Magnesium, Gas, Stoichiometry and Exam Review

Here is the ultimate goal. You will be given a piece of magnesium metal and a really large test tube with graduated marks on it (called a eudiometer). A small amount of extremely concentrated acid (8-12 Molar handled by your instructor) will react with the metal creating a gas. Your job is to predict the amount of gas that will form in the eudiometer as the metal reacts, forms the gas and pushes the water out of the bottom of the tube.

1. An a separate sheet of paper, you must have a neat data table. What data is required before the reaction so that you can make an accurate prediction? All data MUST be in INK.
2. Calculations: You must provide a nice neat calculation that predicts the milliliters of gas that forms. This MUST be turned in before the reaction occurs.

Questions.

A. Concentrated HCl(aq) is 1.19 g/mL. If I use 3.30 mL, how many grams of HCl is that? Please use the correct number of significant figures.

3.30 mL HCl x 1.19g HCl/1 mL HCl = 3.93 g HCl

B. What is the name of HCl?

Hydrochloric Acid

C. How many moles of HCl are used?

3.93 g HCl x 1 mole HCl/36.46 g HCl = .108 moles HCl

D. The acid and the metal will react. Provide the name of the 5 different types of reactions we discussed. Which reaction is this one?

1. Combustion

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2.Single Displacement

3. Double Displacement

4. Synthesis

5.Decomposition

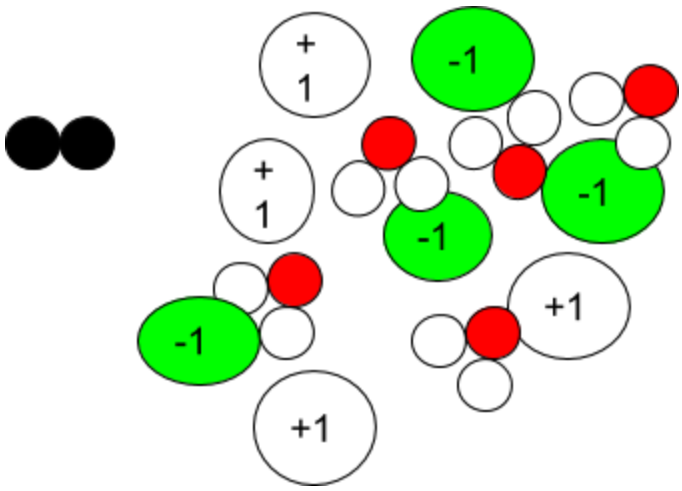
*This is a single displacement reaction.

E. What is the balanced equation of magnesium reacting with hydrochloric acid? Please include state symbols.

$Mg(s) + 2\ HCl\ (aq) \rightarrow MgCl_2(aq) + H_2(g)$

F. Draw a model of the reactants and the products.

Reactants



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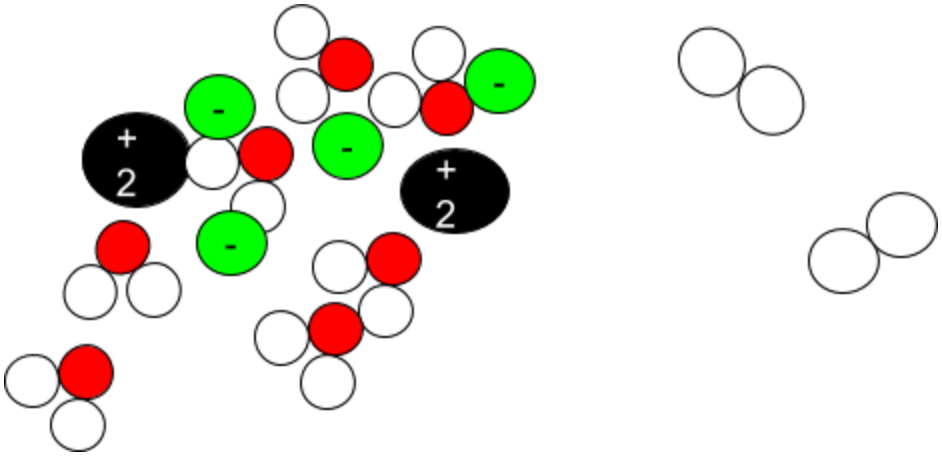
Products



G. If 1. 5 grams of magnesium reacts with 20.3 mL of a 2.7 M HCl solution. The gas is collected over water at 28 degrees C and the atmospheric pressure is 104.5 kPa. What is the volume of gas collected?

$Mg(s) + 2\ HCl\ (aq) \rightarrow MgCl_2(aq) + H_2(g)$

1. 1.5 g Mg x 1mole Mg/24.305g Mg = .062 moles Mg
2. .0203 L HCl x 2.7 moles HCl/1 L HCl = .055 moles HCl
3. Limiting is HCl. Should be a 1 to 2 mole ratio of Mg to HCl. It is not even 1:1. Not enough HCl.
4. .055 moles HCl x 1 mole H_2/2 mole HCl = .0275 moles of H_2 = n
5. T = 28 C + 273 = 301 K
6. 104.5 kPa x 760 mmHg/101.3 kPa =784 mm Hg total pressure
7. $P_{total} = P_{dry\ gas} + P_{water\ vapor}$ 784 mmHg-28.3 mmHg = 755.7 mmHg (pressure of dry gas)
8. V = nRT/P .0275 moles H_2 x 62.4 L mmHg/Kmole x 301K/755.7 mmHg = .683 L

H. Some experiments have students make a small copper cage out of copper wire to place the magnesium in while the reaction takes place. What other metals could be used instead of copper? How do you know?

Gold, Platinum, Silver - Look at reactivity series.

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I. Initially, a person did a similar experiment and found that the temperature was 28 degrees C, the pressure of the dry gas was 104.4 kPa and the volume was 20.07 mL. What is the volume at STP based on those conditions?

T = 28 + 273 = 301 K P = 104.4 kPa V = .02007 L

PV/T = P' V'/T' V' = PV/T x T'/P'

104.4 kPa x .02007 L/ 301 K x 273 K/ 101.3 kPa = .0187 L

J. Given your answer in "I", how many moles of magnesium were there? Please report your answer in scientific notation.

.0187 L x 1 mol/22.4 L = 8.35×10^{-4} moles

K. Another person does this experiment. They use 12.0 inches of magnesium ribbon. The magnesium ribbon is .0211g in every 1.00 cm. How many grams did they use? How many moles?

12.0 inches x 2.54 cm/ 1 inch x .0211 g/ 1 cm x 1 mole Mg/ 24.305 g Mg =.0265 mole Mg

Pre lab experiment:

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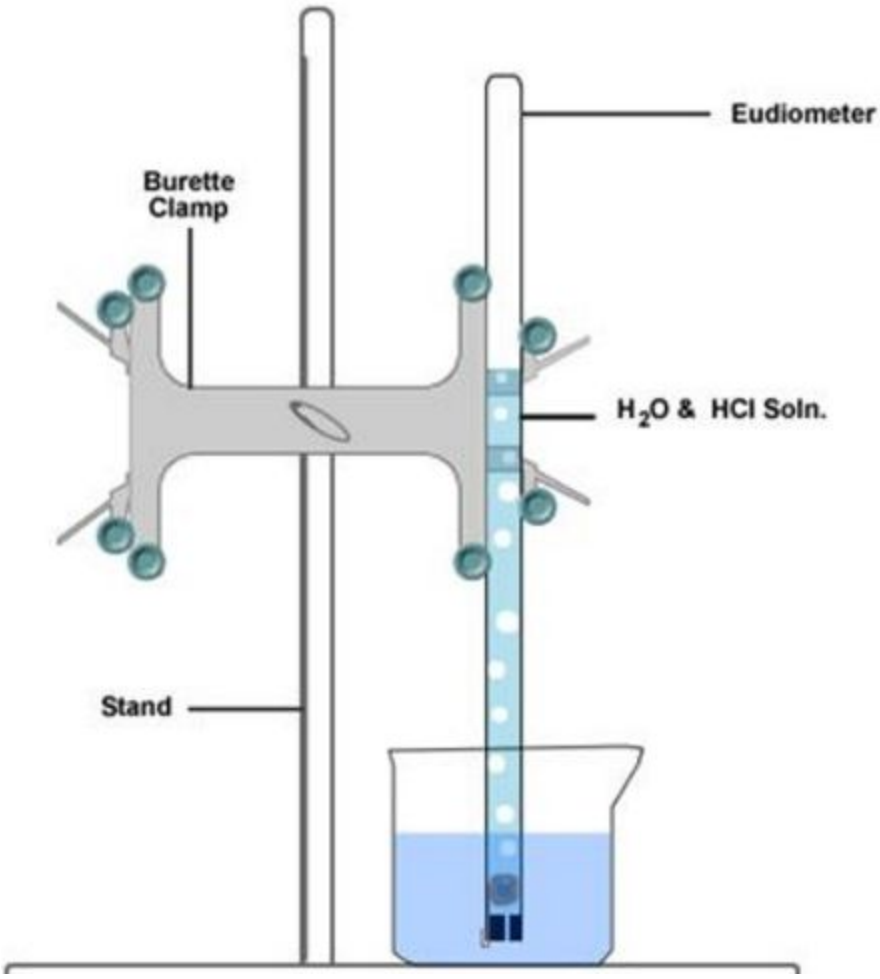

Work with a partner. A concentrated solution of HCl is going to react with a small piece of magnesium ribbon. Your job is to accurately predict the level of gas when the experiment is over. You must provide three items.

1. A neat data table of required data. Data must be in INK.
2. Calculations: Must show all work labels and units.
3. Prediction: How much gas is going to be collected?