SPH3U Task – Uncertainty Name: Soln

For questions 1. through 4. consider the line shown here:

1. What is the measured length of this line in mm? Use the amount of significant figures a wooden meter stick is capable of supplying.

   6.5cm 65mm

2. What is the precision of this measurement?

   ± 1mm

3. If the above line is one side of a perfect square, what is the **area** of that square, take into account the correct number of significant figures and the correct units?

   $A = (65)(65)$

   $= 4225\ mm^2$

   (2 sig fig) $= 4200\ mm^2$

A student measures a line to be 3.8 cm ± 0.1 cm.

4. Find the absolute uncertainty in the measurement. abs uncertainty $\Rightarrow \pm 0.1\ cm = \Delta x$

5. Find the fractional uncertainty in the measurement. fractional $\frac{\Delta x}{x} = \frac{0.1}{3.8} = 0.026$

6. Find the percentage uncertainty in the measurement. % $\frac{\Delta x}{x} \times 100 = \frac{0.1}{3.8} \times 100 = 2.6\%$

7. A flagpole is placed on the roof of a house. A student measures the flagpole to be 4.25 m ± 0.05 m. The same student measures the height from the ground to the base of the flagpole to be 6.40 m ± 0.15 m. If the flagpole is mounted vertically upward (straight up), how far is the tip of the flagpole above the ground. Be sure to use significant figures and include the uncertainty with your answer.

   $h = 4.25 + 6.40$ $\quad \Delta h = 0.05 + 0.15$

   $h = 10.65\ m$ $\quad \Delta h = \pm 0.20\ m$ $\quad \therefore h = 10.65m \pm 0.20m$

8. A car travels 250 m ± 15 m in 12.2 s ± 0.2 s. Calculate its speed (v=d/t). Be sure to use significant figures and include the uncertainty with your answer.

   $v = \frac{d}{t}$ $\quad v = \frac{250m}{12.2s}$

   $v = 20.4918$

   $v = 20\ m/s$

   $\frac{\Delta v}{v} = \frac{\Delta d}{d} + \frac{\Delta t}{t}$

   $\frac{\Delta v}{v} = \frac{15}{250} + \frac{0.2}{12.2}$

   $\frac{\Delta v}{v} = 0.0764$

   $\frac{\Delta v}{20} = 0.0764$

   $\Delta v = \pm 1.53$

   $\approx 2\ m/s$

   $\therefore v = 20\ m/s \pm 2\ m/s$