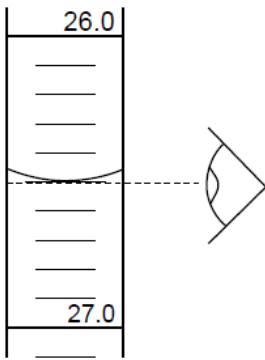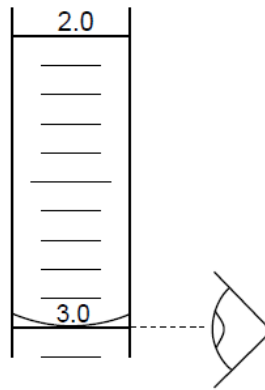# Uncertainty Worksheet

1. Determine values of each of the measurements including the uncertainties.

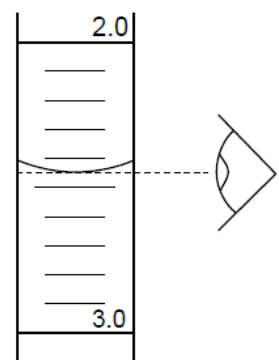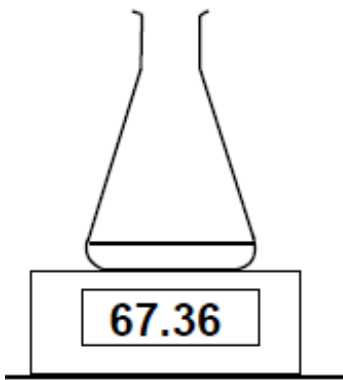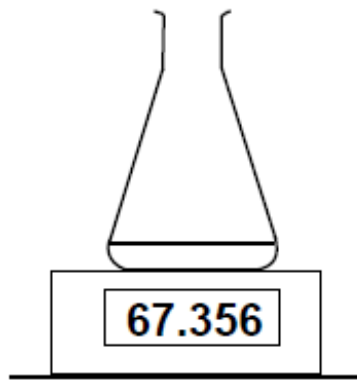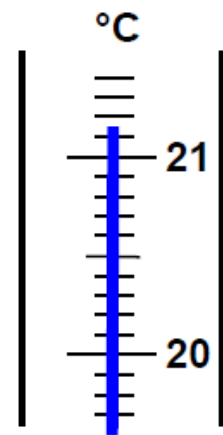a.   b)   c)

d)   e)   f)
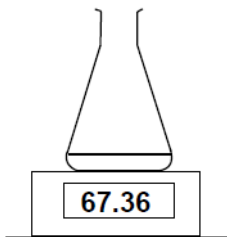

2. Convert the following to percent uncertainties:

a. 2.70 ± 0.05 cm

b. 12.02 ± 0.08 cm

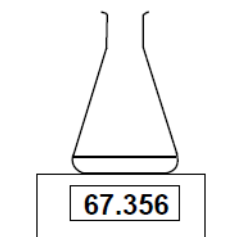3. Convert the following to absolute uncertainties:

a. 3.5 cm $\pm 10\ \%$

b. 16 s $\pm 8\ \%$

4. Determine the percent uncertainties on the following measurements.
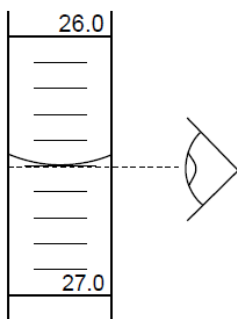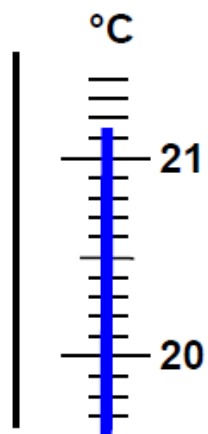
a)

67.36

b)

67.356

c)

26.0

27.0

d)

°C

21

20

Complete these last two questions in your note book.

5. The literature value for the standard enthalpy change of combustion of methanol, $CH_3OH(l)$ was found to be -726.0kJ mol^{-1}. The experimental value was found to be -680.0 kJ mol^{-1}.

Calculate the percentage error, correct to two decimal places.

6. A student undertakes an experiment to determine the density of a copper cube. She takes the following measurement: Length = 2.00 ± 0.05cm, Width = 2.00 ± 0.05cm, Height = 2.00 ± 0.05cm and mass = 74.0± 0.1g

a) Calculate the density (g cm^{-3}) of the copper cube from her experiment.
b) If the literature states the density of copper to be 8.95 g cm^{-1}, calculate the percentage error with the correct significant figures.

Answers

1. a) $26.50 \pm 0.05 \text{ cm}^3$ b) $3.00 \pm 0.05 \text{ cm}^3$ c) $2.45 \pm 0.05 \text{ cm}^3$

   d) $67.36 \pm 0.01 \text{ cm}^3$ e) $67.356 \pm 0.001 \text{ cm}^3$ f) $21.12 \pm 0.05 \, ^oC$

2. a) $2.70 \text{ cm} \pm 2 \%$ b) $12.02 \text{ cm} \pm 0.7 \text{ cm3}$
3. a) $3.5 \pm 0.4 \text{cm}$ b) $16 \pm 1s$

4. a) $(0.01/67.36) \times 100 \% = 0.01\%$ (NOTE: 1 significant figures due to dividing and uncertainty at 1 sig fig)
   b) $(0.001/67.356) \times 100 \% = 0.001\%$ (NOTE: 1 significant figures due to dividing and uncertainty at 1 sig fig)
   c) $(0.05/26.50) \times 100 \% = 0.2\%$ (NOTE: 1 significant figures due to dividing and uncertainty at 1 sig fig)
   d) $(0.05/21.13) \times 100 \% = 0.2\%$ (NOTE: 1 significant figures due to dividing and uncertainty at 1 sig fig)

5. 6.34%

6. a) density $= (m/V) = (74.0 / 8.00) = 9.25 \text{ g cm}^{-3}$ (NOTE: 3 significant figures due to dividing)
   b) Percentage error $= \dfrac{|\text{literature - experimental}|}{\text{literature}} \times 100\%$

   $= \dfrac{|8.95 - 9.25|}{8.95} \times 100$

   $= 3.3519\%$

   $= 3.35\%$ (NOTE: 3 significant figures due to dividing)