

Chemistry 105-Fundamental Chemistry
Exam 2-Wednesday, 6 November 1996

Name _____
Laboratory Section _____.

PLEASE ANSWER IN THE SPACE PROVIDED. **SHOW ALL WORK** WHEREVER POSSIBLE- ESPECIALLY STOICHIOMETRIC FACTORS AND UNIT CONVERSIONS. YOU DO NOT NEED TO SHOW MOLAR MASS CALCULATIONS. THERE WILL BE ABSOLUTELY **NO TALKING** DURING THIS EXAM PERIOD. IF YOU HAVE A QUESTION RAISE YOUR HAND. IF YOU FINISH EARLY, BRING YOUR EXAM TO THE FRONT AND LEAVE QUIETLY. DURING THE LAST TEN MINUTES OF THE EXAM PERIOD, DO NOT LEAVE YOUR SEAT AND DO NOT SPEAK TO OTHERS UNTIL ALL PAPERS HAVE BEEN COLLECTED. **INITIAL EACH PAGE** SO THAT IF THE PAGES BECOME SEPARATED I CAN PIECE YOUR EXAM BACK TOGETHER. PLEASE USE A **PEN**. FILL YOUR **STUDENT ID NUMBER** IN THE SPACE PROVIDED AT THE BOTTOM OF THIS SHEET. GOOD LUCK.



ID NUMBER _____.

1) (10pts) Fill in the blank with the most appropriate response.

Titration is an analytical technique used to determine the amount or concentration of an unknown present in solution. The technique is based upon adding a solution of one reactant, known as the _____, from a _____ to the other reactant which is held in a beaker or flask below the _____. At the _____ point the solution contains an excess of _____ reagent. In a neutralization reaction, the solution would be neither acidic nor basic at this point. It would consist of a _____ and _____. If one then knows the original concentration of one of the reagents and the volumes used, it is then an easy task to calculate the unknown quantity. However, if one were to forget to add an _____ to the solution being titrated, the _____ would never be seen. In lecture, another method was used to visualize this point. A light bulb and two electrodes were placed into the solution being titrated and a lack of conductivity was observed as a _____ of BaSO_4 formed.

2) (10pts) Identify each chemical substance as a strong acid (**SA**), weak acid (**WA**), strong base (**SB**), weak base (**WB**), or salt (**S**) by placing the given abbreviation for each in the first space provided (the shorter one). In the second (longer) space PRINT the chemical name for the substance.

NH_3	_____	_____
HClO_3	_____	_____
HNO_2	_____	_____
KOH	_____	_____
H_2SO_4	_____	_____
HBr	_____	_____
$\text{Fe}(\text{OH})_3$	_____	_____
MgCl_2	_____	_____
H_3PO_4	_____	_____
PbI_2	_____	_____

3) (10pts) Give a balanced chemical equation for each of the following.

A. Sodium hypochlorite produces sodium chloride and sodium chlorate when heated.

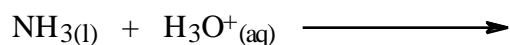
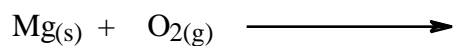
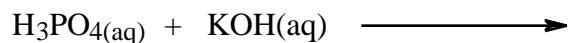
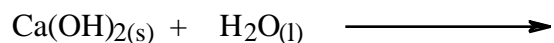
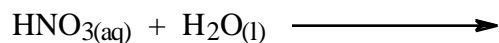
B. Carbon disulfide reacts with nitrogen monoxide to give elemental sulfur, nitrogen gas, and carbon dioxide.

C. Calcium carbonate yields calcium oxide and carbon dioxide when heated.

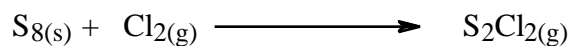
D. Ammonia is prepared by reaction of hydrogen gas and nitrogen gas.

E. Aluminum metal reacts with iron (III) oxide to produce iron metal and aluminum oxide.

4) (10pts) Give the completed balanced chemical equation for each reaction shown below.



5) (5pts) Disulfur dichloride, S_2Cl_2 , is used to vulcanize rubber. It can be made by treating molten sulfur with gaseous chlorine.

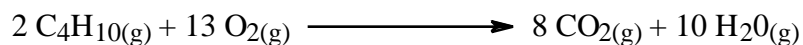


If you begin with 32.0 g of sulfur and 71.0 g of Cl_2 , how many grams of S_2Cl_2 can be produced? What quantity of which starting material will remain after the maximum amount of S_2Cl_2 has been formed?

6) (5 pts) A sample of H_2 gas occupies 615 mL at $27.0^\circ C$ and 575 mm Hg. When the gas is cooled, its volume is reduced to 455 mL and its pressure is reduced to 385 mm Hg. What is the new temperature of the gas?

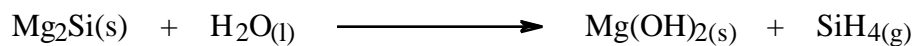
7) (5 pts) What is the molarity of a sodium hydroxide solution if 38.0mL is needed to neutralize 35.0mL of a 0.138M sulfuric acid solution? **Show all steps to receive full credit.**

8) (5 pts) Butane can be used as a fuel in an automobile engine. It burns in O_2 according to the equation



If one cylinder of the engine is filled with butane to a pressure of 1.5 atm at $500^\circ C$, it requires 2.45 g of O_2 for complete combustion. How many grams of O_2 would be required if the cylinder were filled with butane at a total pressure of 2.0 atm at $500^\circ C$?

9) (25 pts) For the reaction shown below,



a) How many moles of SiH_4 are formed by complete reaction of 3.95g Mg_2Si ? (Remember, balanced equations are most useful...and there are 4 qts = 1 gal, 1.057 qts = 1L, 4.184 J = 1 cal, 2.54 cm = 1 in, 2000 lbs = 1 ton, 5280 ft = 1 mile, 453.6g = 1.00lb, 12 = dozen, 101.325 kps = 1 atm, 1.00 troy oz. = 1.10 avoirdupois [ordinary] oz., 16.0 avoirdupois oz. = 1.00 avoirdupois pound, $R=0.08206\text{L atm/K mol}$, $1\text{atm}=29.92\text{ in}=760\text{torr}=760\text{mm Hg}$).

b) While carrying out the reaction shown above in part a, if you were to capture the SiH_4 gas at 25°C and 1.0atm , what would its volume be?

c) Calculate the weight of water necessary to react with all the Mg_2Si from part a.

d) If 42.5mg of Mg_2Si is reacted with 27.0mg of water, what mass of SiH_4 is formed, assuming that the limiting reactant is completely reacted?

e) In part d above, supposing only 7.00mg of SiH_4 gas was actually isolated, what would the percentage yield be?

10) (12 pts) Assuming you could see at the molecular level (ie., you are a tiny little person) draw a representation for what one would find for each of the following solutions.

a) $\text{HNO}_{3(\text{aq})}$ added to water:

b) 10.0g $(\text{NH}_4)_2\text{SO}_4$ in water

c) 300.0 mL of 0.6M $\text{H}_3\text{PO}_{4(\text{aq})}$ and 400.0 mL of 0.5 M $\text{KOH}_{(\text{aq})}$ before they are mixed together.

d) 300.0 mL of 0.6M $\text{H}_3\text{PO}_{4(\text{aq})}$ and 400.0 mL of 0.5 M $\text{KOH}_{(\text{aq})}$ after they are mixed together.

11) (3 pts) Explain what a primary standard is and what it is used for.