Chemistry 125/126
Hourly 1 Review Notes and Questions to check your understanding.

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Experiment 1 Electrons and Solution Color

Major Concepts Developed/Applied

A. Beer-Lambert absorbance relationship

- Absorbance a given wavelength = $E\,l\,c$
- A spectrum describes variations of E (absorptivity coefficient) for the sample at varying wavelengths (l and c are held constant).
- The shape of a spectrum is characteristic of the sample (its "fingerprint").

B. Absorbance and transmission of light are inversely related.

Example: If a sample does not interact with light (Abs = 0), all the light is transmitted (100%)

C. Observable color of a solution = transmitted wavelengths

Example: A solution of Co2+ is red. Class data shows it transmits red wavelengths (and absorbs blue wavelengths..

D. Observable color of a cation in solution is NOT related to the size of the cation (ionic radius)

E. Cation color (vs. lack of color) in aqueous solution can be predicted from the electronic structure of a cation

- color is correlated to presence of d sub-energy level e's.
- cation's with filled d sub-energy level (i.e. d^{10}) are colorless
- cation's with unfilled d sub-energy level are colored

Example: Sc^{2+} with electronic structure [Ar] $3d^1$ is colored
Cd^{2+} with electronic structure [Kr] $4d^{10}$ is colorless

F. Calibration Curve can be used to determine the concentration of an unknown

- slope of a calibration curve = El and is dependent on the λ chosen for the calibration curve and the path length.
- The concentration of an unknown can be determined by reading its absorbance at the λ of the calibration graph. The unknown concentration = Abs divided by slope of the calibration line. (or c = Abs/El)

G. When diluting samples, #mmol (or mol...) remains constant.

MiVi = MfVf
initial mmol final mmol

- When adding water to a sample (for dilution purposes), the # particles (i.e. #mol or mmol) remains constant while the Molarity (concentration of particles per unit volume) changes.

EXPERIMENT 1 (ELECTRONS AND SOLUTION COLOR)

Part 1. Preparation and Color of Solutions

1. **A.** You prepare 100 mL of 0.10M manganese (II) sulfate for your study. How many grams of $Mn(SO_4)$ (formula weight = 151) do you use?

B. Which one or more of the statements below are correct with regard to the above prepared solution (**A**)? Put a √ in either the "Correct" or "Incorrect" column.

Statement	Correct	Incorrect
1. The prepared solution contains 10mmol of Mn^{2+} ions.		
2. If you add 100mL water to your prepared solution, the resulting sample = 0.025M.		
3. You remove 10mL from the prepared solution (**A**). This 10mL sample = 0.01M.		

(now try Nov.'07, 9; March'07, 2; Nov.06, 2A; March'06, 1A-B; Nov.'05, 2A; March'05, 2A-B)

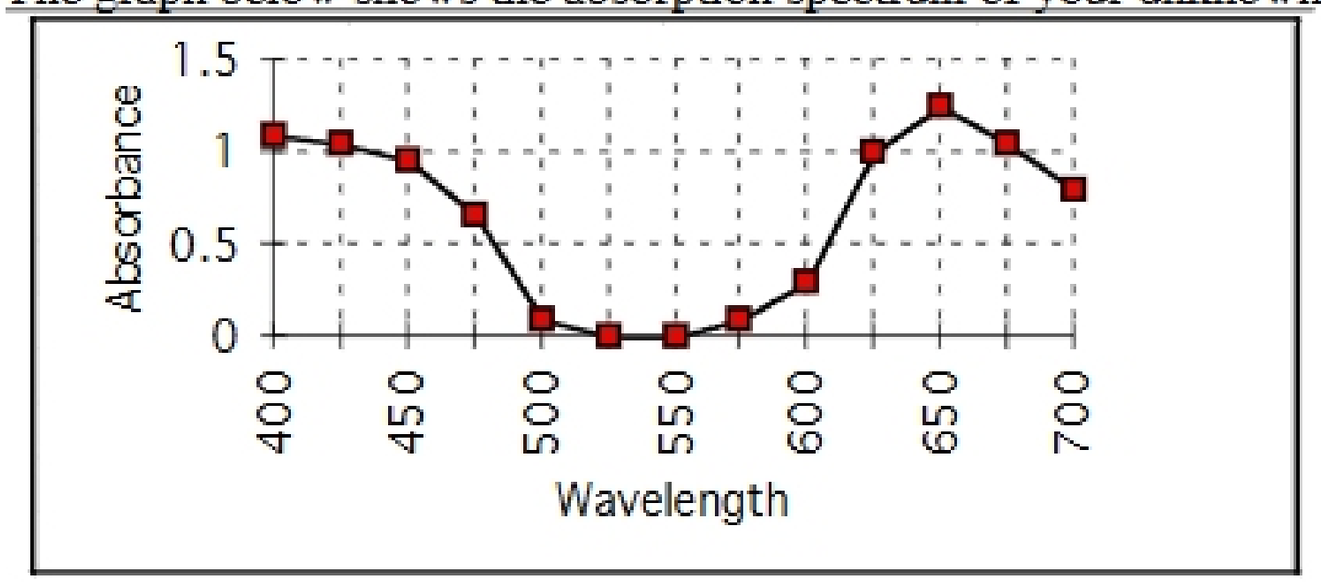
2. Below are the electron configurations for the ions Mn^{2+} and Pb^{2+} and their elements. Will solutions of $MnSO_4$ and $PbBr_2$ be colored or colorless?
note: sulfate and bromide ions are colorless.

Element	Electron Configuration Of *element*	Ion	Electron Configuration of *Ion*	Solution	**Colored or colorless?**
Mn	$[Ar]3d^5 4s^2$	Mn^{2+}	$[Ar]3d^5$	$Mn(SO_4)$	
Pb	$[Xe]5d^{10}6s^2 6p^2$	Pb^{2+}	$[Xe]\ 5d^{10}6s^2$	$PbBr_2$	

(now try Nov. '07, 4E; March'07, 1B, 3B; Nov.06, 1E; March'06 1C; Nov'05, 1C, 2B-C, 3A; March'05, 1D)

Parts 2-3 Wavelength Color; Color and Light Absorption (Spectra)

3. The graph below shows the absorption spectrum of your unknown:



Information: λ400-450 = violet; 450-500 = blue; 500-550 = green; λ550-600 = yellow; 600-625 = orange, 625-700 = red