AP Chemistry Summer Review Assignment

Welcome to AP Chemistry! And, Congratulations!

You have chosen to challenge yourself with one of the most rigorous courses available at FA. AP Chemistry is one of the few AP courses in which students can earn 8-10 credits and replaces actual courses at colleges, allowing you to move ahead (most AP courses only get 3-4 credits and may be general credit only.) However, AP Chem is a big challenge! We will learn more chemistry than most college freshmen do.

Here we go….

1. Complete this summer review. USE the links for things you need a review of.
2. Check your answers using https://tinyurl.com/APsummer0 (that's a zero).
3. Go to Flipgrid https://flipgrid.com/hofstra1377 Login in with your google account. Complete the 2min task: https://flipgrid.com/6218e8fc
4. Expect a quiz first week on the material here.

Significant Figures

Need a tutorial? https://tinyurl.com/APsummer1 (Khan Academy video list): https://goo.gl/uuOU2w

1. Round each of the following off to the specified number of sig fig's:

a. Round 78.241 g to 4 sf: _____ 3 sf: _____ 2 sf: _____ 1 sf: _____

b. Round 0.2983 g to 4 sf: _____ 3 sf: _____ 2 sf: _____ 1 sf: _____

c. Round 50,001 g to 4 sf: _____ 3 sf: _____ 2 sf: _____ 1 sf: _____

2. Solve, and round answers to the proper number of sig figs. SHOW YOUR WORK & include units.

a. A 5627 g brick measures 5.60 cm x 4.51 cm x 24.71 cm.What is its density?

b. Before a titration, the initial reading from a buret is 0.75 mL. Afterwards, the reading is 13.22 mL. What volume of liquid was used in the titration?

c. A 45.67g stone with a density of 6.81 g/cm^3 is placed in a graduated cylinder, what is its volume?

d. A series of masses are added together: 23.1g + 4.77g + 125.39g + 3.581g. What is the total mass?

Dimensional Analysis: (AKA factor-labeling or unit conversions)

Need a tutorial? https://tinyurl.com/APsummer2

1 hr = 60 min	1 min = 60 sec	1 ton = 2000 lbs	7 days = 1 week
24 hrs = 1 day	1 kg = 2.2 lbs	1 gal = 3.79 L	264.2 gal = 1 cubic meter
1 mi = 5,280 ft	1 kg = 1000 g	1 lb = 16 oz	20 drops = 1 mL
365 days = 1 yr	52 weeks = 1 yr	2.54 cm = 1 in	1 L = 1000 mL
0.621 mi = 1.00 km	1 yd = 36 inches	1 cc is 1 cm^3	1 mL = 1 cm^3

3. The moon is 250,000 miles away. How many feet is it from earth?

4. There are 355 ml of soda in a can. How many gallons is this?

5. How many feet per second is a wave going if it travels a distance of 1.00 mile in 7.35 min?

6. A speed of 60.0 miles/ hour is how many ft/sec?

7. A liquid has a density of 0.729 g/mL. What is the volume of 1.45 tons of this liquid?

Atomic Structure: The Basics

Need a tutorial? https://tinyurl.com/APsummer3

8. Complete the following table.

Nuclear Symbol	# of protons	# of neutrons	# of electrons	Atomic #	Mass #	Charge
		28	**21**	**25**		
			18	**15**	**31**	
$^{13}_{6}C$					**13**	
	17				**36**	**1-**
$^{56}_{26}Fe^{3+}$			**23**		**56**	

Need a tutorial? https://tinyurl.com/APsummer4

9. Calculate the average atomic mass for each of the following elements assuming that each consists of the isotopic mixtures given below:
   a. $^{10}B = 20.0\ \%$, $^{11}B = 80.0\ \%$ B: _____

   b. $^{20}Ne = 90.9\%$, $^{21}Ne = 0.3\ \%$, $^{22}Ne = 8.8\ \%$ Ne: _____

Nomenclature: *-Identify the type of substance, then either name it or write the correct formula*

Need a tutorial? https://tinyurl.com/APsummer5

10.

Formula	Type of Compound? *(ionic, covalent, or acid)*	Name
		Hydrobromic acid

		Dinitrogen pentoxide
BaI_2		
SO_2		
		Nickel II chloride
H_2CO_3		
		Phosphorous acid
		Potassium dichromate
$Hg(OH)_2$		
HF		
HNO_2		
NiI_3		
		Zinc arsenide
		Xenon tetrafluoride
		Iron III nitrate
Cu_2Cr_2O		
PCl_3		
		Ammonium sulfide
K_2O		

Solubility Rules: -

Need a tutorial? http://www.kentchemistry.com/links/Kinetics/PredictingDR.htm

12. Predict whether each of these double replacement reactions will give a precipitate or not based on the solubility of the products. If yes, identify the precipitate.

Soluble Ionic Compounds		**Important Exceptions**
Compounds containing	NO_3^-	None
	CH_3COO^-	None
	Cl^-	Compounds of Ag^+, Hg_2^{2+}, and Pb^{2+}
	Br^-	Compounds of Ag^+, Hg_2^{2+}, and Pb^{2+}
	I^-	Compounds of Ag^+, Hg_2^{2+}, and Pb^{2+}
	SO_4^{2-}	Compounds of Sr^{2+}, Ba^{2+}, Hg_2^{2+}, and Pb^{2+}
Insoluble Ionic Compounds		**Important Exceptions**
Compounds containing	S^{2-}	Compounds of NH_4^+, the alkali metal cations, and Ca^{2+}, Sr^{2+}, and Ba^{2+}
	CO_3^{2-}	Compounds of NH_4^+ and the alkali metal cations
	PO_4^{3-}	Compounds of NH_4^+ and the alkali metal cations
	OH^-	Compounds of the alkali metal cations, and NH_4^+, Ca^{2+}, Sr^{2+}, and Ba^{2+}

a. silver nitrate and potassium chloride _____

b. magnesium nitrate and sodium carbonate _____

c. strontium bromide and potassium sulfate _____

d. cobalt (III) bromide and potassium sulfide _____

e. ammonium hydroxide and copper (II) acetate _____

f. lithium chlorate and chromium (III) fluoride _____

Chemical Equations:

Need a tutorial? https://tinyurl.com/APsummer6

13. Balance the following equations with the lowest whole number coefficients.

a. ___S_8 + ___O_2 → ___SO_3

b. ___$C_{10}H_{16}$ + ___Cl_2 → ___C + ___HCl

c. ___Fe + ___O_2 → ___Fe_2O_3

d. ___$C_7H_6O_2$ + ___O_2 → ___CO_2 + ___H_2O

e. ___$KClO_3$ → ___KCl + ___O_2

f. ___H_3AsO_4 → ___As_2O_5 + ___H_2O

g. ___V_2O_5 + ___HCl → ___$VOCl_3$ + ___H_2O

h. ___$Hg(OH)_2$ + ___H_3PO_4 → ___$Hg_3(PO_4)_2$ + ___H_2O

Need a tutorial? (identify reaction types): https://tinyurl.com/APsummer7
(predicting products): https://tinyurl.com/APsummer8

14. For each of the following reactions:
    - Identify the type of reaction (decomposition, synthesis, single replacement, double replacement, acid-base neutralization, or combustion).
    - Predict products and write a balanced equation

Reactants	**Type of Reaction**	**Complete Balanced Equation**
Ammonium chloride is added to silver nitrate		
Magnesium is added to a solution of copper II nitrate		
Calcium carbonate decomposes		
Octane (C_8H_{18}) is burned in air		
Calcium hydroxide is added to sulfuric acid		
Strontium is added to hydrochloric acid		
Aluminum metal reacts with oxygen gas		
A solution of tin IV sulfate is added to a solution of ammonium hydroxide		

Lithium chloride is added to zinc phosphate		
Ethanol (C_2H_5OH) is burned in the air		

Stoichiometry and Limiting Reactant

Need a tutorial? (list of tutorials & activities): https://tinyurl.com/APsummer9 https://tinyurl.com/APsummer10 (scroll down for list of stoichiometry resources)

15. Given the equation below, what mass of water would be needed to react with 10.0g of sodium oxide?

$Na_2O + H_2O \rightarrow 2NaOH$

16. $2NaClO_3 \rightarrow 2NaCl + 3O_2$
    a. What mass of sodium chloride is formed along with 45.0g of oxygen gas?

    b. If only 49.1g of sodium chloride form, what is the percent yield?

17. $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$
    What mass of water will be produced when 100.0g of ammonia is reacted with excess oxygen?

18. If the reaction above is done with 25.0g of each reactant, which would be the limiting reactant?

19. What volume of hydrogen gas (measured at STP) would result from reacting 75.0g of sodium hydroxide with 50.0g of aluminum? $6NaOH + 2Al \rightarrow 2Na_3AlO_3 + 3H_2$

20. $Na_2S + 2AgNO_3 \rightarrow Ag_2S + 2NaNO_3$
    If the above reaction is carried out with 50.0g of sodium sulfide and 35.0g of silver nitrate, which is the limiting reactant?

    What mass of the excess reactant remains?

    What mass of silver sulfide would precipitate?

Percent Composition, Empirical and Molecular Formulas - Textbook sections 3.5-3.6

Need a tutorial? https://tinyurl.com/APsummer12

21. Bismuth subsalicylate, a medication used to treat upset stomachs, has the formula $C_7H_5BiO_4$.
a. Calculate the percent by mass of C and also of Bi. [too easy to be an AP Chem prob]

b. If each tablet of the medication contains 262 milligrams of $C_7H_5BiO_4$ calculate the mass of Bi in 2 tablets. [More like an AP Chem prob]

22. Determine the empirical and molecular formulas of each of the following substances:
    - Benzene contains only carbon and hydrogen and is 7.74% hydrogen by mass. The molar mass of benzene is 78.1 g/mol.

    - Ibuprofen, a headache remedy, contains 75.69 percent C, 8.80 percent H, and 15.51 percent O by mass; molar mass about 206 g

    - Naphthalene, used in mothballs, is composed of 93.7% carbon and 6.3% hydrogen. If naphthalene has a molar mass of 128 g/mol, what is its molecular formula?

23. Many homes in rural America are heated by propane gas, a compound that contains only carbon and hydrogen. Complete combustion of a sample of propane produced 2.641 g of carbon dioxide and 1.442 g of water as the only products. Find the empirical formula of propane. (Hint: Figure out how many moles of C and H were produced. They all came from the fuel.)

24. Menthol, the substance we can smell in mentholated cough drops, is composed of C, H, and O. A 0.1005 g sample of menthol is combusted, producing 0.2829 g of CO_2 and 0.1159 g of H_2O. Menthol has a molar mass of 156.27 g/mol. What is the molecular formula of menthol?

Solutions:

Need a tutorial? https://tinyurl.com/APsummer13

25. If 6.73 g of Na_2CO_3 is dissolved in enough water to make 250.0 mL of solution, what is the molarity of the sodium carbonate solution?

26. What is the mass, in grams, of solute in 250.0 mL of a 0.0125 M solution of $KMnO_4$?

27. What volume of 0.123 M NaOH, in milliliters, contains 25.0 g of NaOH?

28. If 4.00 mL of 0.0250 M $CuSO_4$ is diluted to 10.0 mL with pure water, what is the molarity of copper(II) sulfate in the diluted solution?

29. For each solution, identify the ions that exist in aqueous solution & specify the concentration of each.

a) 0.25 M $(NH_4)_2SO_4$

b) 0.056 M HNO_3

c) 0.123 M Na_2CO_3

d) 0.00124 M $KClO_4$

30. What volume of 0.125 M HNO_3, in milliliters, is required to react completely with 1.30 g of $Ba(OH)_2$?

$$2\ HNO_3(aq) + Ba(OH)_2(s) \rightarrow Ba(NO_3)_2(aq) + 2\ H_2O(l)$$

31. What volume of 0.955M HCl, in milliliters, is needed to completely react with 12.8 mL of 1.27M Na_2CO_3?

$$Na_2CO_3(aq) + 2\ HCl(aq) \rightarrow 2\ NaCl(aq) + CO_2(g) + H_2O(l)$$

Sample AP Multiple Choice Questions [no calculator!]

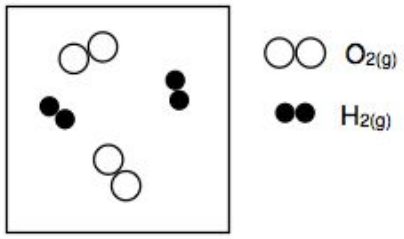
32. In which of the following groups are the three species isoelectronic; i.e., have the same number of electrons?

(A) S^{2-},K^{+},Ca^{2+} (B) Sc,Ti,V^{2+} (C) O^{2-},S^{2-},Cl^{-} (D) Mg^{2+},Ca^{2+},Sr^{2+} (E) Cs,Ba^{2+},La^{3+}

33. What number of moles of O_2 are needed to produce 14.2 grams of P_4O_{10} from P? (Molecular weight P_4O_{10} = 284)

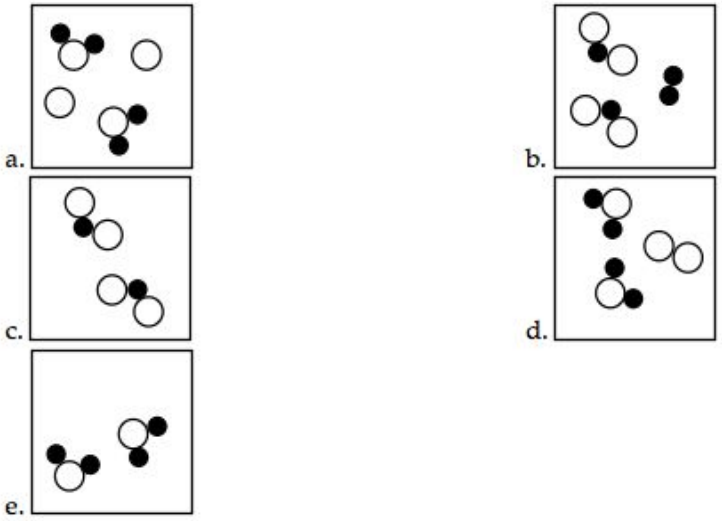
34. (A) 0.0500 mole (B) 0.0625 mole (C) 0.125 mole (D) 0.250 mole (E) 0.500 mole

35.



The picture above is a representation of H2(g) and O2(g) in a sealed container. Which of the following pictures would be the best representation of the products if the reaction below were to run to completion?

$$2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(g)}$$



36. Barium reacts with a polyatomic ion to form a compound with the general formula $Ba_3(X)_2$. What would be the most likely formula for the compound formed between sodium and the polyatomic ion X?

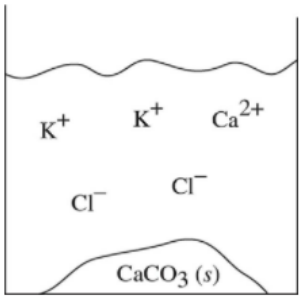
A) NaX B) Na_3X C) Na_2X D) Na_3X_2 E) Na_2X_2

37. Which one of the following molecular formulas is also an empirical formula?

A) C_2H_6SO B) $C_6H_6O_2$ C) H_2O_2 D) $H_2P_4O_6$ E) C_6H_6

38. Solutions of potassium carbonate and calcium chloride are mixed together, and the particulate representation shows what is present after the reaction has gone to completion. Which of the two original solutions is the limiting reagent and why?

a. The potassium carbonate, because of the polyatomic anion
b. The potassium carbonate, because there is no carbonate left after the reaction
c. The calcium chloride, because there is an excess of calcium ions post-reaction
d. The calcium chloride, because the component ions are smaller than those in potassium carbonate



Sample AP Free Response Questions (FRQ)

Note: Portions of each FRQ that we would not yet know how to do have been omitted.

39. Water is added to 4.267 grams of uranium hexafluoride. The only products are 3.730 grams of a solid containing only uranium, oxygen and fluorine and 0.970 gram of a gas. The gas is 95.0% fluorine, and the remainder is hydrogen. From these data, determine the empirical formula of the gas.

40. Solid mercury(II) oxide decomposes as it is heated in an open test tube in a fume hood.
    a. Write a balanced equation for this reaction.

    b. After the reaction is complete, is the mass of the material in the test tube greater than, equal to, or less than the mass prior to heating? Justify your answer.