

Chem 2AP Summer Assignment

Each section provides information on what we feel you should be able to do. You should use the Internet, friend, book or other source to look up any topic that you are unsure of how to do.

1. Chemical Foundations

You should be able to: look these up and create an outline for yourself

- Identify significant figures
- Perform calculations with significant figures
- Differentiate between accuracy and precision as they apply to measurement
- Determine the density of solids and liquids and calculate volumes or masses
- Convert between Celsius and Kelvin
- Identify the characteristics of states of matter: solids, liquids, & gases
- Identify changes as being physical or chemical.
- Name and identify chemical compounds.....knowing common polyatomic ions

Questions

1. Measurements indicate a charge of 0.400 coulombs (C) passes a point in 0.20 seconds. The current (in C/s) is best expressed as:

- a. 0.080 C/s b. 0.0800 C/s c. 2.0 C/s d. 2.00 C/s

2. A given sample contains 2.4 grams hydrogen, 20.5 grams sulfur and 75.09 g of oxygen. What is the total mass of the sample?

- a. 107.99 g b. 108.0 g c. 108 g d. 1.1×10^2 g

3. What is the percent mass of sulfur in the above mixture (see number 2)?

- a. 2.82% b. 2.8% c. 28.2% d. 28%

4. The correct name for B_2O_3 is

- a. boron oxide b. diboron trioxide c. boron (II) oxide(III) d. beryllium oxide

5. The correct name for $Mg(OH)_2$ is

- a. Magnesium hydroxide (II) b. magnesium hydroxide c. magnesium (I) hydroxide
d. magnesium hydrogen oxide

6. The correct name for HCl is

- a. chloric acid b. chlorous acid c. hydrochloric acid d. hypochlorous acid

7. The correct name for FeI_3 is

- a. Iron iodide b. Iron (II) iodide c. Iron (III) iodide d. Iron triiodide

8. The correct name for XeF_2 is

- a. Xenon Fluoride b. Xenon difluoride c. Xenon (II) fluoride d. Xenon (IV) fluoride

9. The correct formula for iodine monobromide is

- a. ICl b. IBr c. IBr_9 d. IF

10. The correct formula for copper (II) phosphate is

- a. Cu_3P_2 b. $CuPO_4$ c. $Cu_3(PO_3)_2$ d. $Cu_3(PO_4)_2$

11. The correct formula for sulfurous acid is

- a. H_2S b. H_2SO_4 c. H_2SO_3 d. H_2SO_2

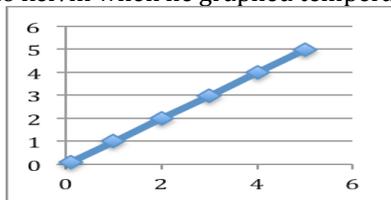
12. The density of copper is approximately 9.0 g/cm^3 . What is the mass of 20.0 cm^3 of pure copper?

- a. 2.2 g b. 200 g c. 180. g d. 180 g

13. Which of the following processes represents a chemical change?

- a. water boiling b. iodine subliming c. sugar dissolving in water d. natural gas burning

14. An experiment that tested the effect of temperature on pressure was performed and data indicated a direct relationship between pressure and temperature. The student forgot to convert their temperature from Celsius to kelvin when he graphed temperature vs. pressure, however. How would this affect his result?



- the slope of the line is 273 times too large
- the slope of the line is 273 times too small
- the y-intercept of the line is 273 units too high
- the y-intercept of the line is 273 units too low

15. A pure solid is heated and it decomposes into two substances, one a liquid and the other a gas. One can conclude with certainty that:

- the two products are elements
- one of the products is an element
- the original solid is not an element
- both products are compounds

16. A student measures the mass of silver in a sample and does four determinations. The results are 1.75 g, 1.71 g, 1.85g, & 1.93 g. The true value is 1.81 g. Which statemtn concerning the results is correct?

- high precision and accurate results
- high precision and poor accuracy
- poor precision and poor accuracy
- poor precision and accurate results

Free response Question

- Describe how, in the laboratory, you might determine experimentally the density of a solid, such as a sugar cube, which is water soluble. Indicate what equipment you might best use in the process.
 - Then describe a second experimental method for determining the density of this same object, so that you might verify the results of the first method.
- What is the difference between a molecular (covalent) compound and an ionic compound, in terms of naming/writing the chemical formula?
- What is the difference between an empirical and molecular formula?
- Explain the rules for significant figures when adding/subtracting & multiplying/dividing.
- Explain the difference between a solid, liquid and gas. Use water as your example.
- Ferrocene consists of carbon, hydrogen, and iron. If 0.652g of ferrocene is burned in oxygen, 1.542g of CO_2 and 0.315g H_2O are isolated. What is the empirical formula of ferrocene?
- Write the formula for magnesium phosphate.
 - Find the mass percent of each element in the compound.
 - How many grams of oxygen are there in 1.55 g of $\text{Mg}_3(\text{PO}_4)_2$?
- Vitamin C contains the elements C, H and O. It is known to contain 40.9% C and 4.58% H by mass. The molar mass of vitamin C has been found to be about 176 g/mol. Determine the molecular formula.
- In lab, you titrated vinegar with sodium hydroxide. Lets say this is what your data table looked like in your notebook: complete the table

mass of Erlenmeyer flask	52.97 g
mass of vinegar and Erlenmeyer flask	83.13 g
mass of vinegar	
volume of vinegar used	30.0 ml
volume of 0.75 M NaOH required	34.2 ml
percent by mass of HAc in vinegar	
Density of vinegar	

CHEMICAL REACTIONS & STOICHIOMETRY

You should be able to: look these up and create an outline for yourself

- Classify reactions by type
- Write balanced molecular and net ionic reactions (Need to know your **strong electrolytes**)
- Predict if a precipitate will form (only solubility rule you really need to know is that all Na^+ , K^+ , NH_4^+ , & NO_3^- salts are soluble)
- Identify compounds as Bronsted-Lowry Acids & Bases based upon evidence of proton transfer
- Identify a reaction as oxidation-reduction based upon electron transfer
- Predict the amount of product formed based upon initial amounts of reactants.

Questions:

1. There 7 strong acids. Which is not a strong acid?

- a. HCl b. HF c. H_2SO_4 d. HClO_4 e. HNO_3 f. HBr
g. HI

2. Spectator ions are those which are in solution but do not react. Identify any spectator ions for the reaction of sodium phosphate and calcium nitrate.

- a. only PO_4^{3-} b. Na^+ & PO_4^{3-} c. Na^+ & NO_3^{1-} d. Ca^{+2} & PO_4^{3-}

3. When $\text{C}_7\text{H}_{14} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ is balanced, using whole numbers, the coefficients are

- a. 2, 7, 7, 7 b. 1, 7, 7, 7, c. 2, 21, 14, 14 d. 1, 14, 7, 14 e. 2, 7, 14, 14

4. Which of the following is the correct net ionic equation for the addition of aqueous potassium sulfate to an aqueous solution of barium chloride? **Model reaction before solving**

- a. $\text{Ba}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{BaSO}_4(\text{s})$
b. $\text{Ba}^{2+}(\text{aq}) + \text{K}_2\text{SO}_4(\text{s}) \rightarrow \text{BaSO}_4(\text{s}) + 2\text{K}^+(\text{aq})$
c. $\text{BaCl}_2(\text{s}) + \text{K}_2\text{SO}_4(\text{s}) \rightarrow \text{BaSO}_4(\text{s}) + 2\text{KCl}(\text{aq})$
d. $\text{BaCl}_2(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{BaSO}_4(\text{aq}) + 2\text{Cl}^-(\text{aq})$
e. $\text{BaCl}_2(\text{aq}) + \text{P}_2\text{SO}_4(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2\text{P}(\text{aq})$

5. What mass of gold is produced when 0.0500 mol of gold (III) sulfide is reduced completely with excess hydrogen gas according to: $\text{Au}_2\text{S}_3 + \text{H}_2 \rightarrow \text{Au} + \text{H}_2\text{S}$

- a. 9.85g b. 19.7g c. 24.5 g d. 39.4 g e. 48.9 g

6. How many milliliters of 0.300 M H_2SO_4 are required to neutralize 50.0 mL of 0.600 M KOH?

- a. 20.0 mL b. 25.0 mL c. 30.0 mL d. 60.0 mL e. 50.0 ml

7. Silver oxide, Ag_2O , can be decomposed to silver metal, Ag, plus oxygen gas, O_2 . How many moles of oxygen gas will form when 4.64 g of solid silver oxide is decomposed? The molar mass of silver oxide is 232 g/mol.

- a. 0.100 mol b. 0.0100 mol c. 0.0200 mol d. 0.0150 mol e. 0.0250 mol

8. Consider the following reaction: $\text{Ca}_3(\text{PO}_4)_2 + \text{H}_2\text{SO}_4 \rightarrow \text{CaSO}_4 + \text{H}_3\text{PO}_4$

The reaction is carried out starting with 103 g of $\text{Ca}_3(\text{PO}_4)_2$ and 75.0 g of H_2SO_4 .

a. Determine the mass of the solid produced during the reaction.

b. If an experimenter finds their yield to be 87%, what mass of the solid is actually produced?

9. Which contains the largest number of ions?

- a. 500. ml of 0.100 M FeCl_3 b. 700.0 ml of 0.200 M NaOH c. 400.0 ml of 0.100 M $\text{Al}(\text{NO}_3)_3$
d. 600.0 ml of 0.200 M AlCl_3

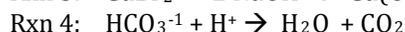
10. What is the oxidation number of the following elements in the compound/ions given:

- a. phosphorus in PO_4^{3-} _____ b. carbon in CO_3^{2-} _____
c. chlorine in ClO_4^{1-} _____ d. hydrogen in LiH _____

11. Which of the following pairs of ions would not form a precipitate in an aqueous solution?

- a. Ba^{+2} & SO_4^{-2} b. Pb^{+2} & S^{-2} c. Na^+ & SO_4^{-2} d. Pb^{+2} & Br^-

12. Classify each reaction as one of the following: acid-base, precipitation, or oxidation-reduction.



	<u>Rxn 1</u>	<u>Rxn 2</u>	<u>Rxn 3</u>	<u>Rxn 4</u>
a.	acid-base	redox	ppt	redox
b.	ppt	redox	acid-base	redox
c.	redox	ppt	acid-base	acid-base
d.	ppt	ppt	redox	acid-base

13. Which of the following is a chemical reaction?

- a. solid carbon dioxide vaporizing b. a seashell dissolving in acid
c. ethanol combining with water d. water freezing

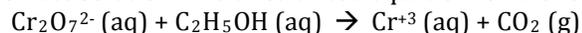
14. Two solutions are prepared, one of $\text{Cu}(\text{NO}_3)_2$ and one of KOH .

a. Draw molecular representations of the two solutions, assuming that one beaker contains four formula units of $\text{Cu}(\text{NO}_3)_2$ and the other beaker with six formula units of KOH .

b. Draw a molecular representation of the two solutions being mixed together.

c. Write the net ionic reaction for what is taking place.

15. Blood alcohol ($\text{C}_2\text{H}_5\text{OH}$) level can be determined by titrating a sample of blood plasma with an acidic potassium dichromate solution. The unbalanced equation for the reaction is:



- a. Identify which species is oxidized and which is reduced.
b. Balance the equation, using the smallest whole number coefficients.
c. How many electrons are transferred in the balanced equation?
d. What visible evidence is there that a reaction has occurred?

16. Iron (III) oxide can be reduced with carbon monoxide to form iron metal and carbon dioxide.

Balanced Rxn: _____

- a. What is the maximum yield of iron metal from 454 grams of iron (III) oxide and 236 grams of carbon monoxide?
b. Determine how many grams of the excess reagent remain at the end of the reaction.

17. 5.65 grams of an MBr_4 compound contains 4.82 grams of bromine. (a) Determine the molar mass of the compound, (b) determine the missing metal, & (c) name the compound.

18. The following information was obtained through a lab experiment.

mass of crucible	34.65 g
mass of crucible and hydrate	40.65 g
mass of crucible and anhydrous salt after final heating	38.52 g
percent by mass of Cobalt	29.2%
percent by mass of chlorine	35.1%

From the above information determine the chemical formula of the hydrate in the following manner:
 $\text{Co}_x\text{Cl}_y \cdot z \text{H}_2\text{O}$ (x, y, & z are all numbers)

THERMOCHEMISTRY & THERMODYNAMICS

You should be able to: look these up and create an outline for yourself

- Perform stoichiometric calculations with the enthalpy of the reaction.
- Perform calculations with specific heat
- Discuss how a calorimeter is used and performed
- Draw, label, and perform associated calculations for heating curves involving specific heat and changes in enthalpy for phase changes
- Draw and label potential energy for chemical reactions
- Use Hess's law, standard heat of formation and the bond energy method to determine the heat of reaction
- Identify the process as exothermic or endothermic
- Compare the absolute entropies, S° , of elements and compounds
- Perform calculations with free energy, ΔG°

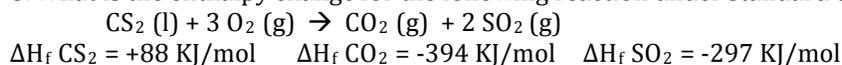
Questions

1. The standard enthalpy of formation for nitrogen dioxide is the enthalpy change of the reaction:
a. $\frac{1}{2} \text{N}_2 + \text{O}_2 \rightarrow \text{NO}_2$ b. $\text{N}_2 + 2 \text{O}_2 \rightarrow \text{N}_2\text{O}_4$ c. $\text{N}_2 + 2 \text{O}_2 \rightarrow 2 \text{NO}_2$ d. $\text{NO} + \frac{1}{2} \text{O}_2 \rightarrow \text{NO}_2$
2. Which of the following has a non-zero standard enthalpy of formation?
a. Na (s) b. Hg (l) c. N_2 (l) d. Fe (s)
3. For endothermic reactions at constant pressure
a. $\Delta H < 0$ b. $\Delta H > 0$ c. $\Delta H = 0$ d. cannot be determined.

For questions 5, 6, & 7, consider the ΔG of four different combinations of ΔH and ΔS . Assume that both ΔH & ΔS are temperature independent.

4. Which processes are spontaneous at all temperatures?
a. $\Delta H = +$ & $\Delta S = +$ b. $\Delta H = +$ & $\Delta S = -$ c. $\Delta H = -$ & $\Delta S = +$ d. $\Delta H = -$ & $\Delta S = -$
5. The process, which, is nonspontaneous at all values of temperature is
a. $\Delta H = +$ & $\Delta S = +$ b. $\Delta H = +$ & $\Delta S = -$ c. $\Delta H = -$ & $\Delta S = +$ d. $\Delta H = -$ & $\Delta S = -$
6. Which of these four processes is improbable at a low temperature but become more probable as the temperature rises?
a. $\Delta H = +$ & $\Delta S = +$ b. $\Delta H = +$ & $\Delta S = -$ c. $\Delta H = -$ & $\Delta S = +$ d. $\Delta H = -$ & $\Delta S = -$
7. In which of the following four processes is there an increase in entropy?
a. $2 \text{SO}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightarrow 2 \text{SO}_3 (\text{g})$ b. $\text{H}_2\text{O} (\text{g}) \rightarrow \text{H}_2\text{O} (\text{l})$ c. $\text{Hg} (\text{g}) \rightarrow \text{Hg} (\text{l})$
d. $\text{H}_2\text{O}_2 (\text{l}) \rightarrow \text{H}_2\text{O} (\text{l}) + \frac{1}{2} \text{O}_2 (\text{g})$

8. What is the enthalpy change for the following reaction under standard conditions?



- a. -900 kJ b. -779 kJ c. -603 kJ d. -1076 kJ

If 7.7 g CS_2 reacts with 2.0 L of O_2 (g) at STP, how many kilojoules of heat energy would be released?

9. A reaction takes place within a system. As a result, the entropy of the system decreases. Which of the following statements MUST be true?
a. The reaction is endothermic b. The entropy of universe decreases
c. The Gibbs free energy of the system increases. d. The entropy of the surrounding increases.

10. When propane burns in air, heat is released: $C_3H_8(g) + 5 O_2(g) \rightarrow 3 CO_2(g) + 4 H_2O(g)$
 What are the signs for ΔH , ΔS , & ΔG for this process as illustrated by the above equation?

	ΔH	ΔS	ΔG
a.	-	+	+
b.	-	+	-
c.	-	-	+
d.	+	+	-

Free Response

1. (a) show the complete equation for the combustion of the flammable gas butene, C_4H_8 .
 (b) Given the following table of bond energies, estimate the enthalpy change, ΔH , for the reaction noted in 1(a).

Average Bond Energies (KJ/mol)							
C-H	413	C-C	347	C=C	614	$C \equiv C$	839
C-O	358	C=O	799	H-O	467	H-H	432
						O=O	495

2. 3.50 g of Ammonium Nitrate is added to 85.5 ml of water, originally at 23.7°C. If, after mixing, the final temperature is 19.6°C, find the heat of solution in KJ/mol. Assume the properties of water.

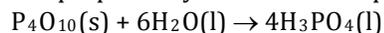
3. Given the following data

$Ca(s) + 2 C(\text{graph}) \rightarrow CaC_2(s)$	$\Delta H = -62.8 \text{ kJ}$
$Ca(s) + \frac{1}{2} O_2(g) \rightarrow CaO(s)$	$\Delta H = -635.5 \text{ kJ}$
$CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(aq)$	$\Delta H = -653.1 \text{ kJ}$
$C_2H_2(g) + 5/2 O_2(g) \rightarrow 2 CO_2(g) + H_2O(l)$	$\Delta H = -1300.1 \text{ kJ}$
$C(\text{graph}) + O_2(g) \rightarrow CO_2(g)$	$\Delta H = -393.5 \text{ kJ}$

Calculate ΔH for the reaction



4. Phosphoric acid is prepared by the reaction of phosphorous (v) oxide (P_4O_{10}) with water.



Given the following ΔH°_f calculate the ΔH°_r of the above reaction

Compound	ΔH°_f (kJ/mole)
$P_4O_{10}(s)$	-2984
$H_2O(l)$	-286
$H_3PO_4(l)$	-1267

5. Two solutions, both at the same temperature are mixed. After mixing, the temperature drops dramatically. Which of the following is/are true? EXPLAIN

- products have stronger bonds than reactants
- products have weaker bonds than reactants.
- Products are more stable than reactants
- Products are less stable than reactants.