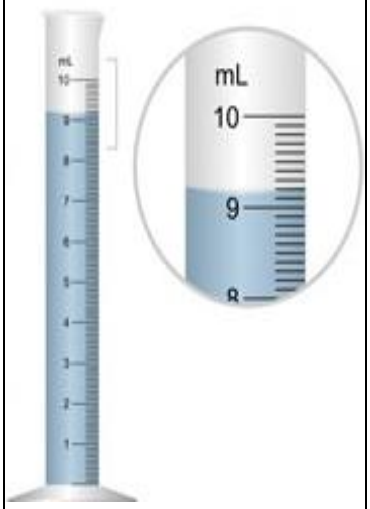
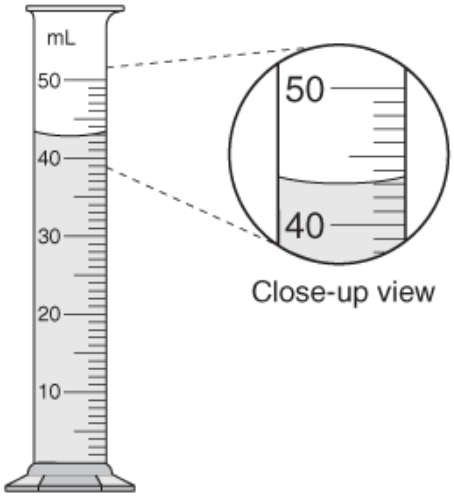
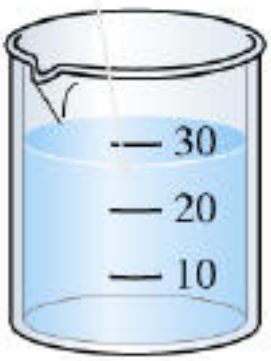
Sig Fig Notes & Practice Name: _____ Date: _____

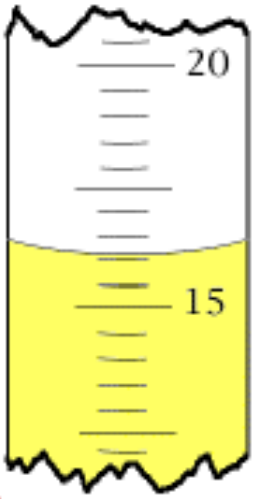
Uncertainty in Measurement: When reading an instrument…Write all the digits you see **+ 1** more that you ***estimate***

1. Measure the volume, in mL, of each liquid in the images below.

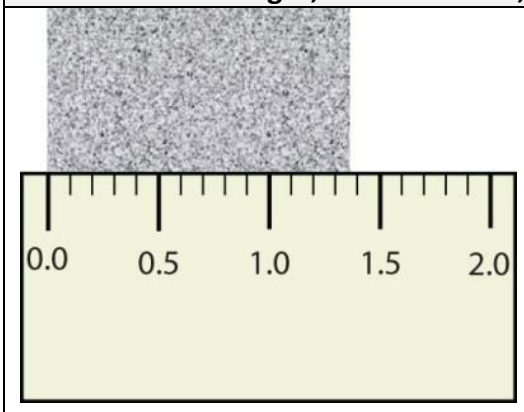


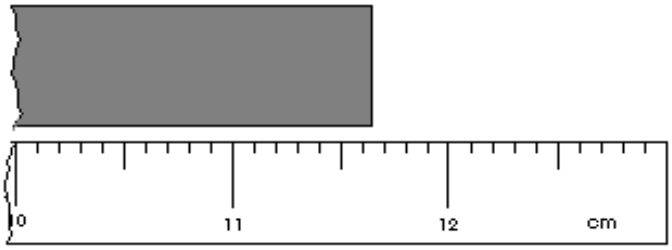


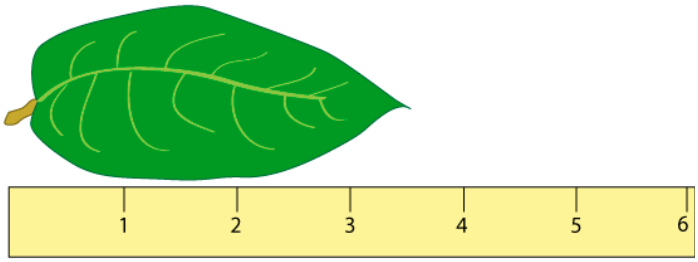


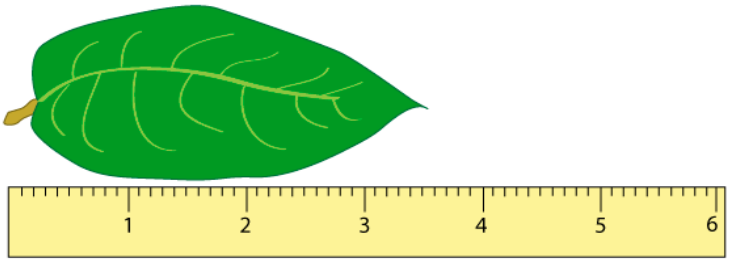


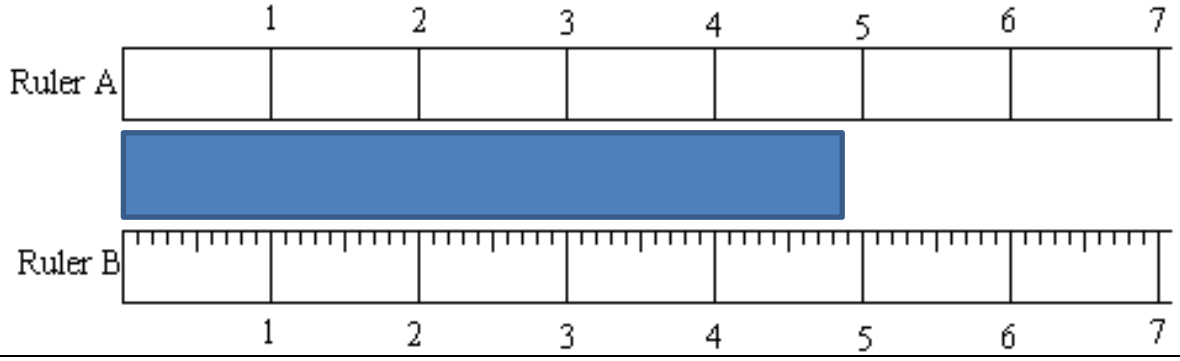
2. Measure the length, in centimeters, of each item in the images below.











Sig Fig Rules

1) **Count all non-zero digits** (ex. **1234** = 4 sig figs **139** = 3 sig figs)

2) Counting Zeros
   a) **Count zeros that are "sandwiched"** between non-zero digits (ex. **708** = 3 sig figs **1008** = 4 sig figs)
   b) Count zeros at the end of a number **only** if there is a **decimal point** (ex. **100** = 1 sig fig **100.** = 3 sig figs)
   c) **NEVER count zeros at the beginning** of a number (i.e. start counting sig figs with the first non-zero digit) (ex. **0.00051** = 2 sig figs)

3) **Count all the digits in scientific notation** (ex. **3.42×10^5** = 3 sig figs **1.000×10^{-8}** = 4 sig figs)

4) **Exact numbers.** Numbers that are counted rather than measured are called *exact numbers*. For example, you count 3 apples or perform 5 trials. Since there is no uncertainty in these numbers, exact numbers have an infinite number of siginificant figures and are not used to determine the number of significant figures when doing calculations.

3. Determine the number of sig figs in each value.			
a) 213 mg	b) 3001 dm	c) 81000 pg	d) 6.00 L
e) 0.0021 km	f) 0.420 g	g) 92.00 cm	h) 7.80×10^3 m

Rules for Rounding

1) Determine the number of significant digits to keep.

2) Moving left to right, start counting significant digits with the first non-zero digit.

3) Stop once you reach the last significant digit to keep. Look at the digit directly to the right of the last significant digit.
   a) If the digit to the right is less than 5, then the preceding digit stays the same.

      Example: 1.346 m rounds to 1.3 m (note that only the first number to the right of the last significant digit is used to round, i.e. the 6 does not round the 4 to a 5 and then the 3 to a 4).

   b) If the digit to the right is equal to or greater than 5, then the preceding digit is increased by one.

      Example: 1.37 m rounds to 1.4 m

4) When the last significant digit is in the tens, hundreds, thousands place or any other multiple of ten, round according to Rules #1-3 above, but also write a zero, "0", for each eliminated digit between the last significant digit and the decimal point. Do not write a decimal point.

   Example: 34914.849 m rounded to two significant figures is 35000 m

   In most cases it will be easier to first convert to scientific notation and then round for sig figs.

   Example: 34914.849 m = 3.4914849×10^4 m which rounded to two significant figures is 3.5×10^4 m which is the same value as 35000 m

4. Round each measurement to the specified number of sig figs.		
a) 3.5844 m (round to 2 sig figs)	b) 0.0043965 L (round to 3 sig figs)	c) 0.23388 km (round to 3 sig figs)
d) 63845 g (round to 3 sig figs)	e) 4985.97 s (round to 5 sig figs)	f) 90.211 hrs (round to 3 sig figs)
g) 144.11 s (round to 3 sig figs)	h) 0.08938 mol (round to 1 sig fig)	i) 412.56 mL (round to 2 sig figs)

Adding & Subtracting Sig Fig Rules

1) Add or subtract the numbers.
2) Keep all digits before the decimal in the answer.
3) Count the **number of decimal places** in each number used in the calculation.
4) Round answer after the decimal to the **LEAST number** of **decimal** places.

Ex) 5.00 cm
- 4.352 cm
0.648 cm = **0.65 cm**

5. Calculate and round answer to the correct number of decimal places.			
a) 0.04216 days − 0.0004134 days	b) 0.0677 mL 48.1 mL + 82.7655 mL	c) 27.34 km 6.90 km + 13.124 km	d) 349.0 cm 1.10 cm + 100. cm

Multiplying & Dividing Sig Fig Rules

Ex) 6.7 cm x 1.1 cm= 7.37 cm^2 = **7.4 cm^2**

1) Multiply or divide the numbers.
2) Count the **TOTAL number of sig figs** in each number used in the calculation.
3) Round answer to the **LEAST # of TOTAL sig figs**.

6. Calculate and round answer to the correct number of sig figs.			
a) $\frac{2.61\ x\ 10^6\ joules}{0.0034\ seconds}$	b) $\frac{24.1\ miles}{0.005\ hour}$	c) $\frac{34\ grams}{10.1\ mL}$	d) $\frac{252\ meters}{910\ seconds}$

e) 0.0222 mm x 0.7000 mm x 8.702 mm	f) 6.450 dm x 1.010 dm	g) 0.32cm x 14.50 cm x 120 cm

7. Calculate and round answer to the correct number of sig figs.

a) (320. − 22.7) x 3.8

b) (1.80 x 3.4) + 32.00

c) (1.80 x 25.3) + 32

d) $\frac{(6.8 + 4.701)}{(21.25 - 18)}$

e) $\frac{(3.65)(2.10)}{(2.1134)(42.1)}$

f) $\frac{(14.86 + 13.7)(65.346 - 4.10)}{(43.888 - 32.888)}$

g) Average the following masses: 0.621 g, 1.614 g, 0.08456 g, 0.4 g

h) Calculate the density of an object with a mass of 760 g and volume of 15.0 mL

i) Calculate the quantity of heat transferred when a 0.050 g object with a specific heat of 2.06 J/g°C is heated from an initial temperature of 85°C to a final temperature of 90.°C.

j) Calculate the percent error of a density experiment in which the experimental density value is determined to be 5.01 g/mL and the accepted value in a handbook is reported as 5.850 g/mL.