

(f) How many C atoms are there in 0.125 g of ephedrine?

2. (3 points) All of the following statements 57.1 g of octane, C_8H_{18} , EXCEPT
- (a) 57.1 g is 0.500 mol of octane.
 - (b) The compound has 84.1% C by weight
 - (c) The empirical formula of the compound is C_4H_9
 - (d) 57.1 g of octane contains 28.0 g of hydrogen atoms
3. (3 points) The formula of barium molybdate is $BaMoO_4$. What is the formula of sodium molybdate?
- (a) Na_4MoO
 - (b) $NaMoO$
 - (c) Na_2MoO_3
 - (d) Na_2MoO_4
 - (e) Na_4MoO_4
4. (3 points) Which group of ions contains *only* ions you would predict as “stable”?
- (a) Li^{2+} , Fe^{2+} , Ca^{2+}
 - (b) Ca^{2+} , Fe^{3+} , Al^{3+}
 - (c) Mg^{3+} , Cr^{3+} , O^{2-}
 - (d) F^{2-} , Al^{4+} , Na^+
5. (3 points) A hydrocarbon has the empirical formula CH_2 . If its molar mass is 140.3 g/mol, what is its ***molecular formula***?
- (a) CH_2
 - (b) C_5H_{10}
 - (c) C_8H_{15}
 - (d) $C_{10}H_{20}$
6. (3 points) Succinic acid is a naturally-occurring acid composed of carbon, hydrogen, and oxygen. Its composition is 40.68% C, 5.12% H, and 54.20% O. The ***empirical formula*** of the compound is
- (a) CHO
 - (b) C_2H_2O
 - (c) $C_3H_2O_2$
 - (d) C_2H_3O
 - (e) $C_2H_3O_2$

7. (6 points) Caproic acid, which has a characteristic goat-like odor, has the formula $C_6H_{12}O_2$. What is its empirical formula?



What is the weight percent of oxygen, O, in caproic acid ($C_6H_{12}O_2$, molar mass = 116.2 g/mol)?

(a) 10.3%

(b) 27.5%

(c) 31.0%

(d) 62.0%

8. (3 points) Epsom salt is a hydrated compound with water molecules associated with magnesium sulfate. Its formula is $MgSO_4 \cdot xH_2O$. Using the experimental data below, decide on the value of x .

Mass of $MgSO_4 \cdot xH_2O$ used = 1.687 g

Mass of $MgSO_4$ after heating to drive off the water = 0.824 g

Molar mass of $MgSO_4$ = 120.4 g/mol

(a) $x = 1$

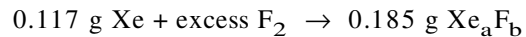
(b) $x = 2$

(c) $x = 4$

(d) $x = 6$

(e) $x = 7$

9. (3 points) Xenon (Xe) and fluorine form several compounds. Suppose 0.117 g Xe react with excess fluorine, F_2 , to give 0.185 g of a compound Xe_aF_b . What is the formula of the compound?



- (a) XeF
 - (b) Xe_2F
 - (c) XeF_2
 - (d) XeF_3
 - (e) XeF_4
10. (4 points) The abundance of the elements in the universe is plotted on the next page. Describe **briefly at least three important observations** regarding this plot. (That is, describe trends in abundance with atomic number, elements with particularly high or low abundances, elements that do not fit trends, and so on.)

