Name _____ Honors Chemistry ___/__/___

Chemical Quantities Review- Practice Test Part 1

Multiple Choice (2 points each). For each of the following, choose the best answer. Circle and write its letter on the line in front of the question

1. _____ What is the gram formula mass of barium phosphite?
(A) 569.9 g/mol (B) 184.3 g/mol (C) 215.3 g/mol (D) 247.3 g/mol (E) none of the above

2. _____ Calcium nitrate forms two hydrates. One is 24.7% water and the other is 30.4% water. Which of the following represents both formulas?
(A) $Ca(NO_3)_2 * 2H_2O$, $Ca(NO_3)_2 * 3H_2O$ (B) $Ca(NO_3)_2 * 2H_2O$, $Ca(NO_3)_2 * 4H_2O$
(C) $Ca(NO_3)_2 * 3H_2O$, $Ca(NO_3)_2 * 4H_2O$ (D) $Ca(NO_3)_2 * 2H_2O$, $Ca(NO_3)_2 * 5H_2O$
(E) $Ca(NO_3)_2 * 3H_2O$, $Ca(NO_3)_2 * 5H_2O$ (F) none of the above

3. _____ How many fluoride ions are there in 3.0 moles of aluminum fluoride?
(A) 3×10^{23} (B) 9.0×10^{23} (C) 1.8×10^{24} **(D) 5.4×10^{24}** (E) none of the above

4. _____ What is the mass of 44.8 liters of helium?
(A) 2.0 grams (B) 4.0 grams **(C) 8.0 grams** (D) 16.0 grams (E) none of the above

5. _____ What is the empirical formula of $C_6H_{12}O_6$?
(A) $C_6H_{12}O_6$ (B) $C_3H_4O_3$ (C) $C_2H_4O_2$ **(D) CH_2O** (E) none of the above

6. _____ What is the volume of one mole of carbon monoxide (CO)?
(A) 6.02×10^{23} liters **(B) 22.4 liters** (C) 627 liters (D) 44.8 liters (E) none of the above

7. _____ What is the name of the following hydrate: $CuSO_4*5H_2O$?
(A) copper(II) sulfate tetrahydrate (B) copper(II) sulfate hexahydrate
(C) copper(II) sulfite pentahydrate **(D) copper(II) sulfate pentahydrate**

8. _____ What is the formula of a compound that contains 0.89g potassium, 1.18 grams of chromium and 1.27 grams of oxygen?
(A) $K_2Cr_2O_7$ (B) $KCrO_3$ (C) $KCrO_4$ (D) K_2CrO_4 (E) none of the above

9. _____ What is the formula of a compound that contains 11.8% hydrogen, 41.1% nitrogen and 47.0% sulfur?
(A) NH_4S **(B) $(NH_4)_2S$** (C) NHS (D) NH_4S_2 (E) none of the above

10. _____ What is the percent of water in molybdenum(V) sulfide trihydrate?
(A) 86.7% (B) 38.7% **(C) 13.3%** (D) 61.3% (E) none of the above

11. _____ How many water molecules are there in a hydrate that is 54.3% $Ba(OH)_2$ &45.7% H_2O?
(A) 2 (B) 3 (C) 7 **(D) 8** (E) none of the above

12. _____ How many grams of hydrogen are there in 17.0 grams of water?
(A) 17.0 grams (B) 11.3 grams (C) 15.1 grams **(D) 1.9 grams** (E) none of the above

13. _____ What is the percentage of water in sodium acetate trihydrate?
(A) 39.7% (B) 60.3% (C) 38.8% (D) 25.5% (E) none of the above

14. _____ What is the percent of nitrogen in ammonium carbonate?
(A) 14.6% (B) 17.9% **(C) 29.2%** (D) 35.9 % (E) none of the above

15. _____ What is the volume of 60.0 grams of nitrous oxide (N_2O)?
(A) 1340 L (B) 2.68 L (C) 44.8 L **(D) 30.5 L** (E) none of the above

16. _____ A 27.0-gram sample of an unknown hydrocarbon was burned in excess oxygen to form 88.0 grams of carbon dioxide and 27.0 grams of water. What is a possible molecular formula of the hydrocarbon?
(A) CH_4 (B) C_2H_2 (C) C_4H_3 **(D) C_4H_6** (E) C_4H_{10}

17. _____ How many grams of calcium nitrate, $Ca(NO_3)_2$, contains 24 grams of oxygen atoms?
(A) 164 grams (B) 96 grams (C) 62 grams (D) 50. grams **(E) 41 grams**

18. _____ The simplest formula for an oxide of nitrogen that is 36.8 percent nitrogen by weight is
(A) N_2O (B) NO (C) NO_2 **(D) N_2O_3** (E) N_2O_5

19. _____ When a hydrate of Na_2CO_3 is heated until all the water is removed, it loses 54.3 percent of its mass. The formula of the hydrate is
(A) $Na_2CO_3 \cdot 10\ H_2O$ **(B) $Na_2CO_3 \cdot 7\ H_2O$** (C) $Na_2CO_3 \cdot 5\ H_2O$
(D) $Na_2CO_3 \cdot 3\ H_2O$ (E) $Na_2CO_3 \cdot H_2O$

20. _____ When hafnium metal is heated in an atmosphere of chlorine gas, the product of the reaction is found to contain 62.6 percent Hf by mass and 37.4 percent Cl by mass. What is the empirical formula for this compound?
(A) HfCl (B) $HfCl_2$ **(C) $HfCl_3$** (D) $HfCl_4$ (E) Hf_2Cl_3

21. _____ A compound contains 1.10 mol of K, 0.55 mol of Te, and 1.65 mol of O. What is the simplest formula of this compound?
(A) KTeO (B) KTe_2O **(C) K_2TeO_3** (D) K_2TeO_6 (E) K_4TeO_6

22. _____ How many carbon atoms are contained in 2.8 grams of C_2H_4?
(A) 1.2×10^{23} (B) 3.0×10^{23} (C) 6.0×10^{23} (D) 1.2×10^{24} (E) 6.0×10^{24}

23. _____ What is the empirical formula of a hydrocarbon that is 10% hydrogen by mass?
(A) CH_3 (B) C_2H_5 **(C) C_3H_4** (D) C_4H_9 (E) C_9H_{10}

24. _____ How many gold atoms are there in 25.0 grams of gold?
(A) 25.0×10^{23} (B) 2.96×10^{27} **(C) 7.64×10^{22}** (D) 560. (E) none of the above

25. _____ What is the percentage of oxygen in iron(III) oxide?
(A) 69.9% (B) 77.7% **(C) 30.1%** (D) 22.3% (E) none of the above

26. _____ What is the mass of silver in 356 grams of silver nitrate($AgNO_3$)?
(A) 226 grams (B) 68.5 grams (C) 63.5 grams (D) 30.3 grams (E) none of the above

27. _____ How many sulfate ions are there in 111 grams of aluminum sulfate?
(A) 1.95×10^{23} (B) 3.90×10^{23} **(C) 5.86×10^{23}** (D) 2.98×10^{24} (E) none of the above

28. _____ What is the formula of a compound that is 62.5 % strontium, 14.7 % phosphorus & 22.8% oxygen?
(A) $SrPO_3$ **(B) $Sr_3(PO_3)_2$** (C) $Sr_3(PO_4)_2$ (D) Sr_3PO_4 (E) $Sr_3(PO_2)_2$

29. _____ What is the mass of 126 liters of diatomic oxygen at STP?
(A) 5.62 grams **(B) 180. grams** (C) 88.2 grams (D) 90.0 grams (E) none of the above

30. _____ The percentage of calcium (by mass) in calcium fluoride is:
(A) 51% (B) 40% (C) 68% (D) 33% (E) 81%

Part II: Solve each of the following. Show all of your work. If you do not show your work it will be marked incorrect. Put a box around your answer. (3 points each)

31. Calculate the percent composition of the elements in lithium phosphite.

Li_3PO_3
Li: 20.8%
P: 31.1%
O: 48.1%

32. Calculate the mass of the elements in 30.5 grams of aluminum sulfite.

$Al_2(SO_3)_3$
Al: 5.6 g
S: 10.0 g
O: 14.9 g

33. A sample of a substance is found to contain 17.83 grams of iron and 7.67 grams of oxygen. Determine the empirical formula of this compound and name it.

Fe_2O_3
Iron(III) oxide

34. A substance has a percent composition of 39.6% carbon, 1.7% hydrogen, 58.7% chlorine. Determine the molecular formula of the substance if it has a molecular mass of 544.5 g/mol.

Empirical - C_2HCl
Molecular - $C_{18}H_9Cl_9$

35. A hydrate is found to be composed of 75.5% calcium chloride and 24.5% water. Determine the empirical formula of the hydrate and name it.

$CaCl_2 * 2H_2O$
Calcium chloride dihydrate

36. Determine the percent of water in sodium sulfate decahydrate.

$Na_2SO_4 *10H_2O$
Na_2SO_4: 44.1%
H_2O: 55.9%

37. Calculate the amount of magnesium ions in 83.5 grams of magnesium phosphide.

1.12×10^{24} Mg^{2+} ions

38. Determine the mass of 23.0 liters of diatomic nitrogen gas.

28.8 g N_2

39. Answer the following questions about a pure compound that contains only carbon, hydrogen, and oxygen. A 0.3968 g sample of the compound burns in $O_2(g)$ to produce 0.8731 g of $CO_2(g)$ and 0.1586 g of $H_2O(g)$.

(i) Calculate the individual masses of C, H, and O in the 0.3968g sample.(2 points each)

C: 0.2381, H: 0.0176, O: 0.1411

(ii) Determine the empirical formula for the compound. (2 points)

$C_9H_8O_4$

40. Answer the following questions that relate to the analysis of chemical compounds.

(a) A compound containing the elements C, H, N, and O is analyzed. When a 1.2359 g sample is burned in excess oxygen, 3.050 g of $CO_2(g)$ is formed. The combustion analysis also showed that the sample contained 0.0862 g of H.

(i) Determine the mass, in grams, of C in the 1.2359 g sample of the compound. (2 points) **0.8318 g**

(ii) When the compound is analyzed for N content only, the mass percent of N is found to be 4.62 percent. Determine the mass, in grams, of N in the original 1.2359 g sample of the compound. (2 points) **0.05710**

(iii) Determine the mass, in grams, of O in the original 1.2359 g sample of the compound. (2 points) **0.2608**

(iv) The molecular mass of the compound is 303.3 g/mol. Determine the molecular formula of the compound. (2 points) **$C_{17}H_{21}NO_4$**