

CHEMISTRY 101
Hour Exam II
October 27, 2015
Adams/Trinh

Name _____

Signature _____

Section _____

**"Success is the sum of small efforts, repeated day in and day out."
--Robert Collier--**

This exam contains 17 questions on 5 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	(15 pts.)	_____
17	(15 pts.)	_____
Total	(60 pts)	_____

Useful Information:

1 L = 1000 mL (exactly)

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

$$PV = nRT$$

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

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

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

$$1 \text{ amu} = 1.6605 \times 10^{-24} \text{ g}$$

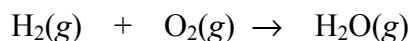
Solubility Rules:

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. You mix 100.0 mL of 0.100 *M* calcium chloride with 100.0 mL of 0.100 *M* silver nitrate. What species are in solution when the reaction is complete?

- a) calcium ion, chloride ion, nitrate ion, water
- b) chloride ion, silver ion, nitrate ion, water
- c) calcium ion, chloride ion, silver ion, nitrate ion, water
- d) calcium ion, nitrate ion, water
- e) calcium ion, silver ion, nitrate ion, water

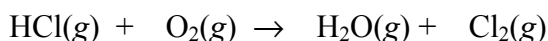
2. Consider the reaction as represented by the following **unbalanced** chemical equation:



You react 15.0 g of hydrogen gas with 100.0 g of oxygen gas. Determine the amount of reactant in excess after the reaction is complete.

- a) Neither reactant is in excess.
- b) 138 g of oxygen gas remains after the reaction is complete.
- c) 85.0 g of oxygen gas remains after the reaction is complete.
- d) 12.6 g of hydrogen gas remains after the reaction is complete.
- e) 2.40 g of hydrogen gas remains after the reaction is complete.

Consider the following **unbalanced** equation to answer questions 3 and 4:



3. How many grams of O₂ are necessary to react completely with 20. mol of HCl?

- a) 5.0 g b) 80. g c) 160 g d) 320 g e) 1280 g

4. How many moles of Cl₂ can be produced from 20. mol of HCl?

- a) 5.0 mol b) 10. mol c) 20. mol d) 40. mol e) 80. mol

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5. What volume of a 0.300 *M* CaCl₂ solution is needed to prepare 240. mL of a 0.100 *M* Cl⁻ solution?

- a) 40.0 mL b) 80.0 mL c) 160. mL d) 240. mL e) 480. mL

6. 25.0 mL of 0.50 *M* Pb(NO₃)₂ is added to four separate beakers containing:

- Beaker I: 50.0 mL of 0.25 *M* NaCl
- Beaker II: 50.0 mL of 0.25 *M* NaOH
- Beaker III: 50.0 mL of 0.25 *M* Na₃PO₄
- Beaker IV: 50.0 mL of 0.25 *M* Na₂SO₄

After addition of the Pb(NO₃)₂ solution, in how many of the beakers will a precipitate form?

- a) 0 (none) b) 1 c) 2 d) 3 e) 4 (all)

7. Given the equation $3A + B \rightarrow C + D$, you react 2 moles of A with 1 mole of B. Which of the following is **true**? Choose the best answer.

a) A is the limiting reactant because of its higher molar mass.
b) A is the limiting reactant because you need 3 moles of A and have 2.
c) B is the limiting reactant because you have fewer moles of B than A.
d) B is the limiting reactant because 3 A molecules react with 1 B molecule.
e) Neither reactant is limiting.

Consider the following information to answer questions 8 and 9: When 200.0 mL of 0.10 M $Zn(NO_3)_2$ is mixed with 100.0 mL of 0.10 M KOH, a precipitate forms.

8. How many moles of precipitate can form in this reaction?

a) 0.0050 mol b) 0.010 mol c) 0.015 mol d) 0.020 mol e) 0.030 mol

9. Calculate the concentration of Zn^{2+} ions in the final solution after precipitate formation is complete.

a) 0.00 M b) 0.010 M c) 0.017 M d) 0.050 M e) 0.075 M

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10. During a summer research internship, you are asked to do some lab work and prepare some solutions for some experiments to be run on samples that will come in from the field. You need to prepare a 0.300 M NaOH solution but only have 6.00 M NaOH on the shelf. What volume of water must be **added** to 10.0 mL of 6.00 M NaOH to make a solution that is 0.300 M NaOH? (Assume that the volumes are additive.)

a) 20.0 mL b) 190. mL c) 200. mL d) 210. mL e) 400. mL

11. In an open flask, 20.0 mL of an aqueous solution (density of solution = 1.103 g/mL) is combined with 13.5 g of a solid, and a chemical reaction takes place. One of the reaction products is 1.473 L of gas with density = 1.798 g/L. What is the mass of the mixture remaining in the flask?

(Hint: Think about how the law of conservation of mass applies in this situation.)

a) 2.6 g b) 10.9 g c) 22.1 g d) 32.9 g e) 35.6 g

12. You are given **1.00 gram** of each of five substances. In which of the substances will there be the greatest number of potassium ions when dissolved in water?

a) potassium chloride
b) potassium chlorate
c) potassium phosphate
d) potassium nitrate
e) potassium carbonate

For questions 13 and 14, write the balanced chemical equation for the complete combustion of pentene, C_5H_{10} . Remember, in combustion, pentene reacts with oxygen to produce carbon dioxide and water.

13. When balanced in standard form, what is the coefficient in front of oxygen?

- a) 1 b) 2 c) 10.5 d) 21 e) 42

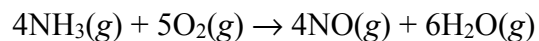
14. If 5.00 moles of carbon dioxide were produced in this reaction, how many moles of oxygen were required?

- a) 3.33 mol b) 5.00 mol c) 7.50 mol d) 15.0 mol e) 21.0 mol
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15. The correct net ionic equation for the reaction between nickel(II) chloride and sodium sulfide is:

- a) $Ni(aq) + S(aq) \rightarrow NiS(s)$
b) $NiCl_2(aq) + Na_2S(aq) \rightarrow NiS(s) + 2NaCl(aq)$
c) $Ni^{2+}(aq) + S^{2-}(aq) \rightarrow NiS(s)$
d) $2Na^+(aq) + 2Cl^-(aq) \rightarrow 2NaCl(aq)$
e) $Ni^{2+}(aq) + 2Cl^-(aq) + 2Na^+(aq) + S^{2-}(aq) \rightarrow NiS(s) + 2Na^+(aq) + 2Cl^-(aq)$

16. Consider the following reaction:

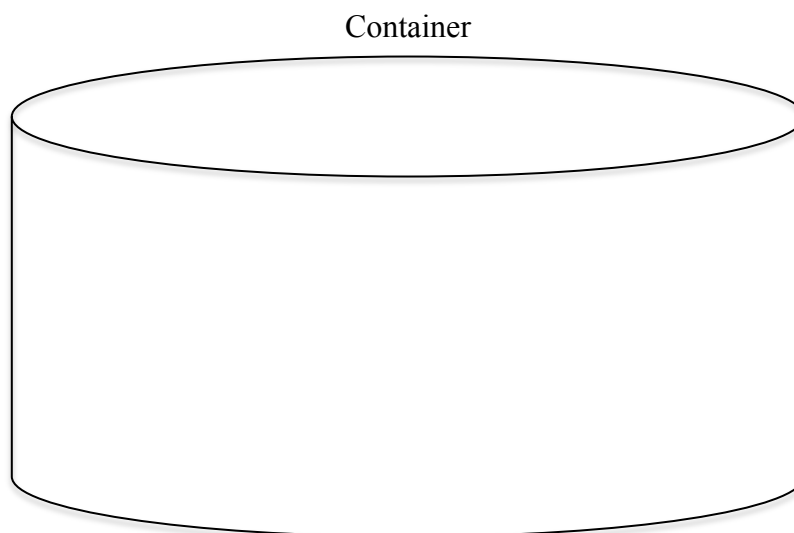


Answer the questions below as thoroughly as you can. **Please limit your answers to the space provided and show all work.**

- a) If a container were to have 10 molecules of $\text{O}_2(\text{g})$ and 10 molecules of $\text{NH}_3(\text{g})$, how many ***total*** molecules (reactant and product) would be present in the container after the above reaction goes to completion?

- b) Draw the total molecules present inside the container (pictured below) after the reaction occurs. Use the following “key” to guide your representative drawing.

KEY	
N =	
O =	
H =	

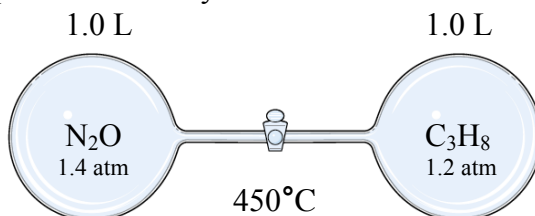


- c) What mass of $\text{NO}(\text{g})$ is present in the container after the reaction occurs? (Report your final answer to 4 significant figures.)

17. Dinitrogen monoxide, N_2O , reacts with propane, C_3H_8 , to form nitrogen, N_2 , carbon dioxide, CO_2 , and water, H_2O .

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

- a) Write the balanced chemical equation in standard form for this reaction treating all substances as gases. Include phases in your equation.
- b) Two reservoirs, separated by a closed valve (of negligible volume) are filled with the reactants (one on each side). The pressure of N_2O is measured to be 1.4 atm. The pressure of C_3H_8 is measured to be 1.2 atm. Each reservoir has a capacity of 1.0 L and the temperature of the system is 450°C .



The valve between the reservoirs is opened and the chemical reaction proceeds. Assuming ideal gas behavior and constant temperature, what is the partial pressure of CO_2 after the reaction is complete?

- c) What is the partial pressure of N_2O after the reaction is complete?