

Name: _____

June 3, 2014

Chemical Principles I

Exam 1

All problems are 4 points except where indicated.

1. Assuming the following numbers are measurements and using the rules for significant figures, determine the answer for the following calculation.

$$(15.5/42) \times 219.5 =$$

- a) 81.0059 b) 81.006 c) 81.01 d) 81.0 e) 81

2. The density of silver is 10.5 g/cm^3 . A piece of silver that occupies a volume of 23.6 cm^3 would have a mass of _____ g.

- A) 248 B) 0.445 C) 2.25 D) 112 E) 23.6

$$10.5 \frac{\text{g}}{\text{cm}^3} \times 23.6 \text{ cm}^3$$

3. The ${}^{21}_{10}\text{Ne}$ isotope has:

How many protons: 10

electrons: 10

neutrons: 11

4. Which element is in the same period as carbon?

- a) fluorine b) silicon c) lead d) phosphorus e) hydrogen

5. Which element is in the same group as calcium?

- a) cadmium b) cesium c) barium d) scandium e) potassium

6. The proper formula unit for the binary compound formed from calcium and fluorine is:

- a) CaF b) Ca₂F c) CaF₂ d) Ca₂F₂ e) Ca₃F₂

7. Give the formula for the following ionic compounds (6 pt.)

a. Ammonium nitrate: NH_4NO_3 .

b. Potassium chlorate: KClO_3 .

c. Magnesium carbonate: MgCO_3 .

8. Name the following ionic compounds: (4 pt.)

a. FeCl_3 : iron (III) chloride.

b. AgO : silver oxide.

9. Name the following binary molecular compounds (4 pt.)

a. BrCl_5 : bromine pentachloride.

b. N_2O_4 : dinitrogen tetroxide.

10. Name the following acids: (6 pt.)

a. HCl : hydrochloric acid.

b. H_2SO_4 : sulfuric acid.

c. HNO_2 : nitrous acid.

11. The atomic number indicates _____.
- A) the number of neutrons in a nucleus
 - B) the total number of neutrons and protons in a nucleus
 - C) the number of protons or electrons in a neutral atom
 - D) the number of atoms in 1 g of an element
 - E) the number of different isotopes of an element

12. How many neutrons are there in an atom of uranium whose mass number is 235?
- A) 92 B) 143 C) 235 D) 238 E) 327 $\frac{-92}{143}$

13. The nucleus of an atom contains _____.
- A) electrons
 - B) protons, neutrons, and electrons
 - C) protons and neutrons
 - D) protons and electrons
 - E) protons

14. Which has more molecules: a mole of H₂O or a mole of O₂?
- a) a mole of H₂O
 - b) a mole of O₂
 - c) insufficient information to answer
 - d) They both have the same number of molecules.
 - e) The answer depends on the volume of the container.

15. Calculate the molar mass of aluminum hydroxide, Al(OH)₃.

$$26.98 + 3(16.00) + 3(1.008) =$$

Answer: 78.00

16. Calculate the molar mass of sucrose, C₁₂H₂₂O₁₁.

$$12(12.01) + 22(1.008) + 11(16.00)$$

Answer: 342.30

17. Calculate the number of moles of sucrose, $C_{12}H_{22}O_{11}$, in a 512 gram sample of sucrose.

$$512 \text{ g} \times \frac{1 \text{ mol}}{342.30 \text{ g}} = 1.4958$$

Answer: 1.50 mol

18. Calculate the percent composition by mass of sodium in Na_2CO_3 .

$$2(22.99) + 12.01 + 3(16.00) = 105.99$$

$$\frac{45.98}{105.99} \times 100\% =$$

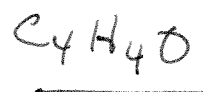
Answer: 43.38 %

19. A compound that is composed of carbon, hydrogen, and oxygen contains 70.6% C, 5.9% H, and 23.5% O by mass. The molecular weight of the compound is 136 amu. Determine a) the empirical formula; b) the molecular formula for this compound. (8 pt.)

$$70.6 \text{ g C} \times \frac{1 \text{ mol C}}{12.01 \text{ g}} = 5.88 / 1.47 = 4$$

$$5.9 \text{ g H} \times \frac{1 \text{ mol H}}{1.008 \text{ g}} = 5.83 / 1.47 = 4$$

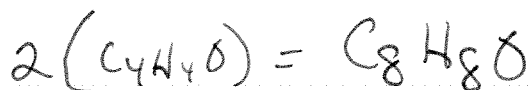
$$23.5 \text{ g O} \times \frac{1 \text{ mol O}}{16.00 \text{ g O}} = 1.47 / 1.47 = 1$$



Empirical Formula wt

$$4(12.01) + 4(1.008) + 16.00 = 68.07$$

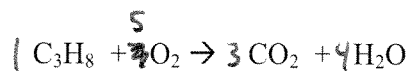
$$\frac{136}{68} = 2$$



a) empirical formula: $\text{C}_4\text{H}_4\text{O}$

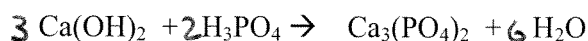
b) molecular formula: $\text{C}_8\text{H}_8\text{O}$

20. When the following chemical reaction is properly balanced the coefficients are:



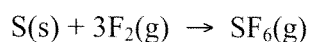
- a) 0, 5, 3, 4 **b) 1, 5, 3, 4** c) 2, 11, 6, 8 d) 2, 12, 6, 16
 e) 3, 13, 9, 12

21. When the following chemical reaction is balanced, with all whole numbers, the coefficients are:



- a) 1, 2, 1, 6 **b) 3, 2, 1, 6** c) 2, 3, 2, 3 d) 3, 2, 4, 6
 e) 3, 2, 3, 2

22. Sulfur and fluorine react in a combination reaction to produce sulfur hexafluoride:



In a particular experiment, the percent yield is 79.0%. This means that a 7.90-g sample of fluorine yields _____ g of SF₆ in the presence of excess sulfur.

- A) 30.3 B) 10.1 **C) 7.99** D) 24.0 E) 0.110

$$7.90 \text{ g F}_2 \times \frac{1 \text{ mol F}_2}{38.00 \text{ g F}_2} \times \frac{1 \text{ mol SF}_6}{3 \text{ mol F}_2} \times \frac{146.06 \text{ g SF}_6}{1 \text{ mol SF}_6} = 10.12 \text{ g SF}_6$$

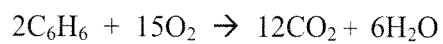
-2 if
not
include
79%

$$\frac{7.99}{10}$$

$$10.12 \text{ g} \times 0.790 = 7.996$$

$$= 8.00 \text{ g}$$

23. How many grams of water are produced when 45 grams of benzene burn in 15 grams of oxygen according to the following balanced chemical equation?



- a) 0.19 g b) 1.7 g c) 3.4 g d) 31 g e) 50 g

$$45 \text{ g C}_6\text{H}_6 \times \frac{1 \text{ mol C}_6\text{H}_6}{78.11 \text{ g C}_6\text{H}_6} \times \frac{6 \text{ mol H}_2\text{O}}{2 \text{ mol C}_6\text{H}_6} = 1.73 \text{ mol H}_2\text{O}$$

$$\frac{15 \text{ g O}_2}{\text{LR}} \times \frac{1 \text{ mol O}_2}{32.00 \text{ g O}_2} \times \frac{6 \text{ mol H}_2\text{O}}{15 \text{ mol O}_2} = \underline{0.1875 \text{ mol H}_2\text{O}} *$$

$$0.1875 \text{ mol H}_2\text{O} \times \frac{18.02 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} = 3.38 \text{ g H}_2\text{O}$$

↓
3.4 g H₂O