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

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

3. The $^{21}_{10}Ne$ 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) Ca_2F c) CaF_2 d) Ca_2F_2 e) Ca_3F_2

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

$235 - 92 = 143$

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 H_2O or a mole of O_2?

a) a mole of H_2O

b) a mole of O_2

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, $C_{12}H_{22}O_{11}$.

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

Answer: 342.30.

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

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

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.)

5.88 5.85 C_4H_4O

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

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

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

C_4H_4O

Epirical Formula wt

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

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

$2(C_4H_4O) = C_8H_8O$

a) empirical formula: C_4H_4O.

b) molecular formula: C_8H_8O.

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

$$1\ C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$$

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:

$$3\ Ca(OH)_2 + 2\ H_3PO_4 \rightarrow Ca_3(PO_4)_2 + 6\ H_2O$$

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:

$$S(s) + 3F_2(g) \rightarrow SF_6(g)$$

In a particular experiment, the percent yield is 79.0%. This means that a 7.90-g sample of fluorine yields _____ g of SF_6 in the presence of excess sulfur.

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

$$7.90\ g\ F_2 \times \frac{1\ mol\ F_2}{38.00\ g\ F_2} \times \frac{1\ mol\ SF_6}{3\ mol\ F_2} \times \frac{146.06\ g\ SF_6}{1\ mol\ SF_6} = 10.12\ g\ SF_6$$

$$10.12\ g \times 0.790 = 7.996 = 8.00\ g$$

-2 if not include 79%

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?

$$2C_6H_6 + 15O_2 \rightarrow 12CO_2 + 6H_2O$$

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

$$45\ g\ C_6H_6 \times \frac{1\ mol\ C_6H_6}{78.11\ g\ C_6H_6} \times \frac{6\ mol\ H_2O}{2\ mol\ C_6H_6} = 1.73\ mol\ H_2O$$

$$\underbrace{15\ g\ O_2}_{LR} \times \frac{1\ mol\ O_2}{32.00\ g\ O_2} \times \frac{6\ mol\ H_2O}{15\ mol\ O_2} = 0.1875\ mol\ H_2O\ *$$

$$0.1875\ mol\ H_2O \times \frac{18.02\ g\ H_2O}{1\ mol\ H_2O} = 3.38\ g\ H_2O$$

$$\downarrow$$

$$3.4\ g\ H_2O$$