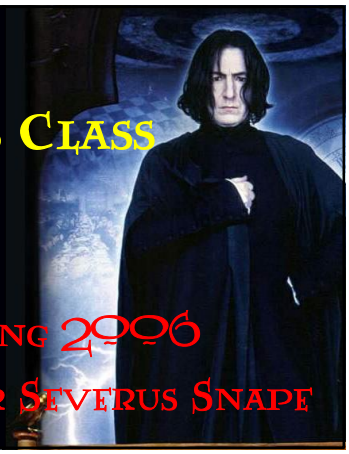
CH204
Potions Class



Spring 2006
Professor Severus Snape

Last Week in the Potions Laboratory

Separated mixtures based on differing physical and chemical properties

Used Excel to calculate average and standard deviation

Q-test in action!

Buchner filtering and the magic of Pasteur pipettes and Parafilm

What can go wrong in the laboratory

Experiment 3
Qualitative Chemical Analysis

Previous Years

Gorgon's blood

Liquid gold

Vitreous humor of a blind mule

2006

Acids

Bases

Inorganic salts

"Qual" vs "Quant"

Qualitative – what is it?

Quantitative – how much is there?

You will identify the chemical identities of 5 unknown solutions based on how they react *(or don't react!)* with one another.

Two-Part Lab

- Part 1: Mix ten known solutions and record the results of the reactions
- Part 2: Mix your five unknowns and compare the results with what you saw in Part One.

The Known Solutions

Acids: HCl H_2SO_4 HNO_3

Bases: NaOH

Salts: $Ba(NO_3)_2$ $AgNO_3$ K_2CrO_4 Na_2S $Fe(NO_3)_3$ $Ni(NO_3)_2$

All solutions are 0.10 or 0.20 M.

What are we looking for?

*Explosions

*Supernatural creatures

*Rashes, mutations, transformations

What are we (really) looking for?

Precipitates, mostly.

(See the solubility table in Appendix 2.)

Maybe a color change.

Don't expect to see any acid–base action.

Riddle me this

What do you get when you cross hydrochloric acid with silver nitrate?

Balanced Chemical Equation

$$HCl + AgNO_3 \longrightarrow AgCl + HNO_3$$

Add the physical states of each compound

$$HCl_{(aq)} + AgNO_{3(aq)} \longrightarrow AgCl_{(s)} + HNO_{3(aq)}$$

This is sometimes called a molecular equation.

Let's Get Real

$$HCl_{(aq)} + AgNO_{3(aq)} \longrightarrow AgCl_{(s)} + HNO_{3(aq)}$$

Total Ionic Equation – write aqueous compounds as individual ions:

$$H^+_{(aq)} + Cl^-_{(aq)} + Ag^+_{(aq)} + NO_3^-{}_{(aq)} \longrightarrow AgCl_{(s)} + H^+_{(aq)} + NO_3^-{}_{(aq)}$$

Lots of spectator ions.

Time to Clean House

Cross out spectator ions

$$\cancel{H^+_{(aq)}} + Cl^-_{(aq)} + Ag^+_{(aq)} + \cancel{NO_3^-{}_{(aq)}} \longrightarrow AgCl_{(s)} + \cancel{H^+_{(aq)}} + \cancel{NO_3^-{}_{(aq)}}$$

Net Ionic Equation

$$Ag^+_{(aq)} + Cl^-_{(aq)} \longrightarrow AgCl_{(s)}$$

The Net Ionic Equation

$NaCl_{(aq)} + AgNO_{3(aq)} \longrightarrow NaNO_{3(aq)} + AgCl_{(s)}$

$Ba(Cl)_{2\,(aq)} + 2AgCH_3COO_{(aq)} \longrightarrow Ba(CH_3COO)_{2\,(aq)} + 2AgCl_{(s)}$

$NH_4Cl_{(aq)} + AgClO_{3(aq)} \longrightarrow NH_4ClO_{3(aq)} + AgCl_{(s)}$

All of these reactions have the same net ionic equation:

$Ag^+_{(aq)} + Cl^-_{(aq)} \longrightarrow AgCl_{(s)}$

Simple is Good

- The net ionic equation describes the chemical reaction that occurs, and does not include any ions that do not take part in the reaction, *even though those ions are present in solution.*
- How do we know which ions will react and which ones won't?

Some Quick Solubility Rules

* All compounds containing alkali metals and ammonium ion are soluble.

Li^+ Na^+ K^+ Rb^+ Cs^+ NH_4^+

* All compounds containing nitrate, chlorate, perchlorate, and acetate are soluble.

NO_3^- ClO_3^- ClO_4^- CH_3COO^- or $C_3H_3O_2^-$

Some Quick INsolubility Rules

* All compounds containing PO_4^{3-} CO_3^{2-} and SO_3^{2-} ions are insoluble except those that also contain alkali metals or NH_4^+.
* All hydroxides and sulfides are insoluble except those that also contain alkali metals, or NH_4^+. (some group II hydroxides are slightly soluble.)
* When in doubt, Ag^+ Pb^{2+} and Hg compounds tend to be insoluble.

In the Potions Laboratory

* Create an array of reactions in the microwell plate similar to the one in the lab manual.
* Use only 2 – 3 drops of each reactant.
* *DO NOT* touch the tips of the dropper bottles to the solutions in the microwell plate or you will die a most painful death.

A Dire and Serious Warning!

- This lab is graded in part on the accuracy of your identifications.
- Your set of 5 unknowns has been preassigned and is already waiting for you on your lab bench.
- Use the unknowns that are already there. DO NOT move the unknowns!

Vile, hideous fluids!

Chromium (VI) in particular is nasty!

Empty your used microwell plates into the disgusting plastic tray in the hood.

Rinse the plates with ordinary tap water, do a final rinse with DI water, and stack the plates in the hood.

Madness and Chaos and Bedlam, oh my!

We have many students doing make-up labs this week.

Please try to accommodate visiting students.

Next Week

Experiment 4: Acid-Base titration

- MUCH more involved than this lab.
- Requires MUCH more preparation than any of our previous labs.
- Start preparing early

Quiz Time

* You will need a calculator every week (except next week).

* Make sure you know your section number and your TA's name.