

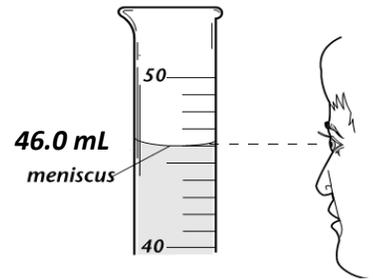
A physical property is something that can be measured or observed without changing the chemical composition of the substance. Mass, volume, and density are examples of physical properties.

1. Volume=amount of _____ an object takes up

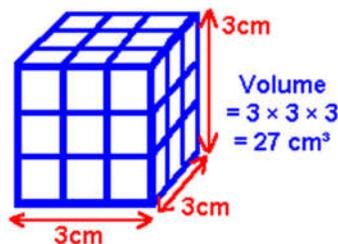
Ways we can measure volume:

***For liquids:** _____

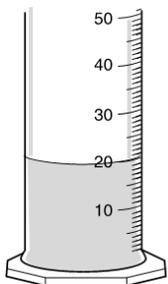
When using a graduated cylinder, read the value from the bottom of the _____



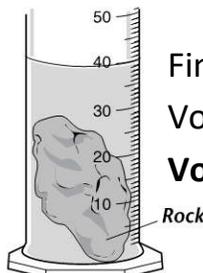
***For regular solids:** _____



***For irregular solids:** _____



Initial Volume = 20 mL



Final Volume= _____

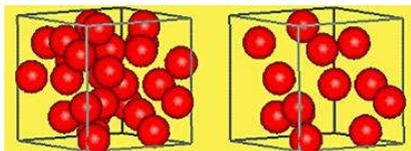
Volume of rock= Final Volume – Initial Volume

Volume of rock = _____

2. Density=the _____.

Density is a property that we cannot directly measure. Rather, we must measure mass and volume separately and then use those values to calculate density.

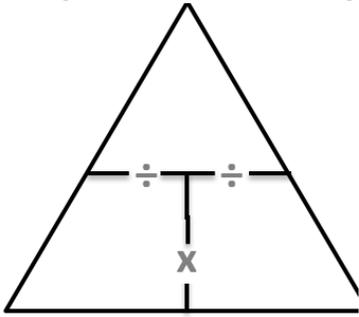
*****YOU MUST KNOW THE FORMULA FOR DENSITY!**



$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

****Which cube has a higher density? Why?**

Density Problems: Show your work!



How to use the triangle to solve density problems

1. Cover up the value you are trying to find
2. Look at the 2 values remaining
3. If you have a value above the other value, then you will divide
4. If the two remaining values are side by side, you will multiply

$$d = m/V$$

$$V = m/d$$

$$m = dxV$$

Solve the following problems using your knowledge with density. Express the final answer using the **proper units and number of significant figures!**

1. If a sample of copper has a mass of 4.23 g and has a measured volume of 1.31 mL, what is its density?

2. A piece of metal with a mass of 147 g is placed in a 50 mL graduated cylinder. The water level rises from 20 mL to 41 mL. What is the density of the metal?

3. What is the volume of a sample that has a mass of 20 g and a density of 4 g/mL?

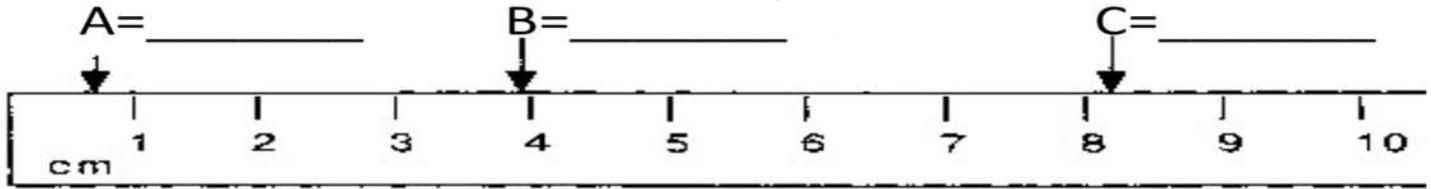
4. If you have a gold brick that is 2.0 cm x 3.0 cm x 4.0 cm and has a mass of 48.0 g, what is its density?

5. What is the mass of an object that has a volume of 34 cm³ and a density of 6.0 g/cm³?

Making Measurement & Estimating the Last Digit: When using tools with graduated “tick marks”, you should _____

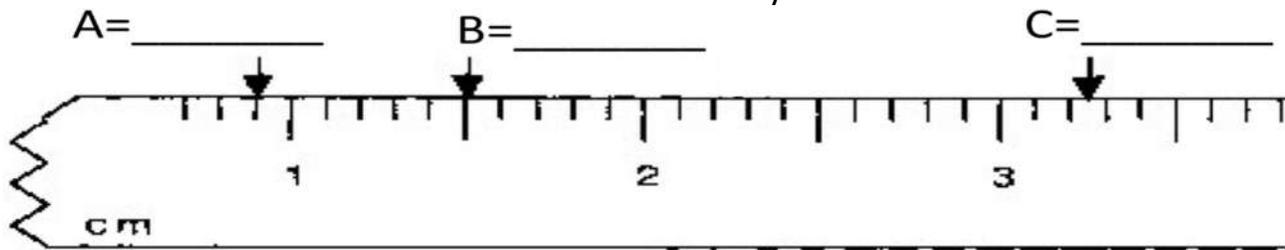
Practice: Reading a Ruler

1. Estimate the number of centimeters indicated by each of the arrows below.



***Each “tick mark” is worth _____, therefore estimate to the nearest _____

2. Estimate the number of centimeters indicated by each of the arrows below.

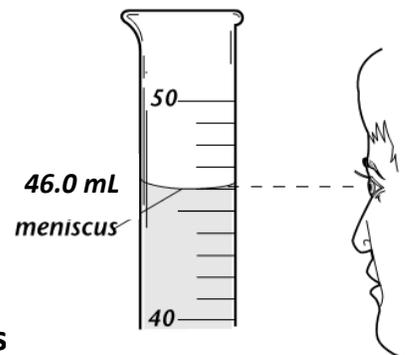


***Each “tick mark” is worth _____, therefore estimate to the nearest _____

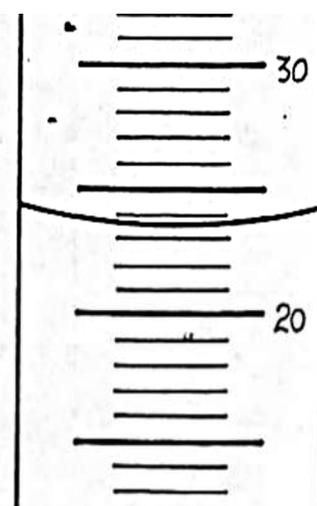
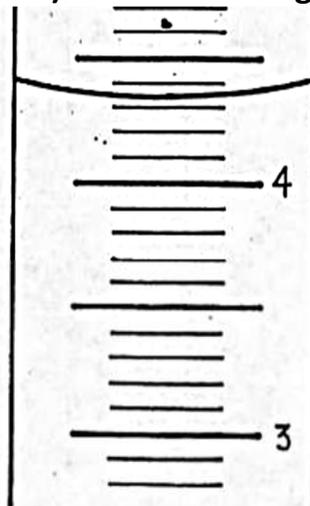
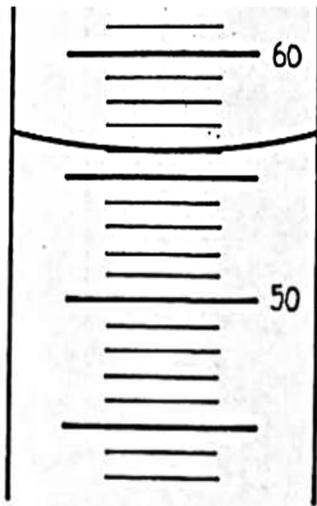
Reading Graduated Cylinders:

*Liquids form a curved surface when in graduated cylinders.

As a standard, you should read the liquid level from the _____



Practice: Estimate the volume (in mL) in the following cylinders



Significant Figures:

- When we make measurements, we are limited by the measuring tool. We can only state values in a measurement that we are sure are correct.
- With each measurement, there is a degree of uncertainty/estimation beyond the markings
- The last digit in a measurement is called the **uncertain digit**
- **Significant figures include** _____
- The _____ significant figures, the _____ precise the instrument

Rules for Counting Number of Significant Figures



1. _____ (1,2,3,4,5,6,7,8,9) are

ALWAYS significant

15=2 sig figs

145=3 sig figs

2. 0's between nonzero digits (_____) are

ALWAYS significant

105=3 sig figs

5005=4 sig figs

3. 0's to the left of the first nonzero are **NOT significant**

0.0005=1 sig fig

0.0505=3 sig figs

4. If there is a _____, the _____ of the number are

ALWAYS SIGNIFICANT

9010.0 = 5 sig figs

5. If there _____, the **0's at the end** of the number **DO NOT count!**

91010 = 4 sig figs

6. For scientific notation, only count the sig figs for the decimal part (not the $\times 10^n$ part)

$3.6 \times 10^5 = 2$ sig figs

"Pacific-Atlantic Method"

P = Pacific = Present

If the **decimal point is** _____, start counting digits from the _____

starting with the first non-zero digit.

→ 1 2 3

0.00310 (3 sig. figs.)

A = Atlantic = Absent

If the **decimal point is** _____, start counting digits from the _____

starting with the first non-zero digit.

3 2 1 ←

31,400 (3 sig. figs.)

Practice: Underline the significant digits and indicate how many significant figures are in each number

1) 1234 _____

5) 9010.0 _____

9) 9.0×10^3 _____

2) 0.023 _____

6) 1090.0010 _____

3) 890 _____

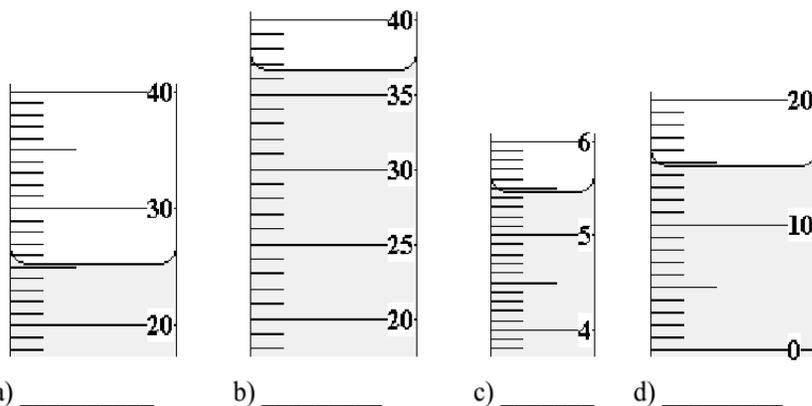
7) 0.00120 _____

4) 91010 _____

8) 3.4×10^4 _____

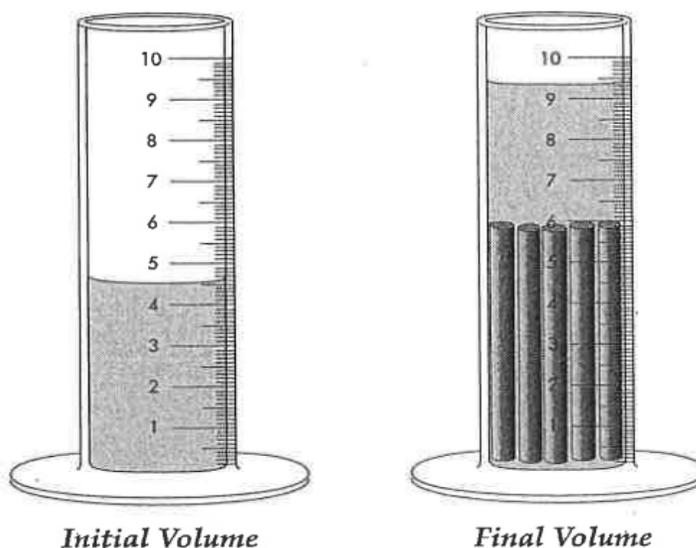
Measurement and Sig Figs HW

Estimate the following measurements to the proper number of decimal places:



To determine the density of a copper alloy wire, a student first found the mass of five pieces of the wire on an electronic balance. The masses are recorded in the table below. Then the five pieces of wire were placed into a graduated cylinder approximately half filled with water. The initial and final volumes are shown below.

Mass 1	8.5780 g
Mass 2	8.9668 g
Mass 3	9.4923 g
Mass 4	8.4310 g
Mass 5	8.4530 g



- Determine the combined mass of the metal wires. How many significant digits are there in this measurement?
- Determine the total volume of the metal wires. How many significant digits are there in this measurement?
- Find the density of the copper alloy using this formula: $\text{density} = \frac{\text{mass}}{\text{volume}}$.
 - What is the correct number of significant digits that should appear in this measurement? Explain your answer.

Identify the number of significant digits in each of the following measurements. Write the number in the space provided.

1. 520-mL _____

5. 10.002-ns _____

2. 0.0102-ms _____

6. 0.451-Pa _____

3. 0.230-kg _____

7. 0.001-cm _____

4. 25,600-L _____

Perform the following calculations and round off the answer to the correct number of significant digits.

8. $0.3287\text{-g} \times 45.2\text{-g} = ?$

13. $0.258\text{-mL} + 0.36105\text{-mL} = ?$

9. $125.5\text{-kg} + 52.68\text{-kg} + 2.1\text{-kg} = ?$

14. $(1250\text{-cal} - (234.207\text{-cal} \div 52.69\text{-cal})) = ?$

10. $\frac{52.8\text{ Pa} + 3.0025\text{ Pa}}{253.4\text{ Pa}} = ?$

15. $\frac{78.26\text{ L} - 89.50\text{ L}}{678.2\text{-L} + 9511\text{-L}} = ?$

11. $(0.12\text{-g} + 5.16\text{-g}) \times (45.56\text{-g} - 93.0\text{-g}) = ?$

12. $68.32\text{-ns} + (-1.001\text{-ns}) + (-0.00367\text{-ns}) + (-678.1\text{-ns}) = ?$