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January 23rd, 2013 Generation of Hydrogen Gas Abstract Hydrogen gas was produced from a reaction in a eudiometer between a weighted amount of magnesium ribbon and 5ml of diluted 6M hydrochloric acid. The partial pressure of the hydrogen gas produced was calculated using Dalton’s Law of partial pressure. With this partial pressure value along with known values in the experiment the number of moles of hydrogen gas produced could be calculated using the ideal gas law equation and this experimental value was compared to the theoretical number of moles that should have been produced in the reaction. It was found that the average comparison value between the theoretical value and the experimental value was 97. 8% with a standard deviation of 5. 7 and a %RSD of 5. 8%. Data and Results Table 1: Production of H2 Gas with Magnesium and HCl using a Eudiometer | Trial 1 | Trial 2 | Trial 3 | Mass of Magnesium Ribbon (g) | 0. 0363 | 0. 0349 | 0. 0373 | Initial Eudiometer Reading (mL) | 11. 6 | 4. 0 | 5. 9 | Final Eudiometer Reading (mL) | 47. 6 | 42. 2 | 41. 8 | Change in Volume (mL) | 36 | 38. 2 | 35. 9 | Final Temperature of H2O (°C) | 21. 5 | 21. 5 | 21. 5 | Height of Water Column After Reaction (mm) | 29 | 81 | 92 | Barometer Reading (mm Hg) | 754. 1 | Table 2: Calculated Results | Trial 1 | Trial 2 | Trial 3 | Partial Pressure of H2 (mm Hg) | 732. 71 | 728. 9 | 728. 1 | Theoretical Number of Moles of H2 Produced (moles) | 1. 49x10-3 | 1. 43x10-3 | 1. 53x10-3 | Actual Value of Moles of H2 Produced (moles) | 1. 44x10-3 | 1. 51x10-3 | 1. 42x10-3 | Comparison Value (%) | 96. 6 | 104 | 92. 8 | Average Comparison Value (%) | 97. 8 | Standard Deviation | 5. 7 | %RSD | 5. 8 | Calculations Please refer to attached sheets for calculations. Discussion In this experiment, hydrogen gas was produced by the reaction of magnesium and hydrochloric acid with the following ratios: one mole of solid magnesium reacts with two moles of

hydrochloric acid producing one mole of magnesium chloride and one mole of hydrogen gas. The equation for this reaction is as shown below: Mg(s) + 2HCl MgCl2 + H2 If a gas contains a mixture of distinct gases the calculated pressure will be for the system as a whole. Dalton’s Law of partial pressures states that the total pressure of the gas is equal to the sum of all the pressures of its parts. This law has the following equation: PressureTotal = Pressure1 + Pressure2 + ... Pressuren In this experiment the total pressure of the system was known and Dalton’s Law of partial pressure was used to calculate the partial pressure of H2 gas on its own since we knew the total pressure of the gas mixture. This was done using the following equation that had been derived from Dalton’s Law: PH2 = Patm — h (in mm) _ PH2O 13. 6 The comparison values for trial 1 and 3 were slightly less than 100% This could be due to the fact that the reactants may not have been completely used up during the reaction or the possibility that some of the hydrogen gas could have escaped during the experiment. The comparison value for trial 2 was slightly more than 100%. This could be because a gas other than hydrogen gas and water vapour entered the eudiometer. Since the unknown gas would not be accounted for when finding the partial pressure of hydrogen, it would raise the number when calculating the experimental number of moles of hydrogen gas produced. If a %RSD is calculated to be less than 2% it is considered to be very good, but the calculated %RSD for this experiment was 5. 8%. Therefore the precision was not particularly good, but was not very poor either. Conclusion Hydrogen gas was produced from the reaction of magnesium and hydrochloric acid in a eudiometer with an average percent yield of 97. 8%. It was found that in this experiment there was a standard deviation of 5. 7 and a %RSD of 5. 8%. References 1.

M. Reimer, Chem 101/102 Laboratory Manual, pp. 101-1-1. (University of Victoria: Victoria, BC). Spring 2013. 2. M. Reimer, Chem 101/102 Laboratory Manual, Appendix, pp. A-10 — A-17. (University of Victoria: Victoria, BC). Spring 2013. 3. http://web. uvic. ca/~dragon/102lab. html