Student Name: Annabelle Nicolas

Student Number: 8715517

Partner's Name and Student #: Sophia Portela Granados, 8846626

Demonstrator's Name: Rebeca Rondon

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):*

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

Lab time (10:00, ***2:30****, 6:30):*

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: **AN**

Data Tables

Table 1. Pure Metal

Data	Trial 1	Trial 2
Identity of Metal	Magnesium	Magnesium
Mass of metal (g)	0.0299 g	0.0277
Uncalibrated volume of eudiometer (mL)	2.2mL	2.2mL
Volume of hydrogen gas (mL)	26.2mL	27.2mL
Height of water column (cm)	12.9cm	13.0cm
Density of water (kg/m^3)	$1000kg/m^3$	$1000kg/m^3$
Acceleration due to gravity (m/s^2)	$9.81m/s^2$	$9.81m/s^2$
Pressure of water column (Pa)	1265.49Pa	1275.30Pa
Water Temperature (°C)	18	19
Water Vapour pressure (Pa)	2060	2200
Atmospheric Pressure (Torr)	753.8 Torr	753.8 Torr
Pressure of Hydrogen	97175.8 Pa	97166 Pa
Room Temperature	295.15 K	295.15K
Ideal Gas Constant, R	8.31	8.31
Actual Moles of Hydrogen (mol)	1.05×10^{-3}	1.08×10^{-3}
Theoretical moles of Hydrogen (mol)	1.23×10^{-3}	1.14×10^{-3}
Percent Yield (%)	85.4%	94.7%

Observations (Part 1):

- Bubbles began to form
- Acid and water did not mix together
- Hydrogen gas began to form as magnesium rose and began to react with the acid, causing the level of liquid to decrease
- Reaction occurred faster if you tapped the eudiometer so the gas would release
- Magnesium continued to react even as it had risen to the top

Table 2. Alloy

Data	Trial 1	Trial 2
Unknown Number	6530	6530
Mass of alloy (g)	0.0430g	0.0406
Uncalibrated volume of eudiometer (mL)	n/a	n/a
Volume of hydrogen gas (mL)	26.7mL	27mL
Height of water column (cm)	18cm	48cm
Density of water (kg/m^3)	$1000kg/m^3$	$1000kg/m^3$

Acceleration due to gravity (m/s^2)	$9.81 m/s^2$	$9.81 m/s^2$
Pressure of water column (Pa)	1764Pa	4704
Water Temperature (°C)	17	17
Water Vapour pressure (kPa)	1.94kPa	1.94
Atmospheric Pressure (Torr)	753.8	753.8
Pressure of Hydrogen	96794.2Pa	93851.2Pa
Room Temperature	22	22
Ideal Gas Constant, R	8.31	8.31
Moles of Hydrogen (mol)	$1.04x10^{-3}$mol	$1.05x10^{-3}$mol
Mass of Zinc (g)	0.0247g	0.0126g
Mass of Aluminum (g)	0.0183g	0.028g
Percent Zinc (%)	42.6%	31%
Percent Aluminum (%)	57.4%	69%
Average Percent	36.8%	63.2%

Observations (Part 2):

- Much slower reaction with the acid than the magnesium
- -Colour change occurred when magnesium rose to the top
- Magnesium reacting with acid released a black/gray residue at the top of the liquid
- Gas bubbles formed

Sample Calculation : Magnesium Pure Metal

1. Uncalibrated Volume of the Eudiometer:

   8mL – 6.2mL = 1.8mL

   8mL - 5.5mL = 2.5mL

Average: 1.8 +2.5/2 = 2.15 → 2.2 mL uncalibrated volume

2. Volume of Hydrogen gas:

   Trial #1: 24 mL +2.2mL= 26.2mL
   Trial #2: 25mL + 2.2mL = 27.2mL

3. Pressure exerted by the water column:

   Trial 1:
   P=dgh
   = (1000kg/m^3) x (9.81 m/s^2) x (0.129m)
   =1265.49 Pa

   Trial 2:
   P=dgh
   = (1000kg/m^3) x (9.81m/s^2) x (0.13m)
   = 1275.30 Pa

4. Pressure of hydrogen gas:

   Trial #1:
   $p_{H_2} = p_{atm} - p_{watercolumn} - p_{watervapour}$
   = 100500 Pa – 1264.2 Pa -2060
   = 97175.8 Pa
   Trial #2:
   $p_{H_2} = p_{atm} - p_{watercolumn} - p_{watervapour}$
   = 100500Pa -1274 – 2060
   = 97166 Pa

5. Moles of hydrogen gas (experimental):

Trial #1:
PV=nRT
n= PV/RT
n= (97.18 kPa) (0.0262L)/ (8.31) (291.15K)
=2.546116/2419.4565
=0.00105 mol of Hydrogen gas

$=1.05 \times 10^{-3}$

Trial 2:
PV=nRT
n= PV/RT
n= (97.17kPa) (0.0272L)/ (8.31) (292.15K)
n=2.643024/2427.7665
n= 0.00108 mol of Hydrogen gas
n= 1.08×10^{-3} mol of Hydrogen gas

6. Moles of hydrogen gas (theoretical):

Trial 1

$Mg + 2HCl \rightarrow MgCl_2 + H_2$

n=m/MM
=0.0299g/24.3g/mol
= 1.23×10^{-3} mol of Mg
Trial 2
N=m/MM
=0.0277 /24.3
=1.14×10^{-3}

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

Moles actual/ moles theoretical x 100%

Trial 1=
$1.05 \times 10^{-3} / 1.23 \times 10^{-3} \times 100\%$
= 85.4%
Trial 2=
$1.08 \times 10^{-3} / 1.14 \times 10^{-3} \times 100 = 94.7\ \%$

8. Average Percent Purity:

85.4% + 94.7%/2= 90.05%

<u>Sample Calculation: 6530 Alloy</u>

1. Trial 1
   Pressure of water column and hydrogen gas:
   P=dgh
   = ($1000 kg/m^3$) ($9.81\ m/s^2$) (0.18m)
   = 1765.8 Pa
   $P_{hydrogen} = p_{atmosheric} - p_{water\ column} - p_{water\ vapour}$
   = 100500 -1765.8-1940 = 96794.2 Pa

Trial 2
Pressure of water column and hydrogen gas:
P=dgh
= (1000kg/m^3) (9.81 m/s^2) (0.48m)
=4708.8Pa

$P_{hydrogen} = p_{atmosheric} - p_{water\ column} - p_{water\ vapour}$
= 100500 -4708.8-1940 = 93851.2Pa

2. Moles of hydrogen gas:

Trial 1
PV=nRT
n= PV/RT
= (93.86) x (0.0267)/ (8.31) (290.15)
=2.506062/2411.1465
=0.00104 mol
=1.04 x 10^{-3}
Trial 2
PV=nRT
n= PV/RT
= (93.86) x (0.027)/ (8.31) (290.15)
=2.53422/2411.1465
=0.00105 mol
=1.05 x 10^{-3}

3. Masses of Zinc and Aluminum in the alloy:

Nhydrogen = nzinc +naluminum
Mtotal = mass of Zn + mass of Al

Trial 1:
0.0430 g = mass of Zn + Mass of Al
Mass of Zn= 0.0406 – mass of Al

1.04 x 10^{-3} = mass of Zn/MM of Zn + 3 Mass of Al/2 MM of Al
1.04 x 10^{-3} = (0.0430 – mass of Al / 65.409) + (3(Mass of Al) / 2(26.98))
1.04 x 10^{-3} = (0.000657402 – mass of Al) + (3(mass of Al) / 53.96)
0.0561184 = 0.00657402 +2 mass Al
0.04954438/2 = mass Al
0.0247 g = mass Al

0.0430 g (total) – 0.0247 g (mass of Al) = 0.0183g of Zn

Trial 2:
0.0406 g – mass of Zn + mass of Al

Mass of Zn = 0.0406 – mass of Al

1.05×10^{-3} = (0.0406 – mass of Al/65.409) + (3(Mass Al) / 53.96
1.05×10^{-3} = 0.00062071 – mass of Al + 3 Mass Al / 53.96
0.056658 - 0.00062071/ 2 = Mass Al
0.028 g = mass of Al

Mass of Zn = 0.0406 – 0.028= 0.0126 g Zn

4. Percent composition of the alloy:

Trial 1

% composition of zinc= mass of zinc / mass of alloy x 100%
=0.0183g/ 0.0430g x 100%
=42.6% Zn

% compostion of aluminum = mass of aluminum / mass of alloy x 100%
= 0.024g7/0.0430g x 100%
= 57.4% Al

Trial 2

% composition of zinc= mass of zinc / mass of alloy x 100%
= 0.0126 g / 0.0406g x 100%
= 31% Zn
% compostion of aluminum = mass of aluminum / mass of alloy x 100%
= 0.028g/0.0406 x 100%
=69 % Al

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

Average percent composition of zinc = (42.6 + 31)/2 = 36.8% Zn
Average percent composition of aluminum = (57.4 + 69)/2 =63.2% Al

Discussion: (within space provided)

Throughout the experiment we realized that it was very important to make sure that if the eudiometer was not calibrated, we had calculate the uncalibrated volume and add it to our measured volume in order to receive accurate results as well as accurate calculations, therefore it does matter if the eudiometer was calibrated or not, before conducting any steps of the experiment. If some metal were to float up and stick to the eudiometer, it would affect our results because the reaction did not reach completion if some of the metal did not react due to it getting stuck on the side of the eudiometer tube, thus the volume of hydrogen will be less than it should theoretically be. The percent yield of pure metal was 90.05%, therefore indicating that some minor things may have gone wrong, causing there to be less than 100% of pure metal yield, such as inaccurate measurements or reading values incorrectly. Your results are affected if air enters the eudiometer because that means that the volume of gas that was produced will be less than the volume of gas that was collected because of the extra air that entered into the tube. An alloy is a combination of two or more metals; an example of usage of an alloy is to prevent corrosion. Additionally, this experiment relates to my work in the lecture course because we are currently discussing gases and their properties. We have also completed several problems that involve percent composition, density, and completed an assignment on partial pressures.

Conclusion: (no more than two lines)

To conclude, it was determined that the average percent yield of Magnesium was 90.05% after 2 trials and the average percent yield of the alloy was 36.8% Zn and 63.2% Al.

Rebecca Rondon

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Lab Due Next Tuesday 5:30pm! 1786354 56678

Section D Locker D17

Alloy # 6530

Calibration

#1 9mL in non calibrated tube
−6.4 = 2.6mL

#2 8mL
− 6.2mL = 1.8mL = 2.15mL

#3 8mL = 2.5mL
− 5.5

2.2 mL

Magnesium: 0.0227 g

Aluminum: 0.410 g Trial did not work

Temp. 22°C

Pressure: 100.5 kPa

Magnesium began to rise as water level began to lower.

Gas collected : 24mL 12,

Temp of ~~water~~ solution = 18°C | ~~[illegible]~~ kPa

2,06 kPa

#1 Aluminum : 0,0406g #2: 0,0430

#2 Magnesium : 0,0[illegible]9g

#2 ~~attempt Aluminum~~ Magnesium = 13.0 cm

19°C → 2,20 kPa

#1 Aluminum - 48 cm 17°C

#2 Aluminum - ~~[illegible]~~ cm + ~~[illegible]~~ 17°C

Aluminum changes color at top floats to the top and begins to dissolve