AP Chemistry Test (Chapter 3) (**October)**

Multiple Choice and FIB (40%)

1) A chemistry student is filtering and drying a precipitate that formed from two solutions reacting. Which one is the most likely reason for an exceptionally high % yield?

A) Careless filtering and sufficient drying
B) Careless filtering and insufficient drying
C) Careful filtering and sufficient drying
D) Careful filtering and insufficient drying

2) What coefficients balance this reaction?

$C_3H_7OH + O_2 \rightarrow CO_2 + H_2O$

A) 1, 12, 3, 4 B) 2, 3, 2, 4
C) 2, 9, 6, 8 D) 1, 8, 1, 4
E) None of these

3) What is the name of $Li_2CrO_3 \bullet 7\ H_2O$?

A) Lithium chromate heptahydrate
B) Lithium chromite heptahydrate
C) Dilithium chromate heptahydrate
D) Dilithium chromite heptahydrate
E) None of these

4) Which one is a molecular formula?

A) $C_{13}H_{26}O_3$ B) P_6O_{21}
C) $C_{10}H_{21}O_5$ D) N_2O_7
E) $C_{10}H_{20}O$

Please use the following information to answer questions 5-8.

7.52 mol A_3 reacts with 6.15 mol B_5 in this reaction in a sealed flask: $20\ A_3 + 9\ B_5 \rightarrow 15\ A_4B_3$

5) Which one is the limiting reagent?

6) How many mol A_4B_3 are produced?

7) How many mol of the excess reagent are consumed during the reaction?

8) How many total mol are in the flask at the end of the reaction?

9) A solution is 2.51 M Na_3PO_4 (aq). Which one best describes this solution?

A) 2.51 mol Na_3PO_4 = 1 L solution B) 2.51 g Na_3PO_4 = 1 L solution
C) 2.51 mol Na_3PO_4 = l L H_2O D) 2.51 mol H_2O = 1 L Na_3PO_4
E) None of these

10) Please consider two samples. One sample is a homogeneous, gaseous mixture of carbon, hydrogen and sulfur in a mole ratio of 4:8:1. The other sample is gaseous C_4H_8S which is the smelly gas skunks spray. Which one is true?

A) The mixture and the C_4H_8S are both physically combined.
B) The mixture and the skunk gas have similar physical and chemical properties.
C) The mixture and the skunk gas both smell "skunky!"
D) The mixture and the skunk gas are both flammable because they contain hydrogen which is flammable.
E) The skunk gas is a compound with different properties than its constituent elements.

11) What happens to the mass of the crucible contents when magnesium is heated until it burns.

A) The mass increases due to the magnesium reacting with N_2 to form Mg_3N_2.
B) The mass increases due to the loss of magnesium when it forms Mg_3N_2.
C) The mass decreases due to the magnesium reacting with N_2 to form Mg_3N_2.
D) The mass decreases due to the loss of magnesium when it forms Mg_3N_2.

12) A solution is 18% NaCl by mass. Which one best describes this solution?

A) 18 g NaCl dissolved in 82 g water
B) 18 g NaCl dissolved in 100 mL solution
C) 18 g NaCl dissolved in 100 g water
D) 18 mol NaCl dissolved in 100 g solution
E) None of these

13) Please consider a mixture of sand, K_3PO_4, Cu, and plastic (low density). Which one is false about separating this mixture.

A) Only physical changes occur.
B) The plastic can be removed by adding water and skimming it off the top of the mixture.
C) The components of the filtrate are K_3PO_4 and H_2O.
D) Filtration will recover the Cu and sand because they are insoluble.
E) The Cu can be recovered by distillation of the solution.

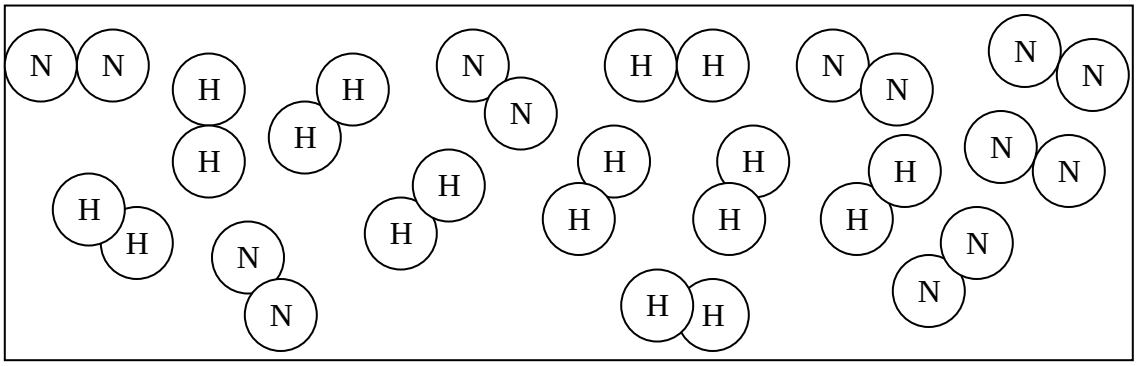
14) What is the formula for nickel (III) oxalate pentahydrate

A) $Ni_2O_3 \bullet 5\ H_2O$
B) $Ni_3(C_2O_4)_2 \bullet 5\ H_2O$
C) $Ni_2(C_2O_4)_3 \bullet 5\ H_2O$
D) $Ni(C_2O_4)_3 \bullet 5\ H_2O$
E) None of these

15) How many atoms of oxygen are in 5.00 g of calcium phosphite?

A) 1.08×10^{22}
B) 7.18×10^{22}
C) 1.80×10^{21}
D) 6.49×10^{22}
E) None of these

16) Hydrogen reacts with nitrogen to form H_3N. Which one is false about the reaction illustrated here?



Reactants

A) 6 molecules of H_3N are produced.
B) N_2 is the limiting reagent.
C) 10 total molecules are in the flask at the end of the reaction.
D) Some chemical bonds are broken and others are created.
E) 3 molecules of N_2 remain in the flask at the end of the reaction.

17) Please choose all fundamental SI units.

A) Kelvin
B) Liter
C) Second
D) Newton
E) Meter/second

18) Which one is the smallest quantity?

A) 1×10^{-12} Tm
B) 1×10^{-6} μm
C) 1×10^{15} fm
D) 1×10^{12} pm

Please choose all choices that apply to 19-20.

A) Compound
B) Tyndall effect
C) Pure substance
D) Element
E) Mixture
H) Homogeneous
I) Representative particle = identical atoms
K) Suspension
M) Solution
R) Colloid

19) NaBr (aq)

20) S_8

Problems (70%) **Please show all your work for any credit.**

1) The following lab results were obtained when iron was strongly heated in the presence of excess oxygen. What is the empirical formula of the metallic oxide? Assume the iron did not react with atmospheric N_2.

Mass of empty crucible & cover	70.0000 g
Mass of crucible, cover & iron (before combustion)	75.0522 g
Mass of crucible, cover & iron (after combustion)	78.9119 g

2) A 8.4235-g sample of an organic compound composed entirely of carbon, hydrogen & oxygen was burned to produce 12.4496 g CO_2 and 4.4604 g H_2O. Assume complete combustion The molar mass of the compound is 595.55 g. What is the molecular formula of this hydrocarbon?

3) An impure sample of solid aluminum carbonate is allowed to react with a solution that is 2.04 % HCl by mass. A 2.900-g sample of the mixture containing the aluminum carbonate requires 31.22 g of the HCl solution to neutralize the sodium carbonate. What is the % $Al_2(CO_3)_3$ in the original sample?

$$Al_2(CO_3)_3 + 6\ HCl \rightarrow 2\ AlCl_3 + 3\ CO_2 + 3H_2O$$

4) Stock phosphoric acid solution is 68.0% H_3PO_4 by mass and has a density of 1.58 g/ml. What volume of stock solution will contain 0.7500 mol solute? Please use dimensional analysis only.

5) A reaction mixture contains 30.0 g NH_3 and 44.0 g O_2. What mass of excess reagent remains after the reaction has gone to completion? Please use dimensional analysis only.

$$4\ NH_3 + 5\ O_2 \rightarrow 4\ NO + 6\ H_2O$$

6) A metal M forms an oxide having the empirical formula M_5O_{13}. This oxide contains 69.07 % of the metal by mass. Calculate the atomic mass of the metal & then identify the metal.

7) A student uses 36.17 ml of HCl solution to neutralize a sample of solid copper (V) carbonate. The density of the HCl solution is 1.08 g/ml. The solution is 3.95 % HCl by mass. The student collects and dries 2.15 g $CuCl_5$. What is the % yield?

$$10\ HCl + Cu_2(CO_3)_5 \rightarrow 2\ CuCl_5 + 5\ H_2O + 5\ CO_2$$

8) A solution is 18.52 % Na_3PO_4 by mass. The density of the solution is 1.0777 g/ml. What mass of solvent is present in 82.05 mL solution? Please use dimensional analysis only.

9) A rock (ore) contains 41.25 % azurite, $Cu_3(CO_3)_2(OH)_2$ by mass. What mass of copper is present in 6.913 g ore? Please use dimensional analysis only.

10) A hydrate contains 65.80% aluminum chlorate and 34.20% water. What is the formula & name of this hydrate?

AP Chemistry Test (Chapter 3) **(November)**

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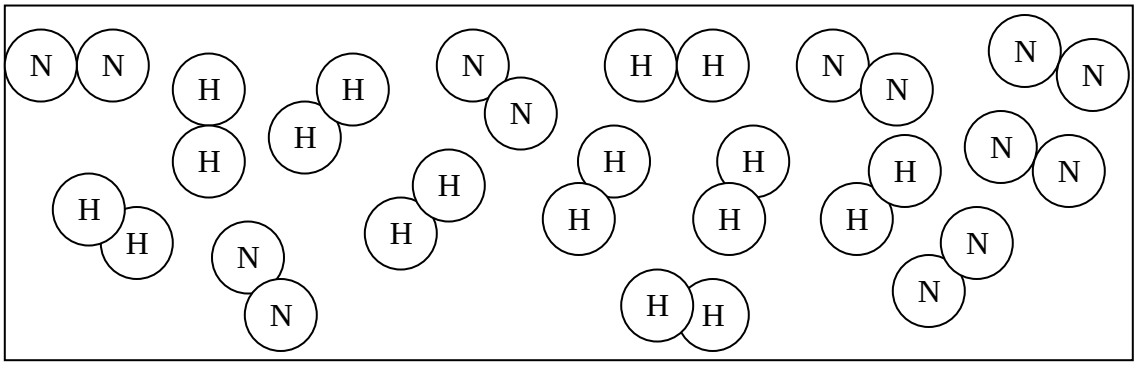

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$$Al_2(CO_3)_3 + 6\ HCl \rightarrow 2\ AlCl_3 + 3\ CO_2 + 3H_2O$$

4) Stock phosphoric acid solution is 88.0% H_3PO_4 by mass and has a density of 1.58 g/ml. What volume of stock solution will contain 0.2500 mol solute?

5) A reaction mixture contains 50.0 g NH_3 and 67.0 g O_2. What mass of excess reagent remains after the reaction has gone to completion?

$$4\ NH_3 + 5\ O_2 \rightarrow 4\ NO + 6\ H_2O$$

6) A metal M forms an oxide having the empirical formula M_5O_9. This oxide contains 86.97 % of the metal by mass. Calculate the atomic mass of the metal and then identify the metal.

7) A student uses 46.17 ml of HCl solution to neutralize a sample of solid copper (V) carbonate. The density of the HCl solution is 1.11 g/ml. The solution is 5.95 % HCl by mass. The student collects and dries 4.75 g $CuCl_5$. What is the % yield?

$$10\ HCl + Cu_2(CO_3)_5 \rightarrow 2\ CuCl_5 + 5\ H_2O + 5\ CO_2$$

8) A solution is 28.52 % Na_3PO_4 by mass. The density of the solution is 1.1777 g/ml. What mass of solvent is present in 92.05 mL solution? Please use dimensional analysis only.

9) A rock (ore) contains 51.25 % azurite, $Cu_3(CO_3)_2(OH)_2$ by mass. What mass of copper is present in 8.913 g ore? Please use dimensional analysis only.

10) A hydrate contains 70.27% aluminum nitrate and 29.73% water. What is the formula and name of this hydrate?

AP Chemistry Test (Chapter 3) **Name_____**

Multiple Choice and FIB (40%)

1) _____
2) _____
3) _____
4) _____
5) _____
6) _____
7) _____
8) _____
9) _____
10) _____
11) _____
12) _____
13) _____
14) _____
15) _____
16) _____
17) _____
18) _____
19) _____
20) _____

Problems (70%) **Please show all your work for any credit.**

1) Please use only the front side of each piece of paper.

2) Please number your problems clearly and consecutively.

3) Please staple your problems to the back of this page in numerical order.

4) Please write on the paper in the conventional manner.

5) Please do not make a separate list of answers. Record your answer at the end of the work supporting your answer.

6) Please circle/box your answer to any problems.