Using the ideal gas law lab answers

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The learning objectives generate and collect hydrogen gas on water from zinc metal reaction with HCL (AQ). It determines the purity percentage of the zinc sample that combines the ideal gas law with stotichemetry. An ideal gas follows the ideal gas law in all conditions of P and T. The particles in an ideal gas do not have finite size and volume. It is said that collisions between ideal gas particles are elastic, do not exert attractive or repulsive forces. The hydrogen gas generated in today's experiment is, however, a real gas is not an ideal gas. Real gases consist of finite-sized molecules, which exert forces on each other. A gas will act as an ideal gas if its gas molecules are small, when the pressure is low and the temperature is high. For our experimental conditions today, we can assume that hydrogen gas adheres to the ideal law of gas. Today's experiment is an example of a single replacement reaction. It involves measuring the volume of hydrogen gas generated by a zinc reaction with excess hydrochloric acid. Â The hydrogen gas produced will be harvested on the water in a buretta. This results in a gas sample that is a mixture of hydrogen gas and water vapor within the Buret. To determine the pressure of hydrogen gas alone, you must use the Dalton law of partial pressures. In accordance with Dalton's law, atmospheric pressure (PT) is equal to the sum of hydrogen gas pressure (pH) and water vapour pressure (PW): Â The collected volume can then be used to calculate hydrogen moles produced using the ideal gas law. ÂEquation 3 Zinc grams present in the impure sample can be determined using calculated hydrogen gas molecules produced and balanced equation coefficients (Equation 1.) You will use the ideal gas law to determine the hydrogen gas molecules generated in this experiment. Equation 4 Moles of hydrogen gas ( ) evolved is calculated by equation 4. Equation 5 P_{H2} = partial pressure of hydrogen gas = PA- PW P_{H2} is in atm or mmHg. Use the appropriate R value in equation 5. PT = atmospheric pressure provided by your PW instructor = water vapour pressure at T V temperature = volume in L n_{H2} = evolute hydrogen gas molecule R = ideal gas constant, 0.08206 R = ideal gas constant, 62.36 T = temperature in Kelvin (°C + 273) Zinc grams present in the impure sample can be determined using the molecules calculated by equations 4. Zn Gram reacted = ________________________ Finally determine the percentage purity of the zinc sample by dividing the zinc mass reacted by the mass of the impure sample and multiplying by 100,% % Zn in the sample = x 100% Equation 7 Table 1. Water vapour pressure at different temperatures Temperature (°C) Steam pressure (mm Hg) Temperature (°C) Steam pressure (mm Hg) 16.0 13.6 24.0 22.4 17.0 14.5 25.0 23.8 18.0 15.5 26.0 25.0 25.0 16.5 27.0 20.0 17.5 28.0 28.3 20.0 18.6 29. (Students should work together for this experiment.) The appliance is shown in Figure 6.1 Add distilled water through the funnel until the water level is just below the 0.0 mL mark in the buretta. Raise and lower the funnel to help expel any air bubbles. (It is important that no air bubble stays in the pipe or shaft funnel at the beginning of the experiment.) It may be necessary to adjust the height of the funnel compared to the rest of the experiment.)Make a lot of careful during this process so that the water does not scroll through the rubber tube used to connect the large test tube to the burette. Figure 6.1 Cut a large tube into a 150 ml beaker. Use a spatula to add between 0.100 g and 0.110 g of zinc powder in the large test tube. Record the zinc mass in your data table. Add about 2.0 ml of HCL 6.0 m into a test tube (70 mm x 10 mm). Using a forceps, gently slide the small test tube and the content in the largest tube containing zinc powder. The test tube must be in a vertical position (mouth facing the high). You need to be very careful for no HCL to contact zinc. If any of the HCL comes into contact with zinc, you will have to start experimenting. Connect the large tube to the appliance while maintaining the small tube containing HCL in a vertical position. Move the funnel to the high or down so that the water in the funnel and the burette are at the same level. This compares the pressure of the gas trapped at the inside of the burette at atmospheric pressure. Record the volume of water in the burette with the approximation of 0.01 ml as an initial reading of the burette in the data table. Always read the volume size from the high downwards. Measure the temperature of the water in the funnel using a thermometer. Keep the thermometer in the funnel containing water until the temperature has stabilized. Record the temperature with a decimal in the data table. Record atmospheric pressure (PT) in Table data. Carefully read the rest of the procedure before continuing. This part of the procedure must be performed by you and your partner in a coordinated way. If something is not clear, please consult your instructor. The reaction between HCl 6.0 m and zinc occurs quickly after mixing. A student will be responsible for mixing the zinc and the HCL 6.0 m in tubes and the other student will have to lower the funnel so that the level of water in the funnel is at the same height as the Water level in the burette during generation of gaseous hydrogen. If you are not sure what to do, consult your instructor before proceeding with the next step. With a student ready to lower the funnel, the other student must gently tilt the large test tube so that a part of the HCL present in the small tube comes out of the small tube and comes into contact with the zinc dust present in the Large test tube. Be careful not to flowing any HCl through the rubber tube that connects the large tube and the burette. The student responsible for lowering the funnel must do so if necessary, after mixing HCL and Zinc so that the water level in the funnel reaches the height of the water level in the burette. Once the reaction has settled, tilt the test tube again so that more HCl comes into contact with the zinc. zinc. the gas has evolved, the water level in the buretta will remain constant. At this point, no unreacted zinc must be observed. Adjust the height of the funnel so that the water level in the funnel is at the same height as the water level in the buretta. Record the final buretta reading in your TABLE DATA. The volume of hydrogen gas produced is the difference between the final and initial readings of burettes. Pour the content of the large test tube into a waste container labeled in the hood. Remove the small test tube with forceps. Wash large and small test tubes with soap and water, followed by rinsing with distilled water. Place large test tubes in the tray and small test tubes in a 400 mL beaker found next to the oven. Make a complete set of data calculations to run 1. Show zinc % in the sample to your instructor and then proceed with the slopes 2 and 3. For each ride use a clean and dry set of glass tubes from the side bench. Record your results. Use your data to calculate the percentage purity of zinc. Pour all the content of the large test tube into the zinc chloride waste container labeled in the hood. Wash all test tubes with soap and water followed by rinse with distilled water. Leave the wet test tubes in a tray near the oven. Put the beaker and the thermometer away. Clean the bench with a wet paper towel. ____ TABLE OF DATA (3 pt.) Quantity Run 1 Run 2 Run 3 Water Temperature (T) Atmospheric pressure (PT) Water vapour pressure (PW) from Table 1 Subtotal pressure of H_2 (P) Zn impure mass sample used Final reading of the skins (mL) Initial reading of the saws (mL) Volume of H_2 gas (VH) Use the numbered steps from the Include at least three comments for full credit. (2 pts.) Calculations: Use the ideal gas law (See equation 5.) and data from the table on the previous page to calculate hydrogen gas molecules. Show the calculation settings for Run 1 with units in place below. Make sure you report the answers to the correct number of significant digits in the appropriate box. (3 pts.) Quantity Run 1 Run 2 Run 3 Moles of H_2 evolved gas Solve stoichiometry problem (see equation 6.) to determine the reacted zinc grams. Show the calculation settings for Run 1 with units in place below. Make sure you report the answers to the correct number of digitsin the appropriate box. (2 pts.) Quantity Run 1 Run 2 Run 3 Grams of Reacted Zinc Calculate the percentage purity of the zinc sample (See equation 7.) Show calculation settings for Run 1 with units in the space below. Be sure to report the answers to the correct number of significant digits in the appropriate box. (2 pts.) Run 1 2 run 3% zinc in the sample sample Date: Using the law of the combined gas, calculate the volume of H_2 gas in mL at STP from the experimental data in Run 1. (3 pts.) Calculate the mean deviation percent of zinc. Show your work in the space below. Use the mean value of deviation to discuss accuracy. (In this experiment, a mean deviation per percent zinc of 3.0% is considered good.) (3 pts.) How could the following errors affect the calculated value for % purity of zinc (the calculated value would be higher, lower or unaffected)? Refer to equations 5 – 7. When calculating the hydrogen molecules produced, it is forgotten to subtract the water vapour pressure from the atmospheric pressure when determining the hydrogen partial pressure. Explain. (2 pts.) There was a leak in the system during the reaction between zinc and HCl. Explain. (2 pts.)