Data Tables

Table 1. Pure Metal

Data	Trial 1	Trial 2
Identity of Metal	Zinc	Zinc
Mass of metal (g)	0.0552 g	0.0346 g
Uncalibrated volume of eudiometer (mL)	0 ml	0 ml
Volume of hydrogen gas (mL)	21.7 ml	14.9 ml
Height of water column (cm)	28.4 cm	32.3 cm
Density of water (kg/m^3)	1000 kg/m3	1000 kg/m3
Acceleration due to gravity (m/s^2)	9.81 m/s2	9.81 m/s2
Pressure of water column (Pa)	2.7 * 10^3 pa	3.16 * 10^3 pa
Water Temperature (°C)	21 c = 294 k	21 c = 294 k
Water Vapour pressure (Pa)	2.49 * 10^3 pa	2.49 * 10^3 pa
Atmospheric Pressure (Torr)	760 mm hg = 760 Torr	760 mm hg = 760 Torr
Pressure of Hydrogen	9.58 * 10^4	9.52 * 10^4
Room Temperature	22.9 c = 295.9 k	22.9 c = 295.9 k
Ideal Gas Constant, R	8.314 m3 pa/mol k	8.314 m3 pa/mol k
Actual Moles of Hydrogen (mol)	8.34 * 10^-4 mol	5.78 * 10^-4 mol
Theoretical moles of Hydrogen (mol)	8.44 * 10^-4 mol	5.29 * 10^-4 mol
Percent Yield (%)	98.7 %	109.1 %

Observations (Part 1):

- **Bubbles**
- **HCl did not mix with water (made shimmer)**
- **Silver metal before reaction**

Table 2. Alloy

Data	Trial 1	Trial 2
Unknown Number	5340	5340
Mass of alloy (g)	20.8 mg	19.3 mg
Uncalibrated volume of eudiometer (mL)	0 ml	0ml
Volume of hydrogen gas (mL)	12.3 ml	5.9 ml
Height of water column (cm)	36.9 cm	44.8 cm
Density of water (kg/m^3)	1000 kg/m3	1000 kg/m3
Acceleration due to gravity (m/s^2)	9.81 m/s2	9.81 m/s2
Pressure of water column (Pa)	3.61 * 10^3 pa	4.39 * 10^3 pa
Water Temperature (°C)	22 c = 295 k	20 c = 293 k
Water Vapour pressure (kPa)	2.64 * 10^3 pa	2.34 * 10^3 pa
Atmospheric Pressure (Torr)	760 mm hg = 760 Torr	760 mm hg = 760 Torr
Pressure of Hydrogen	9.47 * 10^4 pa	9. * 10^4 pa
Room Temperature	22.9 c =295.9 k	22.9 c =295.9 k
Ideal Gas Constant, R	8.314 m3 pa/mol k	8.314 m3 pa/mol k
Moles of Hydrogen (mol)	4.73 * 10^-4 mol	2.29 * 10^-4 mol
Mass of Zinc (g)	1.7 * 10^-2 g	1.5 * 10^-2 g
Mass of Aluminum (g)	3.74 * 10^-3 g	3.75 * 10^-3 g
Percent Zinc (%)	81.73 %	72.11 %
Percent Aluminum (%)	18.27 %	18.75 %
Average Percent	76.92 % Zn	18.51 % Al

Observations (Part 2):

- **Bubbles**
- **Black metal left over after reaction done**
- **Alloy reaction faster than pure metal**

Sample Calculation : Pure Metal

1. Uncalibrated Volume of the Eudiometer:
   I did not need to do Uncalibrated. Therefore, Uncalibrated volume of the eudiometer is 0.00 ml.

2. Volume of Hydrogen gas:
   $V_{Hydrogen\ gas} = V_{uncalibrated} + V_{eudiometer}$
   $= 0\ ml + 21.7\ ml$
   $= 21.7\ ml$

3. Pressure exerted by the water column:
   $P_{water\ column} = dgh$
   $= (1000\ kg/m3) * (9.81\ m/s2) * (0.824)$
   $= 2.7 * 10^3\ pa$

4. Pressure of hydrogen gas:
   $P_{hydrogen} = P_{atm} - P_{water\ column} - P_{water\ vapour}$
   $= (1.01 * 10^5) - (2.7 * 10^3) - (2.49 * 10^3)$
   $=9.58 * 10^4\ pa$

5. Moles of hydrogen gas (experimental):
   $Pv = nRt$
   $n_{H2} = pv/Rt$

   $$= \frac{(9.58 * 10^{-4}\ pa) * (2.17 * 10^{-5}\ m3)}{(8.314\ m3\ pa/mol\ k) * (295.9\ k)}$$

   $= 8.34 * 10^{-4}\ mol$

6. Moles of hydrogen gas (theoretical):
   $n_{H2} = m/M$

   $$= \frac{0.0552\ g}{65.39\ mol/g}$$

   $= 8.44 * 10^{-4}\ mol$

7. Percentage Purity of metal:

$$\% = \frac{(8.34 * 10^{-4})}{(8.44 * 19^{-4})} * 100\%$$

$$= 98.7\ \%$$

8. Average Percent Purity:

$$\text{Average } \% = \frac{(98.7 + 109.1)}{2}$$

$$= 103.9\ \%$$

Sample Calculation : Alloy

1. Pressure of water column and hydrogen gas:

$P_{water\ column} = dgh$

$= (1000\ kg/m3) * (9.81\ m/s2) * (0.369)$

$= 3.61 * 10^3\ pa$

$P_{hydrogen} = P_{atm} - P_{water\ column} - P_{water\ vapour}$

$= (1.01 * 10^5) - (3.61 * 10^3) - (2.64 * 10^3)$

$= 9.47 * 10^4\ pa$

2. Moles of hydrogen gas:

$Pv = nRt$

$n_{H2} = pv/Rt$

$$= \frac{(9.47 * 10^{-4}\ pa) * (1.23 * 10^{-5}\ m3)}{(8.314\ m3\ pa/mol\ k) * (295.9\ k)}$$

$= 4.37 * 10^{-4}\ mol$

3. Masses of Zinc and Aluminum in the alloy:

$Zn + 2HCl = ZnCl_2 + H_2$

$Al + 3HCl = AlCl_3 + \frac{3}{2} H_2$

$m_{Zn} = m_{alloy} - m_{Al}$

$m_{Zn} = 0.0208 - m_{Al}$

$n_{H2} = n_{H2 \text{ in } H2} + n_{H2 \text{ in } Al}$

$= n_{Zn2} + (3/2)\, n_{Al}$

$= \frac{m_{Zn}}{M_{Zn}} + \frac{3m_{Al}}{2M_{AL}}$

$4.37 * 10^{-4} \text{ mol} = \frac{0.0280 - m_{Al}}{64.41 \text{ g/mol}} + \frac{3\, m_{Al}}{2(26.98 \text{ g/mol})}$

$1.644 = 1.122 - 53.98\, m_{Al} + 193.23\, m_{Al}$

$m_{Al} = 3.74 * 10^{-3} \text{ g}$

$m_{zn} = 0.0208 - 3.74 * 10^{-3}$

$m_{zn} = 1.7 * 10^{-2} \text{ g}$

$m_{Al} = 3.74 * 10^{-3} \text{ g}$	$m_{zn} = 1.7 * 10^{-2} \text{ g}$

4. Percent composition of the alloy:

(1) % Of $Zn = \frac{m_{zn}}{m_{alloy}} * 100$

$= \frac{1.7 * 10^{-2}}{0.0208} * 100$

$= 81.73\ \%$

2) % Of Al = $\frac{m_{Al}}{m_{alloy}} * 100$

$= \frac{3.74 * 10^{-3}}{0.0208} * 100$

= 18.01 %

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

   % Of Zn = 76.92 %
   % Of Al = 18.51 %

Discussion: (within space provided)

The purpose of this lab was to find the percentage purity of a Zn and percentage composition of an unknown alloy. The percentage of Zn was found by using mole of hydrogen (experimented) and mole of hydrogen (theoretical). Dividing these two numbers and multiply by 100 would give the percentage of the Zn and also percentage of an unknown alloy. The percentages from trial 1 and trial 2 were 98.7 % and 109.1 %. These show that trial one had more purity than trial two. There were many possible results such, could be used less mass of Zn, could be hydrogen already in tube before start reaction. These both would affect the purity of percentage. The second parts were to find the percentage of the unknown alloy. These calculations were done in trial – 1. The percentage compositions were 81.73 % of Zn and 18.01 % of Al. The total of these percentages could be 100 %, but in this case it was 99.74 %. In this case, there were left over some black metal after reaction done. This could be the mistake of this experiment or may be it could be 0.26 % of that black metal. Therefore, the average percentage composition for trial 1 was 81.73 % of Zn, 18.01 % of Al and 0.26 % of metal.

Conclusion: (no more than two lines)

The average percent purities for trial one was 98.7 %.

The average percent composition for trial 1 was 81.73 % ZN AND 18.01 % Al.