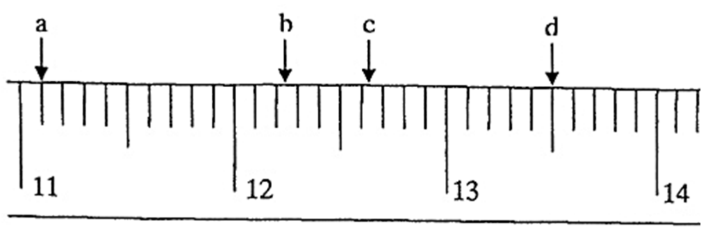
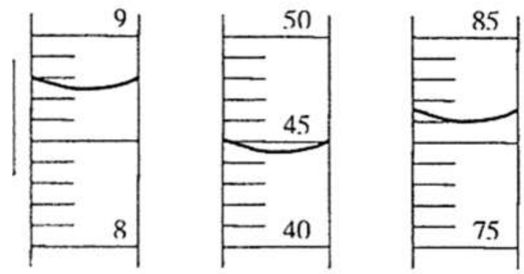
Chemistry
Ms. Ye

Name ___________________________________
Date ______________________ Block ______

<u>Do Now:</u> Measurement, Sig Figs

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





2. Indicate how many significant figures the following numbers have.
   a. 0.00030 ____2______
   b. 1020010 __________
   c. 780 __________
   d. 1000__________
   e. 918.010 __________
   f. 0.0001 __________
   g. 0.00390 __________
   h. 8120 __________
   i. 72 __________
   j. 7.991 __________

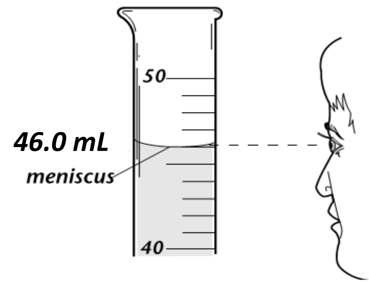
A physical property is something that can be measured or observed without changing the chemical composition of the substance. Mass, volume, and density or examples of physical properties.

1. **Volume**=amount of ________________________ an object takes up

   Ways we can measure volume:

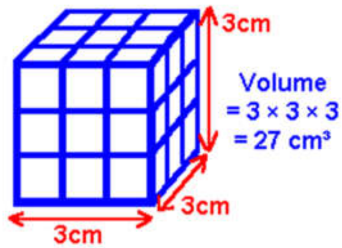
   ***For liquids:** ___________________________

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

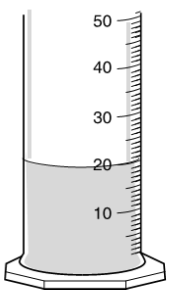


   ***For regular solids:**

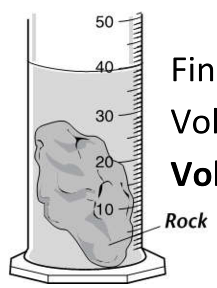
   ____



   ***For irregular solids:** ____



Initial Volume = 20 mL



Final Volume= _______________

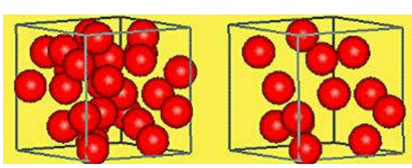
Volume of rock= Final Volume – Initial Volume

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.

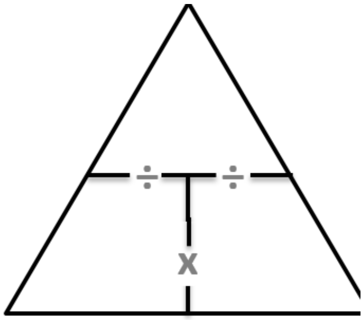
***YOU MUST KNOW THE FORMULA FOR DENSITY!



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

**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?

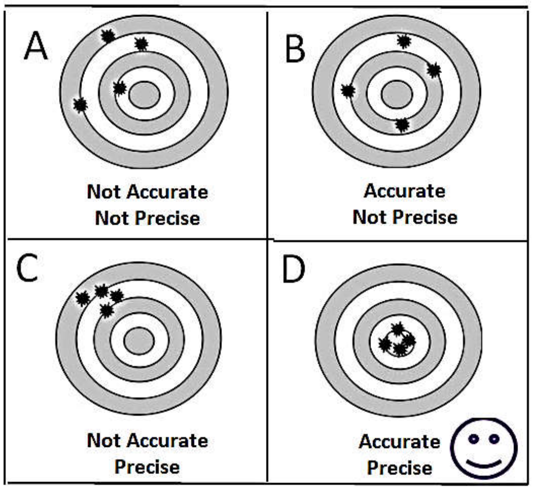
3. What is the volume of a sample that has a mass of 20 g and a density of 4 g/mL?

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 cm^3 and a density of 6.0 g/cm^3?

Analyzing Data: Accuracy vs. Precision

When you do an experiment and analyze your results, there are 4 possibilities:



***Accuracy**=________________________________

→To determine accuracy, we look at the ______________ of our results.

***Precision**= _________________________________

→To determine precision, we look at the ______________ of our results.

Determining Accuracy and Precision of Results from Scientific Experiments

Example: Measuring Vitamin C in Orange Juice (**Actual Answer=100 mg**)-- Tropicana claims that each cup of orange juice has 100 mg of Vitamin C. Julia did an experiment to see whether this was true. Her results are shown in the table.

1. Look at the ____________________ and ask yourself, are the results ______________ (close to the right answer)?

Cup #	Amount of Vitamin C
1	30 mg
2	50 mg
3	70 mg
Average	50 mg

Are Julia's results accurate? _______

2. Look at ________________________ and ask yourself, are the results _______________ (did the experimenter get about the same answer each time)?

Cup #	Amount of Vitamin C
1	30 mg
2	50 mg
3	70 mg
Average	50 mg

Are Julia's results precise? ______

Practice:

1. Measuring Blood Glucose (Actual Answer = 100 mg/dL)

Bayer HealthCare is testing a new glucose meter to be sold to the public. They tested a standard solution that contains 100 mg of glucose/dL of liquid. The results are shown below.

Trial #	Amount of Glucose
1	98 mg/dL
2	99 mg/dL
3	100 mg/dL
Average	99 mg/dL

1. Are the results *accurate*?______________

2. Are the results *precise*? _________

2. Measuring Blood Glucose
(Actual Answer = 100 mg/dL)

The workers at Bayer wanted to add a new feature to the glucose meter. They tested the meter with the added feature in the same 100 mg/dL standard in the example above. The results are shown below.

Trial #	Amount of Glucose
1	79 mg/dL
2	99 mg/dL
3	119 mg/dL
Average	

1. Are the results *accurate*? _______________

2. Are the results *precise*? __________________

3. Measuring Iron in Cereal
(Actual Answer = 18 mg)

Total claims that each serving of cereal contains 18 mg of iron. Bob did an experiment to see if this was true. His results are shown below.

Trial #	Amount of Iron
1	5 mg
2	4 mg
3	5 mg
Average	

1. Are Bob's results *accurate*? _______________

2. Are Bob's results *precise*? ________________

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Percent Error

- A quantitative way we can look at the _______________________ of a set of data if the true value is known
- For this class, we'll say the data is accurate if the percent error is ____________________

★ **Observed value** - value based on laboratory measurements
★ **True value** - most probable value or accepted value based on references

$$\text{Percent error} = \frac{|\text{observed value} - \text{true value}|}{\text{true value}} \times 100\%$$

Percent Error Practice:

1. The freezing point of water is 273.2 K, but it was measured at 250.1 K. What is the percentage error? Was the measured value accurate?

2. The mass of a penny is 2.67 g, but it was measured at 2.55 g. What is the percentage error? Was the measured value accurate?

3. The air pressure was 101.3 kPa, but the weatherman said it was 1001.3 kPa. What is the percentage error? Was the measured value accurate?

4. The amount of heat released when 1 mole of CO_2 forms is 393.5 kJ, but it was measured at 378.2 kJ. What is the percentage error? Was the measured value accurate
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Scientific Notation Review

Scientific Notation: used to express __________________ or ________________ numbers more easily

It is written as a **(**__________________________________**)** **X** ____________________________

ex: 3.2×10^{3} , 7.2×10^{-4}

How to express a number in terms of scientific notation:

Examples: Consider the numbers 360,000 and 0.00037:

1. Move the decimal point of your number so that you have a **decimal between 1 and 10**

360,000. → **3.60000** 0.00037 → **3.7**

*Note: if no decimal point is written, the decimal point is at the end of the number!

2. Count the number of spaces (n) and which direction you moved the decimal point

360,000 → 3.60000: **5** decimal places to the **left** 0.00037 → 3.7: **4** decimal places to the **right**

5 4 3 2 1 1 2 3 4

3. If you moved the decimal point to the **left** multiply (x) your decimal by 10^{n}:

360,000 → $\mathbf{3.6 \times 10^{5}}$

If you moved the decimal point to the **right**, multiply (x) your decimal by 10^{-n}:

0.00037 → $\mathbf{3.7 \times 10^{-4}}$

Practice: Write the following numbers in terms of scientific notation

Category	**Normal Number**	**Scientific Notation**
Population of the World	7,125,000,000 people	
Distance from the Earth to the Moon	240,000 miles	
Raindrops in a Thundercloud	6,000,000,000,000 drops	
Density of Oxygen	0.001332 g/cm^{3}	
Mass of a Dust Particle	0.000000000753 kg	

How to express a value given in scientific notation as a normal number:

Examples: Consider the numbers 3.6×10^{5} and 3.7×10^{-4}:

1. Identify the exponent

3.6×10^{5}: exponent is **5** 3.7×10^{-4}: exponent **– 4**

2. If the exponent is a **positive number**, move the decimal point the same number of places to the **right.** Fill in 0's as placeholders as necessary.

3.6×10^{5}: move decimal 5 places to the right:

3.6 _ . _ . _ . _ . _ . → **360,000**

1 2 3 4 5

If the exponent is a **negative number**, move the decimal point the same number of places to the **left**. Fill in 0's as placeholders as necessary.

3.7×10^{-4}**:** move decimal 4 places to the left:

. _ . _ . _ . _ 3.7 → **0.00037**

4 3 2 1

Practice: Write the following scientific notation expressions as a normal number

Category	**Normal Number**	**Scientific Notation**
Speed of Light		3.00×10^{8} m/s
Distance from the Earth to the Sun		9.3×10^{7} miles
Cells in the Human Body		1.0×10^{14} cells
Water on Earth's Surface		1.40×10^{8} square miles
Diameter of a Grain of Sand		2.4×10^{-3} inches

Accuracy & Precision with Density Homework

Some students were trying to determine the density of aluminum metal. The mass and volume of various samples that each group measured are shown in the data table below:

Group #	Mass (g)	Volume (mL)	Density (g/mL)
1	10.10	3.8	
2	4.31	1.7	
3	8.05	3.0	
4	10.35	4.1	

1. Fill in the "density" column for each group by using their measured mass and volume values. Please report your answer to the proper number of significant figures!

2. If the density of Aluminum metal is 2.7 g/mL, determine the percent error and accuracy of each group. SHOW WORK!

3. Assume that group 2 finished early and was able to make 2 more measurements. Give an example of 2 measurements that would make their data precise!

   Trial 1: Mass 4.31 g Volume 1.7 mL (from data table above):

   Trial 2: Mass _________________ Volume ___________________

   Trial 3: Mass _________________ Volume ___________________