CHM 100

Today's Experiment: 2

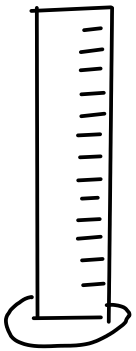
Due today (one per table):
-Pages 19-22

Notes:

* For part A (page 16), use a HOTPLATE to heat the water instead of a bunsen burner.
* Remember to include UNITS on all measurements on page 20-22.
* Remember to show calculation setups when asked (pages 20-22)
* See page 333 for conversion factors

How to measure and calculate density

... of a liquid



1) Measure mass of empty cylinder

mass = 97.35 g

2) Fill cylinder and measure volume of liquid

volume = 25.3 mL

3) Measure mass of filled cylinder

mass = 130.55 g

4) Subtract to find mass of liquid

$$\begin{array}{r} 130.55\ \text{g} \\ -\ 97.35\ \text{g} \\ \hline 33.20\ \text{g} \end{array}$$

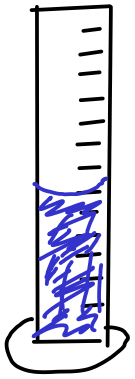
5) Density = mass liquid / volume liquid

$$\text{Density} = \frac{33.20\ \text{g}}{25.3\ \text{mL}} = 1.31\ \text{g/mL}$$

... of an object

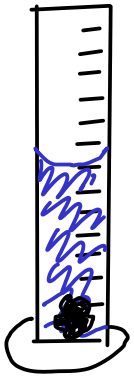
1) Measure mass of object

mass = 9.78 g



2) Partially fill cylinder with liquid, record volume.

volume = 25.0 mL



3) Put object into cylinder, record new volume

volume = 26.6 mL

4) Subtract to find volume of object

$$\begin{array}{r} 26.6\ \text{mL} \\ -\ 25.0\ \text{mL} \\ \hline 1.6\ \text{mL} \end{array}$$

5) Density = mass object / volume object

$$\text{Density} = \frac{9.78\ \text{g}}{1.6\ \text{mL}} = 6.1\ \text{g/mL}$$

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Today's Experiment: 3

Due today (one per table):
- Pages 29-32

Important SAFETY Info:

* Wear glasses/apron for the ENTIRE exeriment!
* 9% H_2O_2 can burn skin on contact!
* Dispose of MnO_2 in marked waste funnel.

Notes on OXYGEN:

* Element, symbol: O
* Exists in air as MOLECULAR OXYGEN or, OXYGEN GAS, symbol: O_2
* MORE DENSE than air.
* Not very soluble in WATER

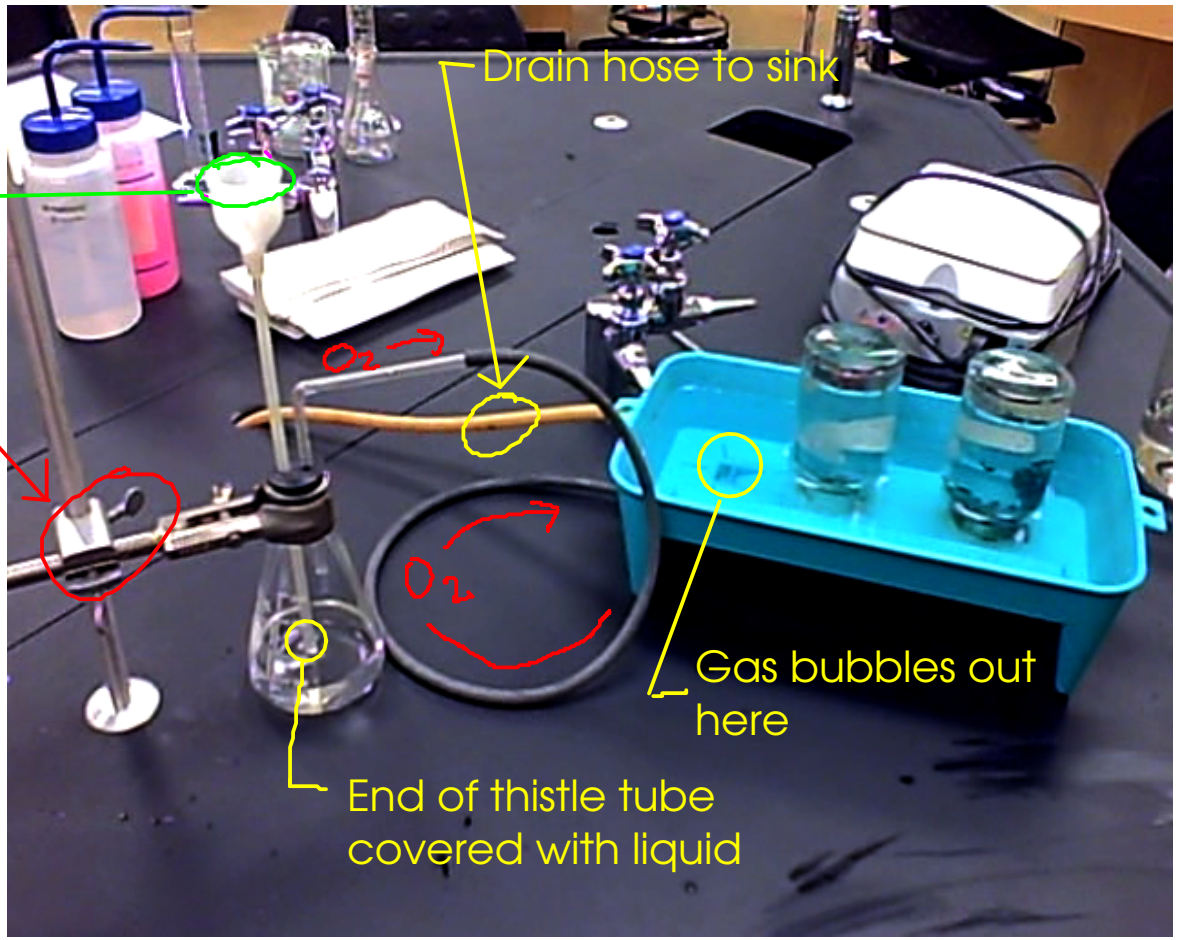
Making oxygen gas:

"Phase labels" - indicate the STATE of each substance in an equation

$$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$$ "Formula equation"

hydrogen peroxide → water + oxygen gas "word equation"

Collect oxygen by DOWNWARD DISPLACEMENT



Oxygen has an important role in COMBUSTION

- combustion is the reaction of a substance with OXYGEN GAS to produce OXIDES

$$C(s) + O_2(g) \rightarrow CO_2(g)$$

carbon + oxygen gas → carbon dioxide (an oxide)

$$3Fe(s) + 2O_2(g) \rightarrow Fe_3O_4(s)$$

iron + oxygen gas → iron oxide

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Today's Experiment: 4

Due today (one per table):
- Pages 39-42

Important SAFETY Info:

* Wear glasses/apron for the ENTIRE exeriment!
* ACIDS can burn skin on contact!
* Dispose of METAL WASTE in marked waste beaker.

Notes on HYDROGEN:

* Element, symbol :H
* Exists in air as MOLECULAR HYDROGEN or, HYDROGEN GAS, symbol: H_2
* LESS DENSE than air.
* Not very soluble in WATER

Hydrogen is COMBUSTIBLE

- Hydrogen reacts with OXYGEN GAS to produce the most common oxide of hydrogen - WATER.

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$$

hydrogen gas + oxygen gas → water

Making hydrogen gas:

a "salt"

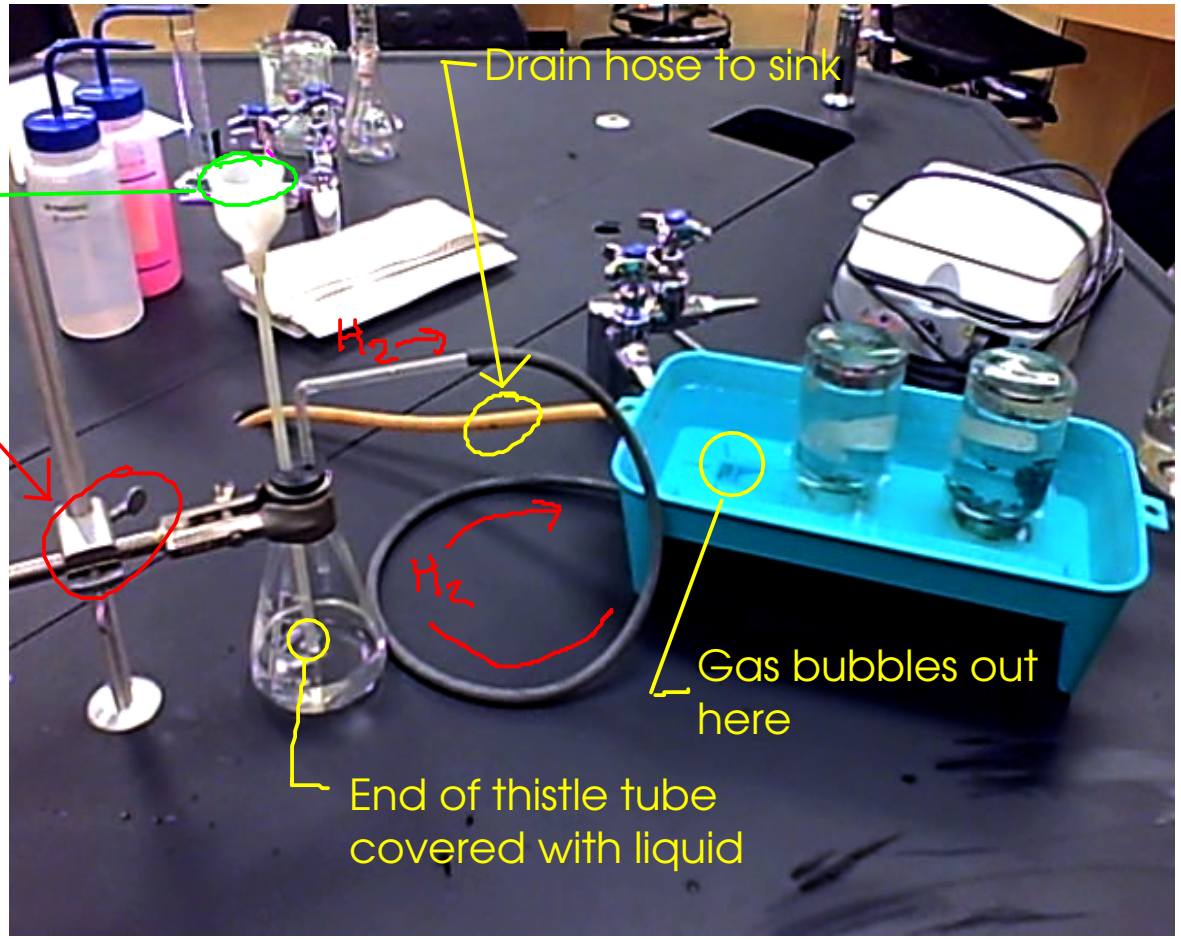
$$Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2(g)$$ "formula equation"

zinc + sulfuric acid → zinc sulfate + hydrogen gas "word equation"

METAL + ACID → SALT + hydrogen gasr

a more general word equation

Collect hydrogen by DOWNWARD DISPLACEMENT



Alternate way to make hydrogen gas: Sodium!

$$2Na(s) + 2H_2O(\ell) \rightarrow 2NaOH(aq) + H_2(g)$$

sodium + water → sodium hydroxide + hydrogen gas

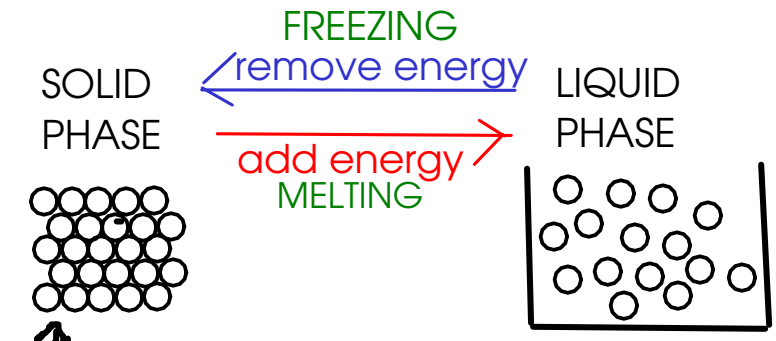
Today: Experiment 6
Due today: p57-59

Today we will measure the freezing point of pure acetic acid and see how that freezing point is affected by impurities

TERMS

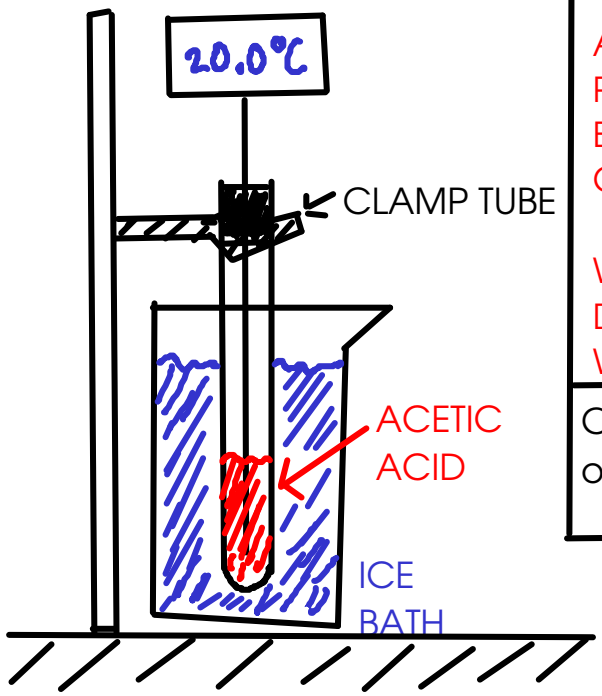
MELTING POINT: Temperature at which a substance changes from solid to liquid
FREEZING POINT: Temperature at which a substance changes from liquid to solid
SUPERCOOLED: A substance that exists as a liquid at a temperature below its freezing point. An unstable state.
FREEZING POINT DEPRESSION: The lowering of freezing point (relative to pure compound) caused by the presence of an impurity.

THE FREEZING PROCESS



The presence of an IMPURITY slows the formation of solid crystals, affecting the freezing point!

EXPERIMENT SETUP



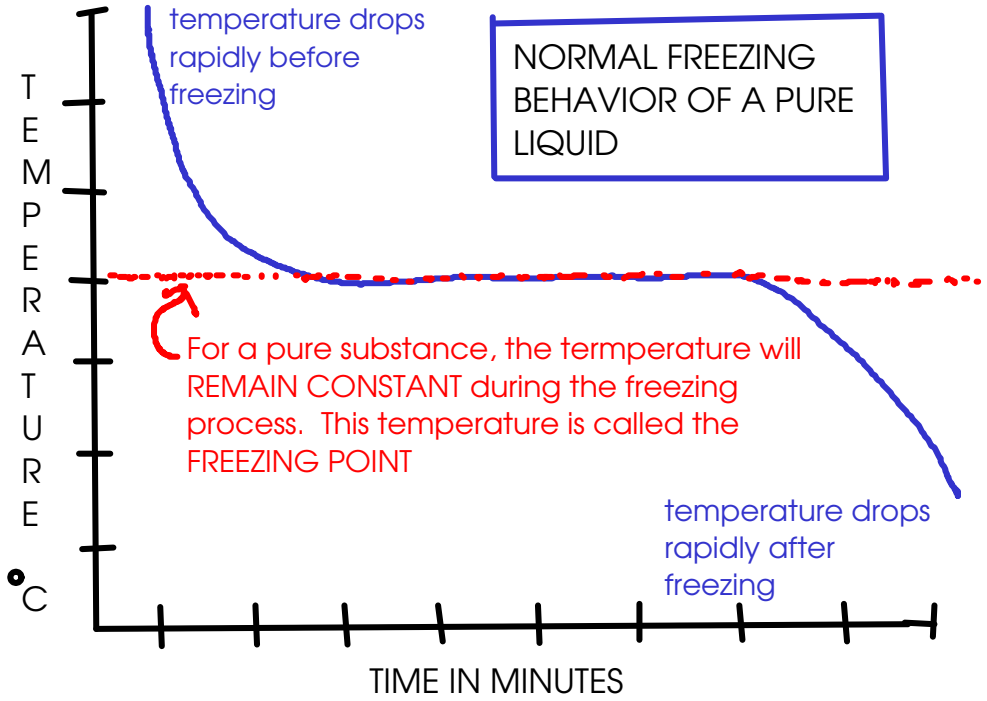
SAFETY / WASTE

AVOID CONTACT WITH PURE ACETIC ACID AND BENZOIC ACID; THEY MAY CAUSE CHEMICAL BURNS

WASTE MAY BE FLUSHED DOWN THE SINK WITH WATER

CRC freezing point of acetic acid: 16.6°C

SAMPLE PLOT



Today: Expt. 7
Turn in: p65-66

HYDRATES

- Ionic compounds that have incorporated WATER MOLECULES into their crystal structure.

- will DECOMPOSE when heated - sometimes by losing just the water, sometimes by losting water and other substances

$$\text{hydrate} \xrightarrow{\text{(heat)}} \text{anhydrous salt} + \text{water}$$

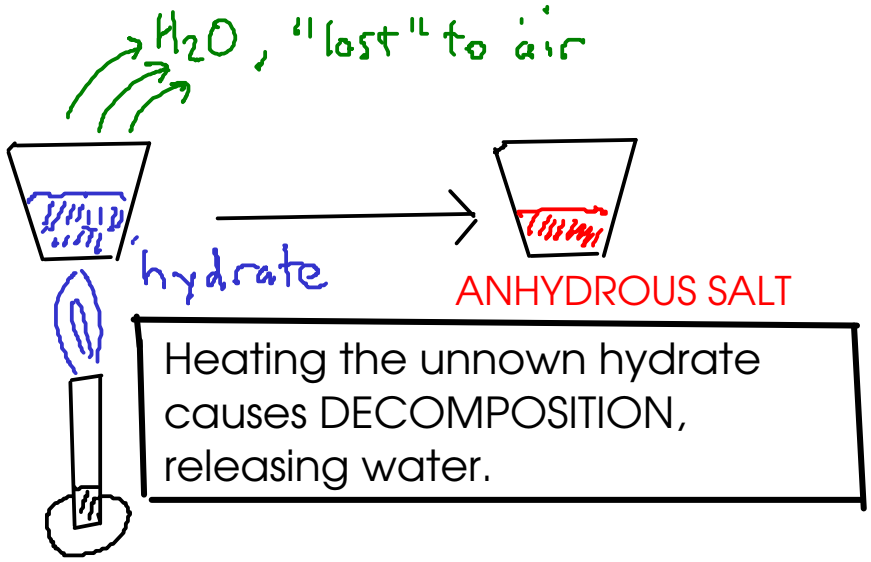
$$CuSO_4 \cdot 5H_2O \xrightarrow{\Delta} CuSO_4 + 5H_2O$$

- We'll look at the decomposition above QUALITATIVELY. The reaction can be easily detected by a COLOR CHANGE.

- The ANHYDROUS SALT can regain its lost water. This reaction may be accompanied by a color change, too!. You may also be able to detect a change in temperature.

SAFETY:
- Do not touch crucible with yoru hands - use crucible tongs! (Burn hazard)
- Make sure your gas tap is OFF before you leave!
- Dispose of all solid waste IN THE DESIGNATED BOTTLE!

QUANTITATIVE EXPERIMENT



Heating the unnown hydrate causes DECOMPOSITION, releasing water.

CALCULATIONS

(6) mass original sample = mass CCS* (before heat) − mass empty crucible/cover

(7) mass lost = mass CCS (before heat) − mass CCS (after last heating)

(8) % water = $\frac{\text{mass lost}}{\text{mass original sample}} \times 100\%$

*: CCS = "crucible, cover, and sample"