

CHEMISTRY 101
Hour Exam II
October 25, 2016
Adams/Huynh

Name _____

Signature _____

Section _____

"We are what we repeatedly do. Excellence, therefore, is not an act but a habit."

--Aristotle--

This exam contains 17 questions on 7 numbered pages. Check now to make sure you have a complete exam. You have one hour and thirty minutes to complete the exam. Determine the best answer to the first 15 questions and enter these on the special answer sheet. Also, circle your responses in this exam booklet. Show all of your work and provide complete answers to questions 16 and 17.

1-15	(30 pts.)	_____
16	(14 pts.)	_____
17	(16 pts.)	_____
Total	(60 pts.)	_____

Useful Information:

1 L = 1000 mL (exactly)

Always assume ideal behavior for gases (unless explicitly told otherwise).

$PV = nRT$

$R = 0.08206 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K}$

$K = ^\circ\text{C} + 273$

$N_A = 6.022 \times 10^{23} = 1 \text{ mole}$

Solubility Rules:

1. Most nitrate salts are soluble.
2. Most salts of sodium, potassium, and ammonium cations are soluble.
3. Most chloride salts are soluble. Exceptions: silver(I), lead(II), and mercury(I) chloride.
4. Most sulfate salts are soluble. Exceptions: calcium, barium, and lead(II) sulfate.
5. Most hydroxide salts can be considered insoluble. Soluble ones: sodium, potassium, ammonium, and calcium hydroxide.
6. Consider sulfide, carbonate, and phosphate salts to be insoluble. Soluble ones: sodium, potassium, and ammonium.

1. Aqueous potassium chloride is mixed in a beaker with aqueous sodium nitrate. Which of the following is/are present in the beaker?
 - a) spectator ions
 - b) water
 - c) precipitate
 - d) both a and b are present
 - e) all of the above (a – c) are present
2. Consider the following representation of a chemical equation:



Balance the equation in standard form and determine the sum of the coefficients.

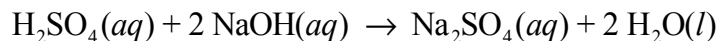
- a) 3 b) 4 c) 5 d) 7 e) 10
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Consider the following balanced equation to answer questions 3 and 4:



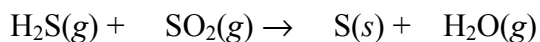
3. How many moles of oxygen are required to produce 2.33 moles of H_2O ?
 - a) 1.55 mol
 - b) 2.33 mol
 - c) 3.50 mol
 - d) 7.00 mol
 - e) 14.0 mol
 4. When 15.0 g of SO_2 is produced, what is the maximum mass of CO_2 created?
 - a) 3.43 g
 - b) 5.00 g
 - c) 10.3 g
 - d) 30.9 g
 - e) 45.0 g
-
5. Potassium sulfate is commonly used in fertilizers. An agricultural researcher in a laboratory measures and weighs a 150.0-g sample of potassium sulfate for her experiment. The solid sample is dissolved in enough water to make an 800.0 mL solution. How many potassium ions (in mol) are contained in the 150.0-g sample?
 - a) 0.430 mol
 - b) 0.861 mol
 - c) 1.08 mol
 - d) 1.72 mol
 - e) 2.15 mol
 6. In which of the following situations would a chemical reaction **not** take place when the two solutions are mixed?
 - a) $\text{AgNO}_3(aq)$ is mixed with $\text{NH}_4\text{Cl}(aq)$
 - b) $\text{Na}_2\text{CO}_3(aq)$ is mixed with $\text{K}_2\text{S}(aq)$
 - c) $\text{Ba}(\text{NO}_3)_2(aq)$ is mixed with $\text{Na}_2\text{SO}_4(aq)$
 - d) $\text{HCl}(aq)$ is mixed with $\text{NaOH}(aq)$
 - e) A chemical reaction would take place in all of the situations above.

7. Consider the equation: $A + 4 B \rightarrow 5 C$. If 4 moles of A are reacted with 8 moles of B, which of the following is **true** after the reaction is complete? Choose the best answer.
- A is the leftover reactant because for every 1 mole of A, 5 moles of C are produced.
 - A is the leftover reactant because you only need 2 moles of A and have 4.
 - B is the leftover reactant because you have more moles of B than A.
 - B is the leftover reactant because 4 moles of B react with every 1 mole of A.
 - Neither reactant is leftover.
8. Recall from lab where you mixed two different acids with sodium hydroxide and measured the temperature change for various amounts added. The larger the temperature change, the more products formed. For the reaction of sulfuric acid with sodium hydroxide, which trial would show the **greatest** temperature change?



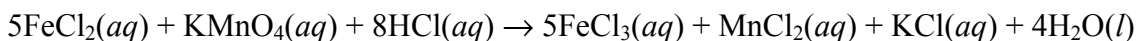
	<i>mol Acid</i>	<i>mol Base</i>
Trial 1	5.00	10.0
Trial 2	5.00	5.00
Trial 3	10.0	20.0
Trial 4	10.0	30.0

- Trial 1
 - Trial 2
 - Trial 3
 - Trial 4
 - At least two trials would show the same greatest temperature change.
9. What volume of H_2S gas is required to produce 55.0 g of sulfur? Assume that excess SO_2 is present and that the reaction is conducted at 375 K and 1.20 atm. The **unbalanced** equation for the reaction is:



- a) 1.14 L b) 9.77 L c) 29.3 L d) 44.0 L e) 66.0 L

10. What volume of 0.750 M FeCl_2 is needed to completely react with 1.00×10^2 mL of 0.250 M KMnO_4 in the reaction below?



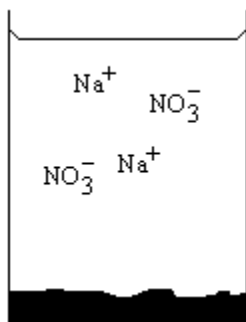
- a) 167 mL b) 150. mL c) 93.8 mL d) 33.3 mL e) 6.00 mL

Use the following scenario to answer questions 11 – 13.

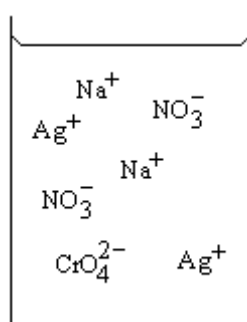
Consider the following reaction between 200.0 mL of 0.10 M Na_2CrO_4 and 150.0 mL of 0.10 M AgNO_3 . A red precipitate forms.

11. Which of the following microscopic drawings **best** represents what is in solution after the reaction is complete? (Note: The ions in solution are not necessarily in a stoichiometric ratio. Just pay attention to the types of ions that should be in solution.)

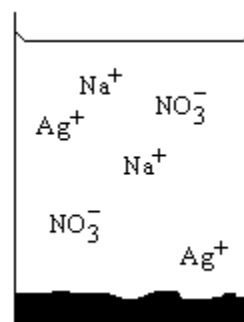
a)



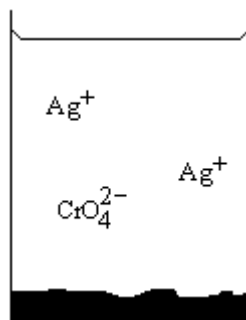
b)



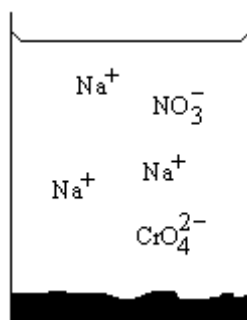
c)



d)



e)



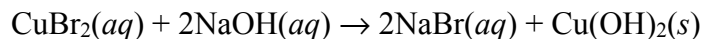
12. What mass of precipitate will form?

- a) 2.5 g b) 3.3 g c) 5.0 g d) 6.6 g e) 10. g

13. What is the concentration of chromate ions left in solution after the reaction is complete?

- a) 0.0 M b) 0.021 M c) 0.036 M d) 0.043 M e) 0.063 M
-

14. What is the correct balanced net ionic equation for the following reaction?



- a) $\text{Cu}^{2+}(aq) + 2\text{OH}^{-}(aq) \rightarrow \text{Cu}(\text{OH})_2(s)$
- b) $\text{Cu}^{2+}(aq) + 2\text{Br}^{-}(aq) + 2\text{Na}^{+}(aq) + 2\text{OH}^{-}(aq) \rightarrow 2\text{Na}^{+}(aq) + 2\text{Br}^{-}(aq) + \text{Cu}(\text{OH})_2(s)$
- c) $2\text{Br}^{-}(aq) + 2\text{Na}^{+}(aq) \rightarrow 2\text{NaBr}(aq)$
- d) $\text{Cu}^{2+}(aq) + 2\text{Br}^{-}(aq) + 2\text{Na}^{+}(aq) + 2\text{OH}^{-}(aq) \rightarrow 2\text{NaBr}(aq) + \text{Cu}(\text{OH})_2(s)$
- e) There is no net ionic equation for this reaction.

15. How many grams of ammonium phosphate are needed to prepare 200.0 mL of a 1.50 M solution?

- a) 0.300 g b) 19.9 g c) 33.9 g d) 39.3 g e) 44.7 g

16. The following are true/false statements that require explanation. State whether each are “true” or “false” and then provide the requested explanation or support. **Please limit your answers to the space provided.**

True or False? For the following unbalanced reaction:

$\text{C}_3\text{H}_8 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$, a coefficient of “10” in front of oxygen can be used to balance the equation. Whether true or false, provide a thorough explanation along with a correctly balanced equation.

Consider a solution with the following ions present:

NO_3^- , Pb^{2+} , K^+ , Ag^+ , Cl^- , SO_4^{2-} , PO_4^{3-} .

True or False? When all are allowed to react (and there is plenty available of each), exactly three different solids will form. Whether true or false, list all of the solids that will form using the correct formulas in your explanation.

True or False? The limiting reactant is always the reactant that has the smallest molar mass. If true, explain why. If false, explain why along with a counterexample.

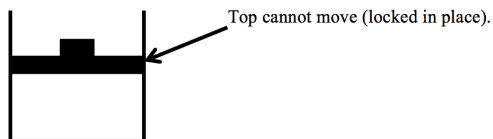
Consider the following scenario: You have a graduated cylinder containing 50.0 mL of 0.500 *M* NaCl sitting uncovered on your lab bench. You leave the solution uncovered for a week and find that 13.0 mL of water evaporated.

True or False? The concentration of the solution will remain the same over this period of time. Whether true or false, explain why and include the actual concentration of the final solution. (Show all work.)

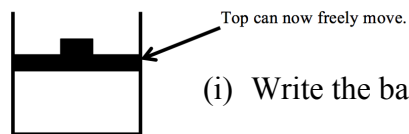
17. Answer the questions below as thoroughly as you can. **Please limit your answers to the space provided and show all work.**

A piston contains 2.00 g of ammonia gas (NH_3) and 2.50 g of oxygen gas at 325 K. The volume of the locked (immovable) piston is currently 3.00 L.

- a) Before any reaction takes place, what is the total pressure inside the piston?



- b) The piston is now unlocked so that the top can freely move. The two reactants react to produce nitrogen gas and water vapor.



- (i) Write the balanced chemical equation for this reaction in standard form.

- (ii) Recall from Exam 1 that the piston will move freely to equalize with atmospheric pressure. What will be the new volume (in L) after the piston is unlocked and the chemical reaction takes place at the same temperature of 325 K?