

Graduated Cylinders - be sure to first establish what increments are used on the cylinder then read the instrument accordingly.

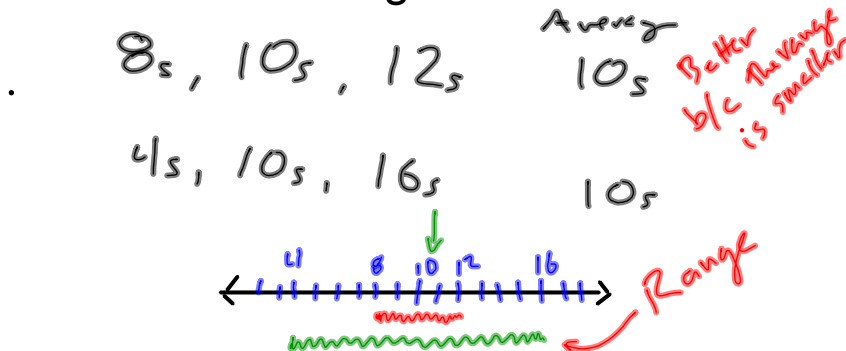
$\frac{100}{2} = 50$
 0.109
 0.108
 0.09
 $\frac{0.01}{2} = 0.005$
 Answer _____
 2000
 1000
 Answer _____
 1605 ± 50
 1650 ± 50
 1620 ± 50
 1600
 1660
 1610
 1600

0.108 ± 0.005
 100
 88 ± 3
 89 ✓ ± 3
 92 ✗ ± 3
 89 ± 3
 Answer _____
 5
 3.5 ± 0.3
 3.2
 3.1
 Answer _____
 50
 Answer _____
 0
 Answer _____

$\frac{5}{2} = 2.5 \Rightarrow 3$
 $\frac{0.5}{2} = 0.25 \Rightarrow 0.3$

Uncertainty:

when we record data we are aware that more measurements might not be the same.



Uncertainty of a tool

Half the smallest increment on the measuring device.

Can only have one significant digit (ignore zeros)

$$\begin{array}{ll}
 3.2 \rightarrow 3 & 2.5 \rightarrow 3 \\
 2.7 \rightarrow 30 & .25 \rightarrow .3
 \end{array}$$

Uncertainty of Averages: 423, 487, 461

1. Calculate the average

$$\frac{423 + 487 + 461}{3} = 457$$

2. Find the Range: $Max - Min = 487 - 423 = 64$

3. Divide the range by 2: $\frac{64}{2} = 32$

4. Round the uncertainty to 1 significant digit:

$$32 \rightarrow \underline{30}$$

5. Match the decimal place of your average to that of the uncertainty:

$$457 \pm 30$$

$$\boxed{460 \pm 30}$$