Unit 1 Notes Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Matter and Measurements Date \_\_\_\_\_\_\_\_\_\_\_\_ Block \_\_\_\_

### Knowledge/Understanding Goals:

* Recall definitions of element, compound & mixture
* Understand how instrumentation determines the accuracy that can be reported for measurements

### Skills:

* Report measurements with appropriate precision
* Round numbers to appropriate precision using significant figures use significant figures to estimate precision
* Identify common types of matter and understand techniques to separate mixtures.

### Notes:

**Matter**

* Everything in the universe is composed of \_\_\_\_\_\_\_\_\_\_\_\_\_ (minus vacuums, blackholes, etc.).
* All matter is composed of particles called \_\_\_\_\_\_\_\_, which give matter \_\_\_\_\_\_\_\_\_.
* Matter can be categorized as either a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + See Classification of Matter Concept Map

element:

\*What atomic characteristic determines the element?

molecule:

compound:

mixture:

homogeneous:

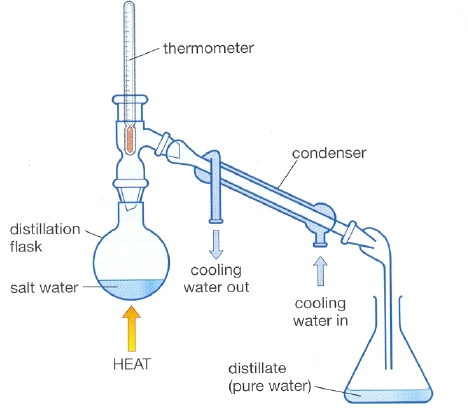
heterogeneous:

solutions:

**Separation of Mixtures**

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ separation of the compounds/molecules that make up a mixture typically is accomplished by exploiting differences in the compounds’ \_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ temperature, or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Condensation/Distillation: Exploits the difference in \_\_\_\_\_\_\_\_\_\_\_\_ temperatures between the mixed compounds. The compound with the \_\_\_\_\_\_\_\_\_\_ BT is evaporated out of the mixture and collected in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ tube, which is cooled with flowing tap water, causing the compound to \_\_\_\_\_\_\_\_\_\_\_\_ back to a liquid in a separate container.

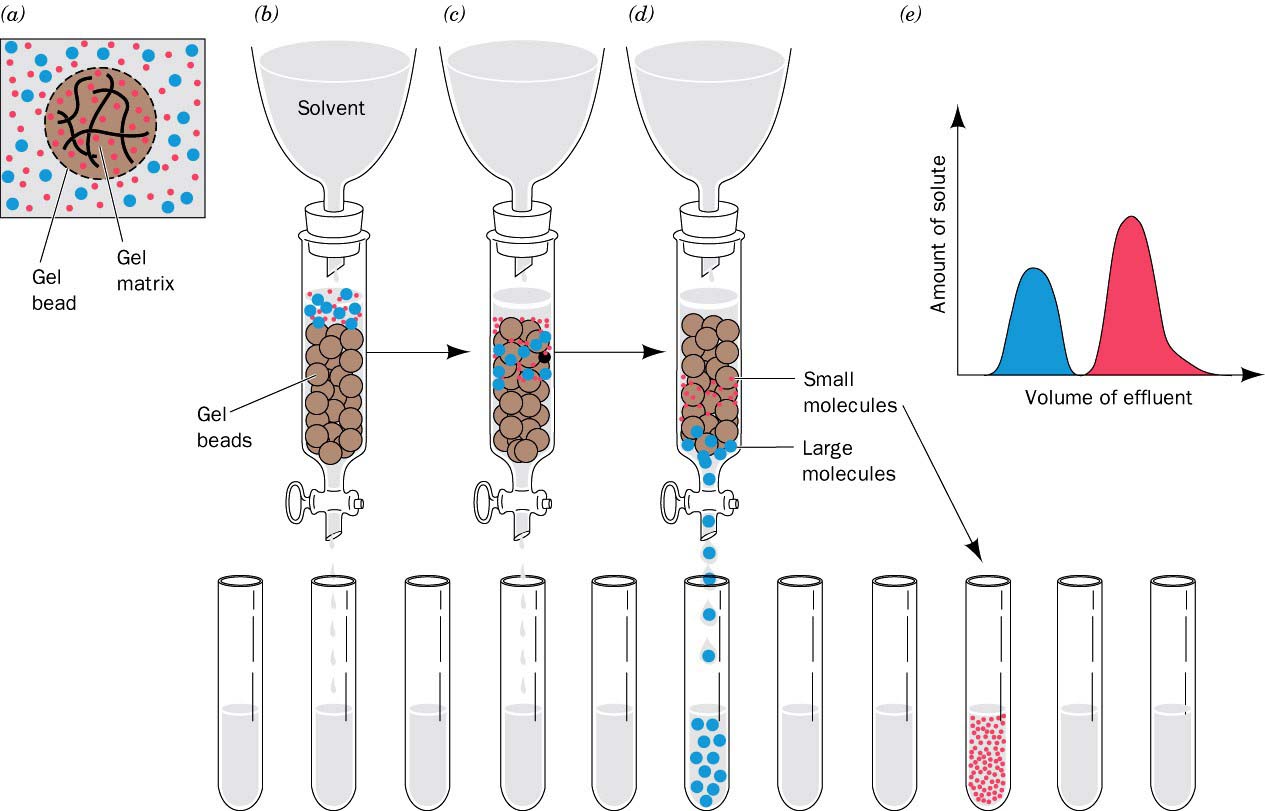


Chromatography:

Size Exclusion Chromatography (SEC): Particles of different \_\_\_\_\_\_\_ are able to move

through a \_\_\_\_\_\_\_\_\_\_\_\_ packed with silicon beads at different \_\_\_\_\_\_\_. Smaller

particles are able to enter the matrix \_\_\_\_\_\_\_\_\_\_\_ the beads and take a \_\_\_\_\_\_\_\_\_\_\_\_ route through the column, causing them to \_\_\_\_\_\_\_\_\_ later than large molecules.



[SEC Animation: https://www.youtube.com/watch?v=rPRbqYWlSEo](https://www.youtube.com/watch?v=rPRbqYWlSEo)

High Performance Liquid Chromatography (HPLC): Particles of differing \_\_\_\_\_\_\_\_\_\_\_\_\_\_ are

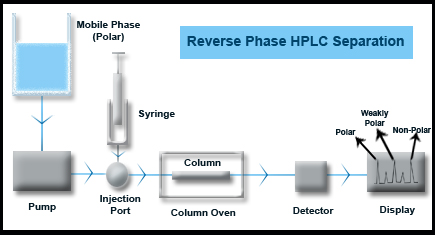
separated out in a column lined/packed with either a polar or non-polar \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

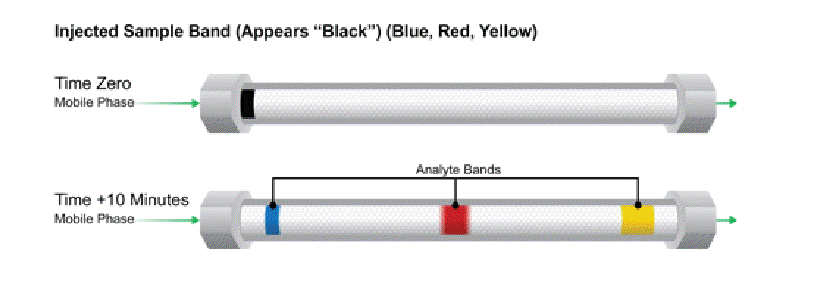
surface. If the lining is polar, \_\_\_\_\_\_\_\_\_\_\_\_ molecules in the mixture will be attracted to it,

causing them to move through the column more \_\_\_\_\_\_\_\_\_\_ and elute \_\_\_\_\_\_\_\_\_. Visa versa

for a non-polar lining. Often times, a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of increasing

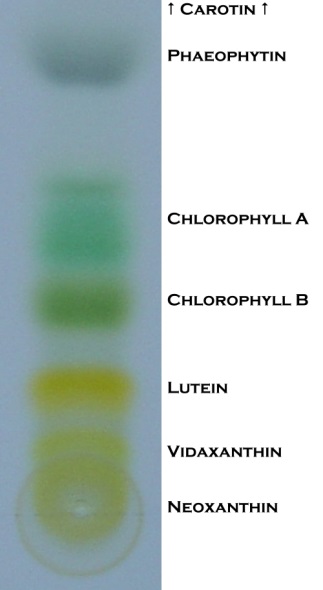
strength must be applied to force the mixture molecules to release from the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.





[HPLC Animation: https://www.youtube.com/watch?v=-ajxqELsCFM](https://www.youtube.com/watch?v=-ajxqELsCFM)

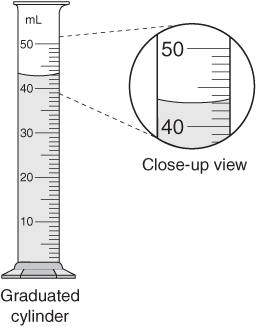
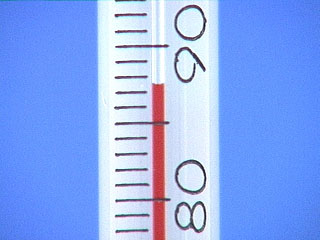
[GC Animation: https://www.youtube.com/watch?v=q0pM-k0SvOQ](https://www.youtube.com/watch?v=q0pM-k0SvOQ)



Paper Chromatography: A method that utilizes the cellulose fibers of the paper pulp as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ phase. As a liquid \_\_\_\_\_\_\_\_\_\_\_\_ phase travels up the paper via \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, it interacts with and carries sample molecules with it at different rates, depending upon the amount of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ between the mobile phase and sample.

[Paper Chromatography: https://www.youtube.com/watch?v=4I9065A\_6UY](https://www.youtube.com/watch?v=4I9065A_6UY)

## Measurement

* Every measurement has a \_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_, and a limit of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. In general, always report both. (*e.g.,* 2.75 g ± 0.03 g, 23.5°C ± 0.1°C, *etc.*)
* For an analog measurement, the last reported decimal place should be your best \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ between the graduated lines. (\*Remember to measure from the *bottom* of the meniscus for liquids\*)

Thermometer (°C) \_\_\_\_\_\_\_\_\_\_\_\_\_ Graduated Cylinder (mL) \_\_\_\_\_\_\_\_\_\_\_\_\_

* For a digital measurement (such as a balance reading), if the measurement is drifting, the limit of precision (plus or minus) is from the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ reading to the highest or lowest value when it drifts. If the measurement is stable, assume the precision is as stated by the manufacturer.

In labs, always give the estimated uncertainty (± value) for all measurements.

* For example, if a measurement made with a metric ruler is 5.6 cm and the ruler has a precision of  0.1 cm, then the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in this measurement is 5.6 ± 0.05 cm,  or from 5.55 cm to 5.65 cm.  Any measurements within this range are "tolerated" or perceived as correct.

## Significant Figures

In any number that represents a measured value:

* The first significant digit is the first one that is not \_\_\_\_\_\_\_\_\_\_
* The last significant digit is the last digit before the place the number was \_\_\_\_\_\_\_\_\_\_\_\_.
  + If there is no decimal point, it’s the last digit that’s not a zero.
  + If there is a decimal point, it’s the last digit shown.
* All \_\_\_\_\_\_\_ between the first significant digit and the last significant digit are significant.
* For a number that does not have an explicit uncertainty listed, assume the uncertainty is ±1 in the \_\_\_\_\_\_\_\_ digit.

Examples:

* 13,500
* 0.000 265 00

Sig Figs and Calculations

Sig Figs represent the \_\_\_\_\_\_\_\_ of accuracy you can guarantee in your measurements. That limitation should be carried out through your calculations.

Ex: You weigh out 50 mL of a sulfuric acid solution in a beaker and take its mass (52.32

g). What density (g/mL) would you report for the solution?

**\*\*\* For the AP Test, the test readers no longer give you a 2 digit cushion for your sig figs! Always report them properly, you never know which free response will be chosen as a sig fig point.\*\*\***

## Dimesional Analysis (Factor Label Conversion Method)

In conversions, treat units like variables in an algebraic expression.

* Get rid of unwanted units in the numerator by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ by something that has the unit in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Get rid of unwanted units in the denominator by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ by something that has the unit in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Any number with two units that make a fraction (one over the other) can be used as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. (E.g., if the density of a substance is , then for that substance you can use the conversion factor 2.75 g = 1 cm3 to convert between grams and cm3.)

Conversion values to memorize:

* 1 g = \_\_\_\_\_\_\_\_ mg, 1 L = \_\_\_\_\_\_\_\_ mL, etc.
* 1 mole = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ atoms or molecules
* To go between moles and grams: use the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the compound or element
* To go between moles and molecules/atoms: use \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Practice Conversion/Sig Fig Problems

1. What is 50.0 mL in liters?
2. How many grams does 0.250 L of a solution with a density of 1.15 g/mL weigh?
3. How many moles of Ca(C2H3O2)2 are present in a 3980 mg of the compound?
4. (a) A solution of AlCl3 has a concentration of 0.4405 mol/L, how many grams of aluminum chloride are dissolved in 150 mL of the solution?

(b) How many atoms of chlorine are in the same 150 mL AlCl3 solution?