

Wednesday, August 8<sup>th</sup>, 2012  
Final Exam

Name: \_\_\_\_\_

1. Calcium hydroxide can react with nitric acid to make calcium nitrate and water. If you begin with 10.0g of calcium hydroxide, how many grams of nitric acid will you need, and how many grams of each product will you obtain?
2. Consider the element Zinc.
  - (a) What is its electron configuration?
  - (b) What ion does it typically form?
  - (c) Is it paramagnetic or diamagnetic?
  - (d) Keeping in mind all the rules and exceptions we discussed in class, predict what the electron configuration of the ion of zinc would look like.
3. How many protons, neutrons, and electrons in the ion of  $^{33}\text{S}$ ?
4. What are allotropes?
5. What is the mass percent of sodium in sodium carbonate?
6. What two assumptions are necessary for a gas to be considered ideal?

7. Give the lewis structure of the following:  
(a)  $\text{NHBr}^{-1}$  (b)  $\text{COCl}^{+1}$

8. What is the shape of each of the molecules in question 7?

(a)  
(b)

9. What is the bond angle for each molecule in question 7?

(a)  
(b)

10. For naming ordinary covalent compounds that have two elements, list the order in which the elements should be placed.

11. Name the following:

(a)  $\text{HClO}_3(\text{aq})$

(b)  $\text{Mg}(\text{C}_2\text{H}_3\text{O}_2)_2$

(c)  $\text{Mn}(\text{PO}_4)_2$

(d)  $\text{Fe}_2(\text{SO}_3)_3$

12. Give the formula of the following:

(a) Titanium (III) bromite

(b) Ammonium sulfide

(c) Cobalt (IV) cyanide

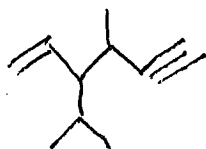
(d) Hypoiodous acid

13. What is the definition of an acid?

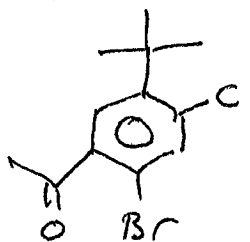
14. Suppose Uranium 238 undergoes three alpha and three beta decays. What remains?

15. What is the formula of the following?

(a)



(b)



16. Draw a molecule below that has a carboxylic acid, an amine, and an alcohol.

17. Is it possible for the molecule you have drawn in question 16 to also contain an alkane? Why or why not?

18. As intermolecular forces go up, boiling point tends to rise as well. Besides boiling point, what are all the other things that tend to rise with stronger IMF?

19. Write down the name for the state changes below:

- (a) Gas to a liquid
- (b) Gas to a solid
- (c) Solid to a gas

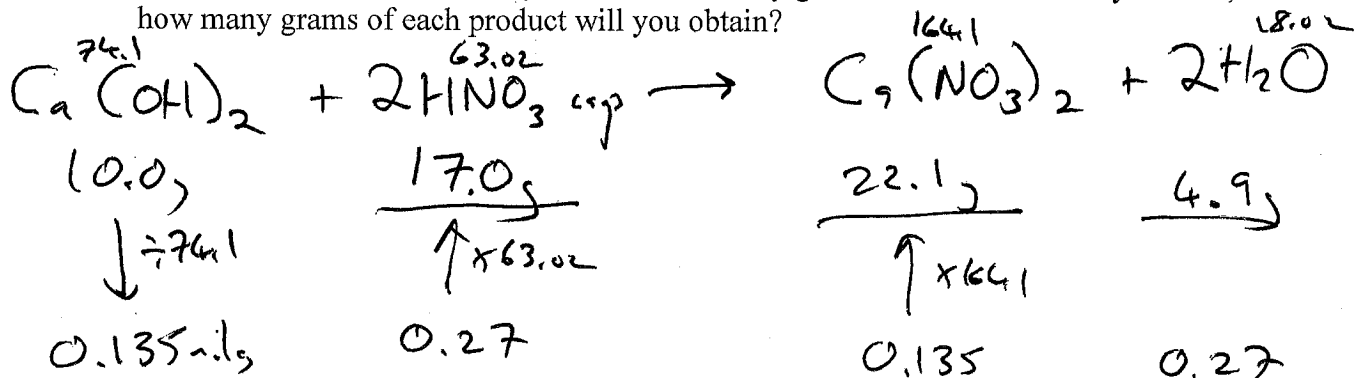
20. How many atoms are there in 11.1g of Neon (Ne)?

21. What is the Cause Causality Trap?

22. Consider phosphorus (P) and arsenic (As)

- (a) Which has the higher electronegativity?
- (b) Which has the higher ionization energy?
- (c) Which is larger?
- (d) If in the gas form, which would be faster?

1. Calcium hydroxide can react with nitric acid to make calcium nitrate and water. If you begin with 10.0g of calcium hydroxide, how many grams of nitric acid will you need, and how many grams of each product will you obtain?



2. Consider the element Zinc.

(a) What is its electron configuration?  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$

(b) What ion does it typically form?  $+2$

(c) Is it paramagnetic or diamagnetic?

(d) Keeping in mind all the rules and exceptions we discussed in class, predict what the electron configuration of the ion of zinc would look like.

$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10}$  (i.e. loses  $4s^2$  to keep a full shell)

3. How many protons, neutrons, and electrons in the ion of  $^{33}\text{S}$ ?

16    17    18

4. What are allotropes?

~~Diff~~ Different bonding arrangements of the same element  
(e.g. diamond & graphite)

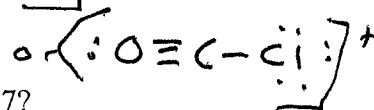
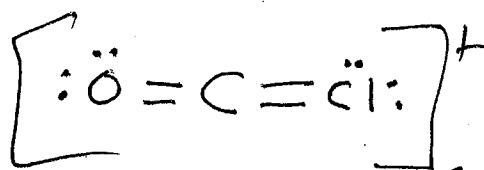
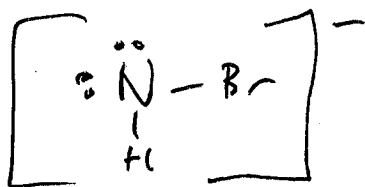
5. What is the mass percent of sodium in sodium carbonate?

$\text{Na}_2\text{CO}_3$      $22.99 \times 2 = \frac{45.98}{105.99} = 43.4\%$

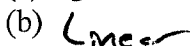
6. What two assumptions are necessary for a gas to be considered ideal?

Volume of gas molecule is insignificant compared to total V.  
Interactions between molecules can be ignored.

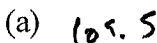
7. Give the lewis structure of the following:



8. What is the shape of each of the molecules in question 7?



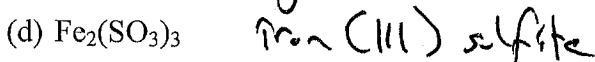
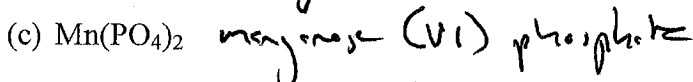
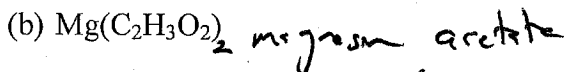
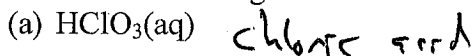
9. What is the bond angle for each molecule in question 7?



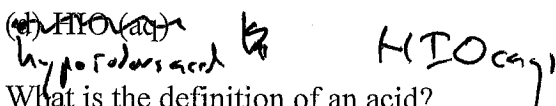
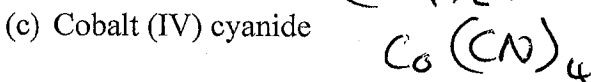
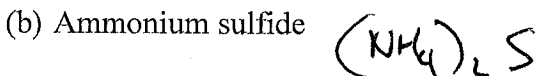
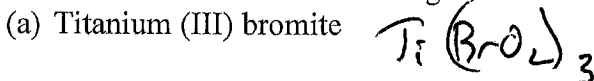
10. For naming ordinary covalent compounds that have two elements, list the order in which the elements should be placed.



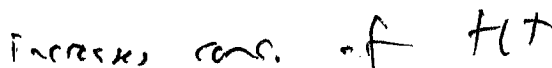
11. Name the following:



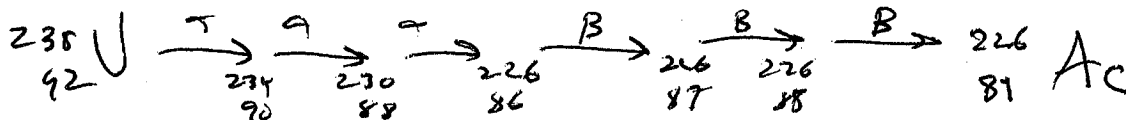
12. Give the formula of the following:



13. What is the definition of an acid?

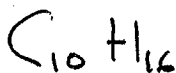
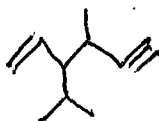


14. Suppose Uranium 238 undergoes three alpha and three beta decays. What remains?

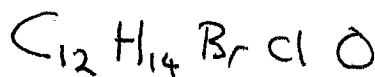
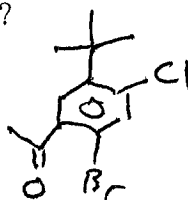


15. What is the formula of the following?

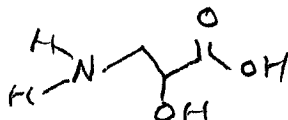
(a)



(b)



16. Draw a molecule below that has a carboxylic acid, an amine, and an alcohol.



17. Is it possible for the molecule you have drawn in question 16 to also contain an alkane?  
Why or why not?

No.

Alkane, can only have C + H.

Alcohol, Carboxylic acids must have O

Amines must have N.

18. As intermolecular forces go up, boiling point tends to rise as well. Besides boiling point, what are all the other things that tend to rise with stronger IMF?

MPT surface tension ↑ (viscosity ↑)  $H_2O$  solubility ↑

19. Write down the name for the state changes below:

(a) Gas to a liquid Condensation

(b) Gas to a solid Deposition

(c) Solid to a gas Sublimation

20. How many atoms are there in 11.1g of Neon (Ne)?

$$11.1 \div 20.18 = 0.55 \text{ mol} \times 6.02 \times 10^{23} = 3.3 \times 10^{23}$$

21. What is the Cause Causality Trap?

Correlation is not causation  
(Just b/c 2 variables are correlated does not mean one causes the other)

22. Consider phosphorus (P) and arsenic (As)

(a) Which has the higher electronegativity?

P

(b) Which has the higher ionization energy?

P

(c) Which is larger?

As

(d) If in the gas form, which would be faster?

P

Tuesday, March 20<sup>th</sup>, 2012  
Final Exam

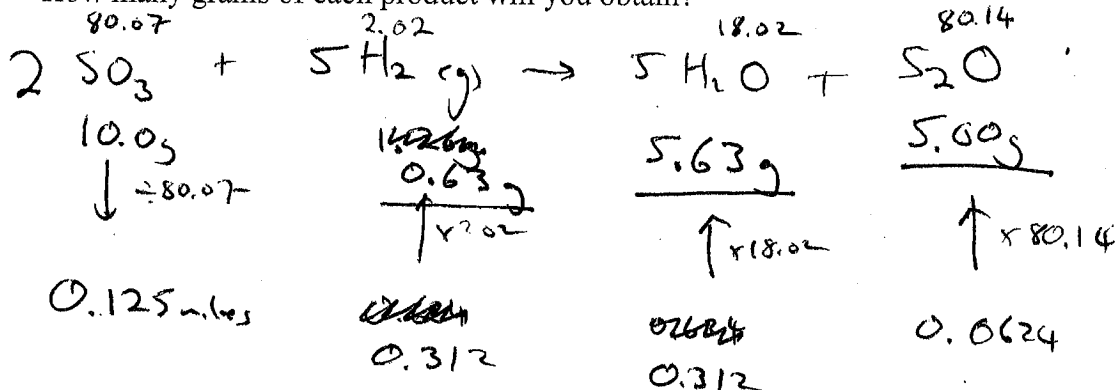
Name: \_\_\_\_\_

1. Sulfur trioxide can react with hydrogen gas to form water and disulfur monoxide. If you begin with 10.0g of sulfur trioxide, how many grams of hydrogen gas will you need? How many grams of each product will you obtain?
2. What are the common characteristics of an acid?
3. Give the electron configuration of...
  - (a) The ion of aluminum (Al)
  - (b) Bromine (Br)
4. Compare  $^{86}\text{Rb}$  and  $^{87}\text{Sr}$ .
  - (a) Which has the higher electronegativity?
  - (b) Which is bigger?
  - (c) Which has the higher ionization energy?
  - (d) Which has more neutrons?
5. What is the mass percent of hydrogen in methane?

6. Give the Lewis Structure of the following:  
(a)  $\text{FBr}_2\text{HSi}$  (b)  $\text{POH}$
7. What is the shape of each of the molecules in question 6?  
(a)  
(b)
8. What is the bond angle for each of the molecules in question 6?  
(a)  
(b)
9. Name the following:  
(a)  $\text{Si}_4\text{Br}_9$   
(b)  $\text{Ti}(\text{CO}_3)_2$   
(c)  $\text{Al}(\text{CN})_3$   
(d)  $\text{HNO}_{2(\text{aq})}$
10. Give the formula for the following  
(a) Hypobromous acid  
(b) Lead (II) periodate  
(c) Lithium phosphate  
(d) Cobalt (III) oxide
11. Would you expect the following reactions to occur?  
(a)  $\text{A}_{(\text{s})} + \text{B}_{(\text{s})} \rightarrow \text{C}_{(\text{g})}$  endothermic  
(b)  $\text{A}_{(\text{l})} + \text{B}_{(\text{g})} \rightarrow \text{C}_{(\text{g})} + \text{D}_{(\text{g})}$  exothermic
12. Suppose that Francium (Fr) 223 undergoes four betas and two alpha decays. What remains?

13. If Thorium (Th) 232 undergoes nuclear fission with a fast-moving neutron, two daughter isotopes are produced. One is Silver (Ag) 118. What is the other?
14. Suppose helium 4 undergoes fusion with hydrogen 3 (called tritium). The result is lithium 6 and what else?
15. What is the difference between alpha, beta, and gamma radiation in terms of structure, damage to humans, and how easy/difficult they are to stop.
16. Assuming the other two variables are kept constant...
- (a) what happens to the temperature when the number of gas molecules is increased
  - (b) What happens to the volume if the temperature is increased?
17. Define boiling point.
18. Imagine all seven diatoms were gases. Which would be the fastest and which the slowest?
19. Explain how a barometer works.
20. Balance the following: If heated, magnesium sulfite reacts with aluminum oxide to make aluminum sulfite and magnesium oxide.

1. Sulfur trioxide can react with hydrogen gas to form water and disulfur monoxide. If you begin with 10.0g of sulfur trioxide, how many grams of hydrogen gas will you need? How many grams of each product will you obtain?

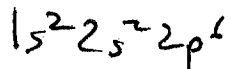


2. What are the common characteristics of an acid?

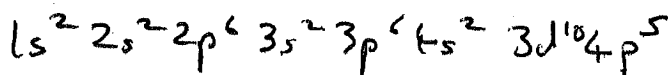
pH < 7  
litmus paper red  
sour  
corrosive

3. Give the electron configuration of...

(a) The ion of aluminum (Al)



(b) Bromine (Br)



4. Compare <sup>86</sup>Rb and <sup>87</sup>Sr.

(a) Which has the higher electronegativity? Sr

(b) Which is bigger? Rb

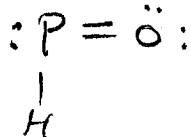
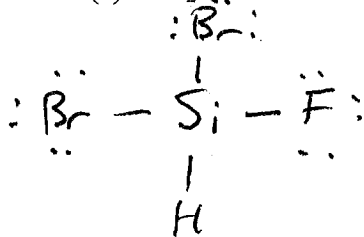
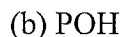
(c) Which has the higher ionization energy? Sr

(d) Which has more neutrons? Same

5. What is the mass percent of hydrogen in methane?

$$\frac{1.01 \times 4}{12.01 + (1.01 \times 4)} = 25.2\%$$

6. Give the Lewis Structure of the following:



7. What is the shape of each of the molecules in question 6?

(a) tetrahedral

(b) bent

8. What is the bond angle for each of the molecules in question 6?

(a)  $109.5^\circ$

(b)  $120^\circ$

9. Name the following:

(a)  $\text{Si}_4\text{Br}_9$  tetrasilicon nonabromide

(b)  $\text{Ti}(\text{CO}_3)_2$  titanium (IV) carbonate

(c)  $\text{Al}(\text{CN})_3$  aluminum cyanide

(d)  $\text{HNO}_2(\text{aq})$  nitrous acid

10. Give the formula for the following

(a) Hypobromous acid  $\text{HBrO}_{\text{hyp}}$

(b) Lead (II) periodate  $\text{Pb}(\text{IO}_4)_2$

(c) Lithium phosphate  $\text{Li}_3\text{PO}_4$

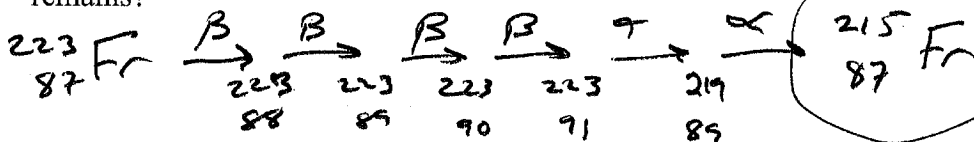
(d) Cobalt (III) oxide  $\text{Co}_2\text{O}_3$

11. Would you expect the following reactions to occur?

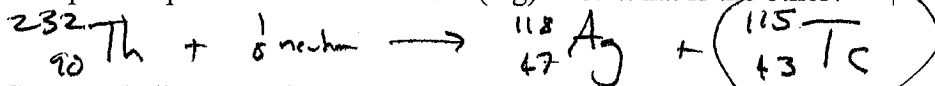
(a)  $\text{A}_{(\text{s})} + \text{B}_{(\text{s})} \rightarrow \text{C}_{(\text{g})}$  endothermic at high  $T$

(b)  $\text{A}_{(\text{l})} + \text{B}_{(\text{g})} \rightarrow \text{C}_{(\text{g})} + \text{D}_{(\text{g})}$  exothermic yes

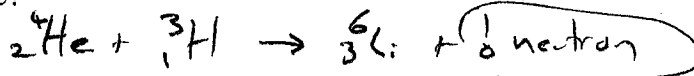
12. Suppose that Francium (Fr) 223 undergoes four betas and two alpha decays. What remains?



13. If Thorium (Th) 232 undergoes nuclear fission with a fast-moving neutron, two daughter isotopes are produced. One is Silver (Ag) 118. What is the other?



14. Suppose helium 4 undergoes fusion with hydrogen 3 (called tritium). The result is lithium 6 and what else?



15. What is the difference between alpha, beta, and gamma radiation in terms of structure, damage to humans, and how easy/difficult they are to stop.

Alpha: 2 protons, 2 neutrons	very harmful	easy to stop
Beta: 1 electron	medium toxicity	awkward to stop
Gamma: energy	mildly harmful	almost impossible to stop.

16. Assuming the other two variables are kept constant...

(a) what happens to the temperature when the number of gas molecules is increased

$$PV = nRT$$

(b) What happens to the volume if the temperature is increased?

17. Define boiling point.

When vapor pressure = atmospheric pressure.

18. Imagine all seven diatoms were gases. Which would be the fastest and which the slowest?

$\text{H}_2$  fastest

$\text{I}_2$  slowest

19. Explain how a barometer works.

A liquid (preferably dense) is placed in a test tube upside down in a bowl. Gravity attempts to pull the liquid down but atmospheric pressure tries to push it up. Since gravity is constant, the height of the liquid is a measure of atmospheric pressure.



20. Balance the following: If heated, magnesium sulfite reacts with aluminum oxide to make aluminum sulfite and magnesium oxide.

