Student Name: ***Reem Hashim***

Student Number: ***8687450***

Partner's Name and Student #: ***Zahra Alsendi (8772928)***

Demonstrator's Name: ***Nancy Marma***

PLEASE NOTE: If ANY of the above information is UNCLEAR or not provided, your grade will NOT be recorded!!

Lab Day (T/W/Th/F): ***Wednesday***

Lab Week (even/odd): ***Even***

Lab time (10:00, 2:30, 6:30): ***10:00 AM - 1:00 PM***

Laboratory Report Form

Experiment 1.

Determination of the Composition of an Alloy

Checklist:

- Raw Data Sheet written in pen, signed by TA and attached
- Report Form typed and attached

Student's Initials *R.H*

Data Tables

Table 1. Pure Metal

Data	Trial 1	Trial 2
Identity of Metal	Magnesium	Magnesium
Mass of metal (g)	0.03 g	0.026 g
Uncalibrated volume of eudiometer (mL)	N/A	N/A
Volume of hydrogen gas (mL)	29.12 mL	32.2 mL
Height of water column (cm)	20.4 cm	17.22 cm
Density of water (kg/m^3)	1000 kg/m^3	1000 kg/m^3
Acceleration due to gravity (m/s^2)	9.8 m/s^2	9.8 m/s^2
Pressure of water column (Pa)	2002.2 Pa	1687.56 Pa
Water Temperature (°C)	21.6°C	23.0°C
Water Vapour pressure (Pa)	2640 Pa	2810 Pa
Atmospheric Pressure (Torr)	0.997 Torr	0.997 Torr
Pressure of Hydrogen	96.5 kPa	96.6 kPa
Room Temperature	22.4°C	22.4°C
Ideal Gas Constant, R	8.314 L kPa/$mol^{-1}\cdot K$	8.314 L kPa/$mol^{-1}\cdot K$
Actual Moles of Hydrogen (mol)	1.14×10^{-3} mol	1.3×10^{-3} mol
Theoretical moles of Hydrogen (mol)	1.2×10^{-3} mol	1.01×10^{-3} mol mol
Percent Yield (%)	95%	118%

Observations (Part 1):

- Reaction started relatively quick compared to alloy
- Creates big bubbles of hydrogen
- Releases some heat
- Magnesium got stuck to the side of the eudiometer *possible source of error*
- Faster reaction than alloy

Table 2. Alloy

Data	Trial 1	Trial 2
Unknown Number		
Mass of alloy (g)	0.04 g	0.04 g
Uncalibrated volume of eudiometer (mL)	N/A	N/A
Volume of hydrogen gas (mL)	20.8 mL	20.9 mL
Height of water column (cm)	28.4 cm	27.8 cm
Density of water (kg/m^3)	1000 kg/m^3	1000 kg/m^3
Acceleration due to gravity (m/s^2)	9.8 m/s^2	9.8 m/s^2
Pressure of water column (Pa)	2783.2 Pa	2724.4 Pa
Water Temperature (°C)	21.7°C	21.9°C
Water Vapour pressure (kPa)	2640 Pa	2640 Pa
Atmospheric Pressure (Torr)	0.997 Torr	0.997 Torr
Pressure of Hydrogen	95.7 kPa	95.8 kPa
Room Temperature	22.4°C	22.4°C
Ideal Gas Constant, R	8.314 L kPa/mol^{-1}·K	8.314 L kPa/mol^{-1}·K
Moles of Hydrogen (mol)	8.5 x 10^{-4} mol	8.2 x 10^{-4} mol
Mass of Zinc (g)	0.0343 g	0.0351 g
Mass of Aluminum (g)	5.7 x 10^{-3} g	4.93 x 10^{-3} g
Percent Zinc (%)	86%	88%
Percent Aluminum (%)	14%	12%
Average Percent	50%	50%

Observations (Part 2):

- Slow reaction compared to the pure metal
- Forms blackish/ greyish cloudy substance at the top of the solution when reaction is close to completion
- Many small hydrogen bubbles formed
- Also radiated some heat

Sample Calculation : Magnesium Pure Metal

1. **Uncalibrated Volume of the Eudiometer:**

N/A . Eudiometer was calibrated

2. **Volume of Hydrogen gas:**

$V_{hydrogen\ gas}$= 29.12 mL or 0.02912 L

3. **Pressure exerted by the water column:**

Pressure= dgh

= $(1000\ kg/m^3)(0.204\ m)(9.8\ m/s^2)$

= 2002.2 pa x 0.001

= 2.0 kPa

4. **Pressure of hydrogen gas:**

Pressure of hydrogen gas= 101.1 kPa - 2.0 kPa - 2.64 kPa

= 96.5 kPa

5. **Moles of hydrogen gas (experimental):**

PV= nRT

n= PV/RT

= $(96.5\ kPa)(0.02912\ L)/\ (8.314\ L\ kPa/mol^{-1}\cdot K)(295.55\ K)$

= 1.14×10^{-3}

6. **Moles of hydrogen gas (theoretical):**

n_{Mg}= 0.03 g Mg(1 mol Mg/24.31 g Mg)

= 1.2×10^{-3}

n_{H2}=1.2E-3 mol Mg(1 mol H_2/ 1 mol Mg)

= 1.2×10^{-3}

7. **Percentage Purity of metal (percentage yield of hydrogen):**

Percent yield H_2= (Actual yield/ Theoretical yield)x100

= $(1.14 \times 10^{-3}/1.2 \times 10^{-3})$x100

= 95%

8. **Average Percent Purity:**

Percent purity= (percent yield trial 1 +percent yield trial 2 / 2)

= 95% + 118% /2

=106.5%

<u>Sample Calculation : Zinc-Aluminum Alloy</u>

1. **Pressure of water column and hydrogen gas:**

Pressure= dgh

= (1000 kg/m^3)(0.284 m)(9.8 m/s^2)

= 2783.2 pa x 0.001

= 2.8 kPa

Pressure of hydrogen gas= 101.1 kPa - 2.8 kPa - 2.64 kPa

= 95.7 kPa

2. **Moles of hydrogen gas:**

PV= nRT

n= PV/RT

= (95.7 kPa)(0.0208 L)/ (8.314 L kPa/mol^{-1}·K)(295.55 K)

= 8.5 x 10^{-4}

3. **Masses of Zinc and Aluminum in the alloy:**

Mass $_{total}$= Mass $_{Al}$ + Mass $_{Zn}$

n Hydrogen gas = (Mass zinc/ Molar mass Zinc) + (Mass of Aluminum/ Molar mass aluminum)

n Hydrogen gas = (Mass total- Mass Aluminum/ Molar mass Zinc)+(3 Mass Aluminum/2 Molar mass of Aluminum)

8.5x 10^{-4} = (0.04 g/ 64.41 g/mol) - (Mass Al/ 65.41 g/mol) + (3 mass Al/ 2 Molar mass Al)

8.5 x 10^{-4} = (0.04 g/ 64.41 g/mol) - (Mass Al/ 65.41 g/mol) + (3 mass Al/ 2 (26.98 g/mol)

8.5 x 10^{-4} - (0.04 g/ 64.41 g/mol) = 3(Mass Al)(65.41 g/mol) + (53.96) (mass Al)/3529.52

2.3 x 10^{-4} (3529.52) = Mass Al ((3x65.41)-53.96)

Mass $_{Al}$ = 5.7 x 10^{-3} g
= 5.7 mg

Mass $_{total}$ = m_{zn} + m_{Al}
0.04 g= m_{zn} + 5.7 x 10^{-3} g
m_{zn}= 0.0343 g

4. Percent composition of the alloy:

% Aluminum = (Mass Aluminum/Mass Alloy) x 100

= (5.7×10^{-3} g/ 0.04 g) x 100

= 14%

% Zinc = (Mass Zinc/Mass Alloy) x 100

= (0.0343 g/ 0.04 g) x 100

= 86%

5. Average Percent composition of the alloy (average of zinc values and average of aluminum values):

Average percent Zc = (Percent of Zn trial 1 + Percent of Zn trial) / 2

= (86%+88%) / 2

= 87%

Average percent Al = (Percent of Al trial 1 + Percent of Al trial 2) / 2

= (14%+12%) / 2

= 13%

Average percent Alloy = (Percent average of Al 1 + Percent average of Zn) / 2

= (87%+13%) / 2

= 50%

Discussion: (within space provided)

In this experiment, the composition of an alloy and pure magnesium metal was determined by calculating the percentage of hydrogen gas produced after reacting the metals with an acid based reactant, hydrochloric acid (HCl). When the alloy and magnesium metals were placed into the hydrochloric acid, hydrogen bubbles formed forcing the solution to decrease down the eudiometer while being filled with hydrogen gas. The results showed that the moles of hydrogen gas produced from the magnesium metal was 1.14×10^{-3} moles, much less the theoretical yield of hydrogen gas. The composition of alloy, from the amount of hydrogen gas produced is 14% Aluminum and 86% zinc. Alloy is a metal made by combining two or more metal elements, to produce a metal with greater strength and resistance to corrosion. Alloy metal is used to build many infrastructures around the world to ensure that our buildings or bridges wont fall apart if to much pressure is put on it or corrode.

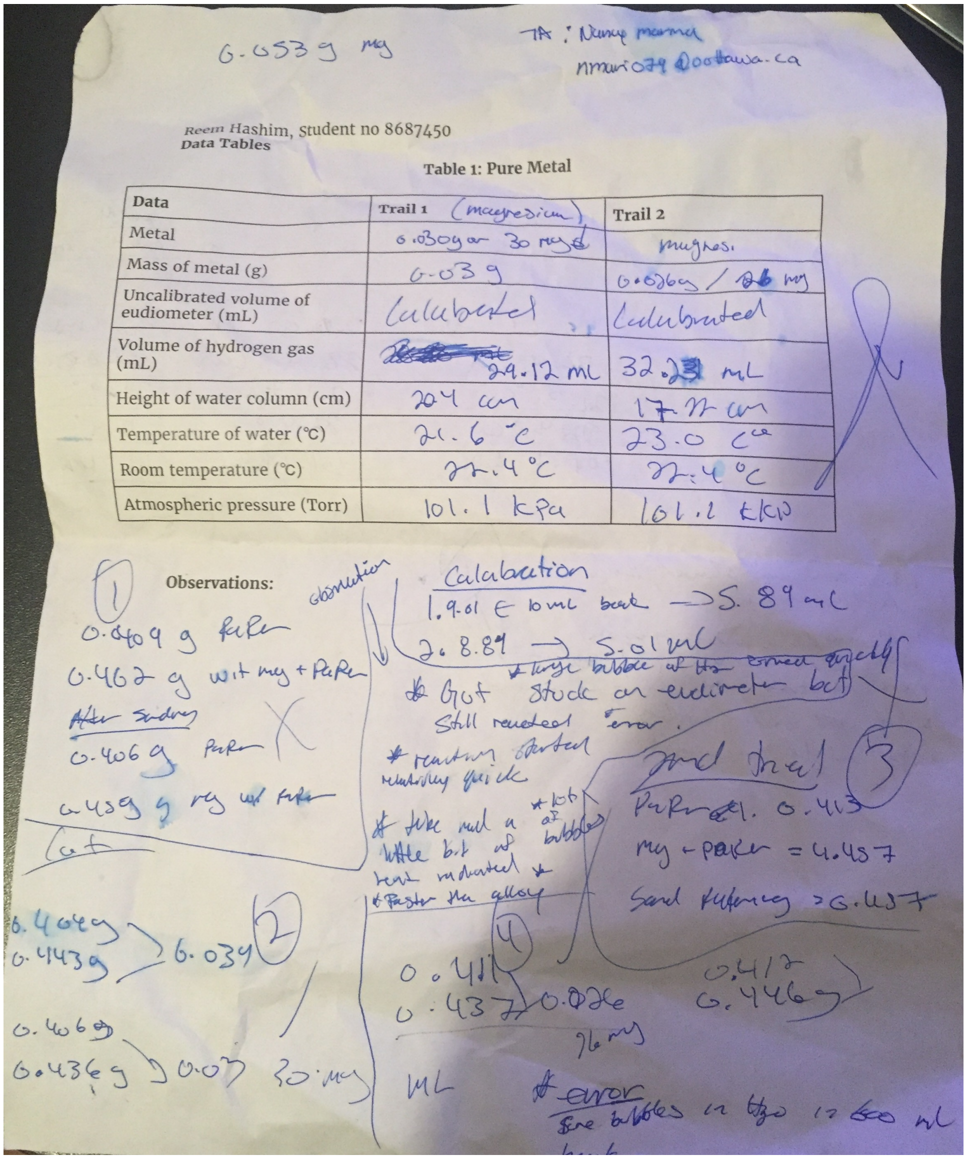
During the experiment a calibrated eudiometer was used to get highly accurate data, instead of an uncalibrated eudiometer that would give us fluctuated results. Another example of measurement that needed to be highly accurate was the mass of alloy and magnesium metal used. The masses of both metals, needed to be precise to correspond with the volume of hydrochloric acid that was to be needed for a successful reaction to occur, without the correct measurements the reaction could have been effected. The metal used for each experiment also effected the rate at which the reaction occurred. Magnesium metal reacted much more quickly compared to the alloy, this is due to the alloys metallic mixture that makes it much more difficult to break down.

Throughout the experiments possible experimental and human errors may have occurred, effecting the results of the lab. Magnesium metal was effected due to errors in the experiment. When the the reaction was progressing, the magnesium stuck to the side of the eudiometer, halting the reaction before falling back into the solution and continuing the reaction. This error effects the results, since the metal in not reacting to produce the hydrogen being collected for that experiment. The results of magnesium metal was also effected by human error. When placing the eudiometer into the sample holder inside the beaker of water, it took too long to get the the sample holder into eudiometer causing to started the reaction late. These errors only has sigh effects on the results, seeing as the results are similar. The experiment of alloy metal contained no errors and resulted in very similar results. Overall the experiments ere proven to be successful with small errors that haven't effected the results greatly.

Conclusion: (no more than two lines)

In conclusion the percent composition of alloy metal was 12% Al and 88% Zn. Magnesium metal produced 1.14×10^{-3} moles of hydrogen gas, much less than the theoretical yield.

Raw data



6.053 g mg

TA: Nancy mamari
nmari074@uottawa.ca

Reem Hashim, student no 8687450
Data Tables

Table 1: Pure Metal

Data	Trail 1 (magnesium)	Trail 2
Metal	0.030g or 30 mg	magnesi
Mass of metal (g)	0.03 g	0.026g / 26 mg
Uncalibrated volume of eudiometer (mL)	Calibrated	Calibrated
Volume of hydrogen gas (mL)	29.12 mL	32.23 mL
Height of water column (cm)	20.4 cm	17.72 cm
Temperature of water (℃)	21.6 ℃	23.0 ℃
Room temperature (℃)	22.4 ℃	22.4 ℃
Atmospheric pressure (Torr)	101.1 kPa	101.2 kPa

(1) Observations: observation

0.409 g paper
0.462 g wit mg + paper
After sanding
0.406 g paper
0.439 g mg wit paper

Calabration
1. 9.01 ∈ 10 mL beak → 5.89 mL
2. 8.89 → 5.01 mL
* large bubble at the formed quickly
* Got stuck on eudimeter but still reached error.
* reaction started relatively quick
* the had a little bit of heat indicated
* lots of bubbles
* faster the alloy

(2)
0.404 g
0.443 g → 0.039
0.406 g
0.436 g → 0.03 30 mg

(3) 2nd trail
Paper 1. 0.413
mg + paper = 0.457
Sand paper = 0.437

(4)
0.411
0.437 → 0.026
26 mg
0.412
0.446 g

mL

* error
fine bubbles in H_2O in 600 mL beak

Table 2: Alloy

Data	Trial 1	Trail 2	Trial 3
Alloy	alloy	alloy	alloy
Mass of alloy (g)	0.04 g	0.0412 g	0.049 4609
Uncalibrated volume of eudiometer (mL)	/	/	/
Volume of hydrogen gas (mL)	15.61 mL	20.82 mL	20.4 mL
Height of water column (cm)	36.4 cm	28.4 cm	27.8 cm
Temperature of water (℃)	21.3 °C	21.7 °C	21.9 °C
Room temperature (℃)	22.4 °C	22.4 °C	22.4 °C
Atmospheric pressure (Torr)	101.1 kPa	101.1 kPa	101.1 kPa

Observations:

* reaction was slower than with pure metal
* Alloy made a blackish/grayish cloudy substance at top of solution when reaction was coming to an end
* More smaller bubbles
- Also emitted some heat