1. **OBJECTIVE:** Calculate the properties of each object (rectangular prism, sphere, and hollow cylinder) including an error bar.

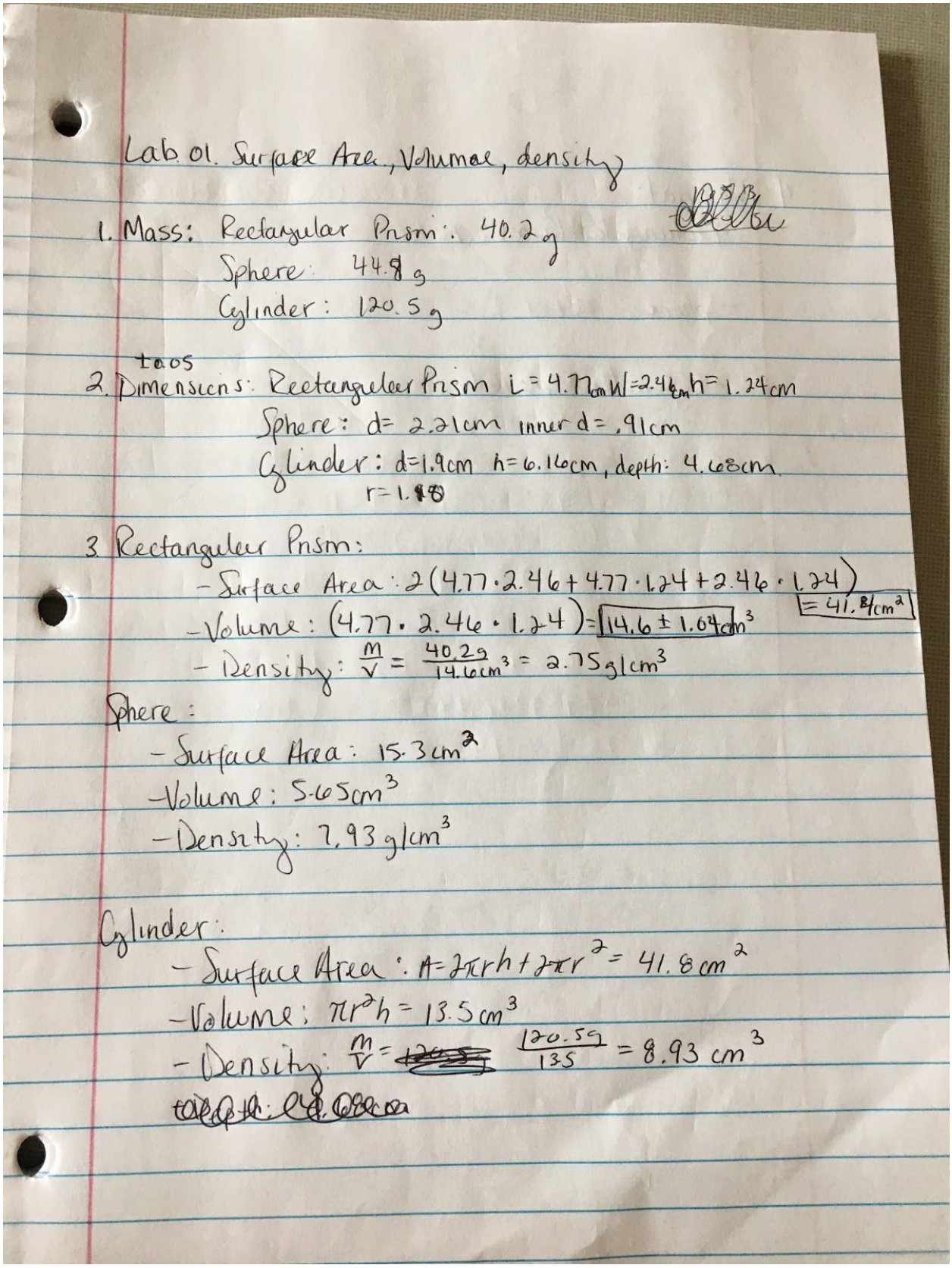
2**. THEORY:** Results will be determined using formulae for surface area, volume, density, and the propagation error.

3. **PROCEDURE:**
    1. Determine the mass of each object using an electronic balance and record results.
    2. Determine the dimensions of each object using a caliper to measure them and record results.
    3. Use measurements to calculate surface area, volume, and density of each object and calculate the error bar.

4. **DATA:**

	Rectangular Prism	**Sphere**	**Hollow Cylinder**
Mass	**40.2g**	**44.8g**	**120.5g**
Dimensions	**Length=4.77cm Width=2.46cm Height=1.24cm**	**Diameter=2.21cm Inner diameter= .91cm**	**Diameter=1.9cm H=6.16cm depth= 4.68cm radius= 1.10cm**
Surface Area	**2(L*W+L*H+W*H) =41.4cm^2**	**=15.21cm^2**	**Area=41.8cm^2**
Volume	**(L*W*H)=14.6cm^3**	**=5.65cm^3**	**=16.73cm^3**
Density	**Mass/volume =40.2g/14.6cm^3 =2.75g/cm^3**	**=7.93g/cm^3**	**8.93cm^3**
Material	**Smooth, silver**	**Smooth, silver**	**Smooth, silver**

5. **CALCULATIONS:**



Lab 01. Surface Area, Volume, density

1. Mass: Rectangular Prism: 40.2 g
   Sphere: 44.8 g
   Cylinder: 120.5 g

2. Dimensions: Rectangular Prism L = 4.77cm W = 2.46cm h = 1.24cm
   Sphere: d = 2.21cm inner d = .91cm
   Cylinder: d = 1.9cm h = 6.16cm, depth: 4.68cm.
   r = 1.

3. Rectangular Prism:
   - Surface Area: $2(4.77 \cdot 2.46 + 4.77 \cdot 1.24 + 2.46 \cdot 1.24) = 41.8 cm^2$
   - Volume: $(4.77 \cdot 2.46 \cdot 1.24) = 14.6 \pm 1.04 cm^3$
   - Density: $\frac{m}{V} = \frac{40.2g}{14.6cm^3} = 2.75 g/cm^3$

Sphere:
- Surface Area: $15.3 cm^2$
- Volume: $5.65 cm^3$
- Density: $7.93 g/cm^3$

Cylinder:
- Surface Area: $A = 2\pi rh + 2\pi r^2 = 41.8 cm^2$
- Volume: $\pi r^2 h = 13.5 cm^3$
- Density: $\frac{m}{V} = \frac{120.5g}{135} = 8.93 cm^3$

Error bar

RP:

V: $(4.77 \cdot 2.46 \cdot 1.24) = \boxed{14.6 \pm 1.04 cm^3}$

A_{high}: $(4.82 \cdot 2.51 \cdot 1.29) = 15.61$

A_{low}: $(4.72 \cdot 2.41 \cdot 1.19) = 13.54$

$A_{high} - A_{low} = 2.07 \div 2 = 1.035$

SA: $2(4.77 \cdot 2.46 + 4.77 \cdot 1.24 + 2.46 \cdot 1.24) = \boxed{41.4 cm^2 \pm 1.69 cm}$

A_{high}: $2(4.82 \cdot 2.51 + 4.82 \cdot 1.29 + 2.51 \cdot 1.29) = 43.1078 cm^2$

A_{low}: $2(4.72 \cdot 2.41 + 4.72 \cdot 1.19 + 2.41 \cdot 1.19) = 39.7198 cm^2$

$A_{high} - A_{low} = 3.388 \div 2 = 1.694$

Density: $\frac{40.2 g}{14.6 cm^3} = 2.75 g/cm^3 \pm 0.38$

high: $\frac{40.3}{15.64} - \frac{40.1}{13.56} = 2.5767 - 2.9572 = -0.38$ (low.)

Sphere:

SA: $4\pi r^2 = 15.21 cm^2$

$4\pi (1.10 + .05)^2 = 16.62$

$4\pi (1.10 - 0.05)^2 = 13.82$

$16.62 - 13.85 = \frac{2.77}{2} = 1.39$

SA $= 15.21 \pm 1.39 cm^2$

Cylinder: $A = 2\pi rh + 2\pi r^2$ = [illegible]

$2(\pi r^2)$ h

$D = (1.90 \pm .05)$

$r = 0.95 \pm .05)$

$h = (5.9 \pm .05)$

[illegible]

$\pi(.95)^2 5.90 = \boxed{16.73 cm^2}$

r: $\pi(.95 + .05)^2 5.9 = 18.54$

$\pi(.95 - 0.05)^2 5.9 = 16.68$

$1/2(18.54 - 16.68) = .93$

h: $\pi(.95)^2(5.9 \pm .05) = 16.87$

$\pi(.95)^2(5.9 - .05) = 16.59$

$1/2(16.87 - 16.59) = .14$

$\sqrt{(.93)^2 + (.14)^2} = \sqrt{.88} = \boxed{.94}$

$V = 16.73 \pm 0.94 cm^3$

6. **RESULTS:**

	Rectangular Prism	**Sphere**	**Hollow Cylinder**
Mass	**40.2g**	**44.8g**	**120.5g**
Dimensions	**Length=4.77cm Width=2.46cm Height=1.24cm**	**Diameter=2.21cm Inner diameter= .91cm**	**Diameter=1.9cm H=6.16cm depth= 4.68cm radius= 1.10cm**
Surface Area	**=41.4** $\pm 1.69 cm^2$	**=15.21** $\pm 1.39 cm^2$	**=41.8cm^2**
Volume	**=14.6** $\pm 1.04 cm^3$	**=5.65** cm^3	**=16.73** $\pm 0.94 cm^3$
Density	**=2.75** $\pm 0.38 g/cm^3$	**=7.93g/cm^3**	**8.93cm^3**
Material	**Smooth, silver**	**Smooth, silver**	**Smooth, silver**

7. **ANALYSIS:** Error bar was determined to propagate measurements.

8. **COMMENTS:**