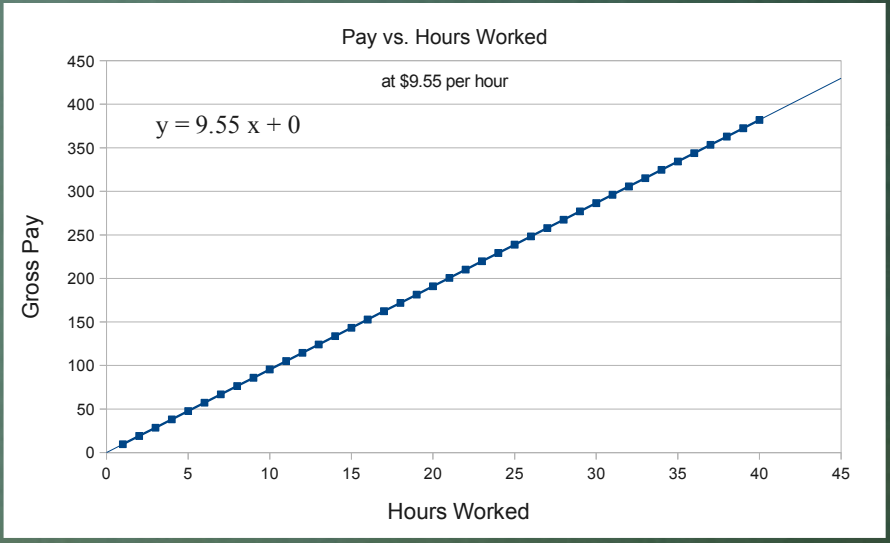
8: Standard Curves and Beer's Law

- Linear relationships
- Beer's Law
- Standard Curves
- Today's Lab: Measuring iron in a vitamin

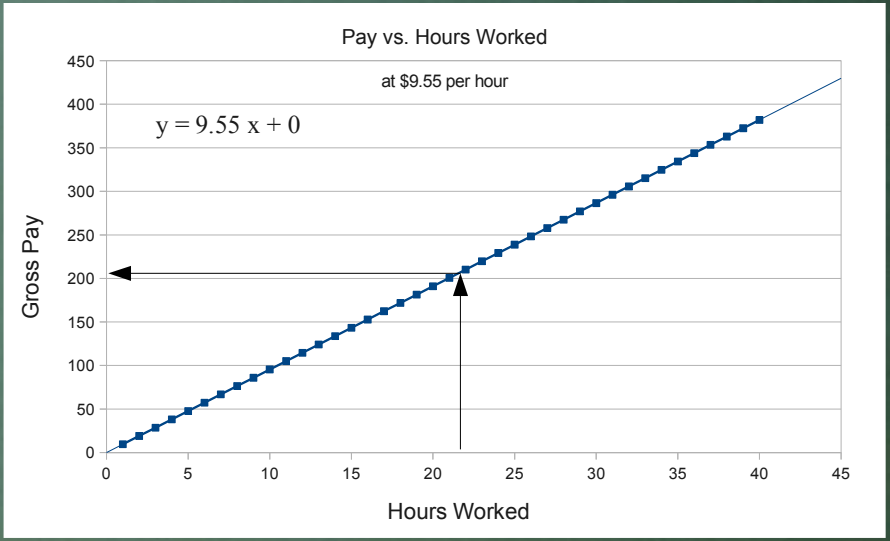
Linear Relationships

- Refer to graph as “'y' versus 'x'”
- Independent on 'x', Dependent on 'y'



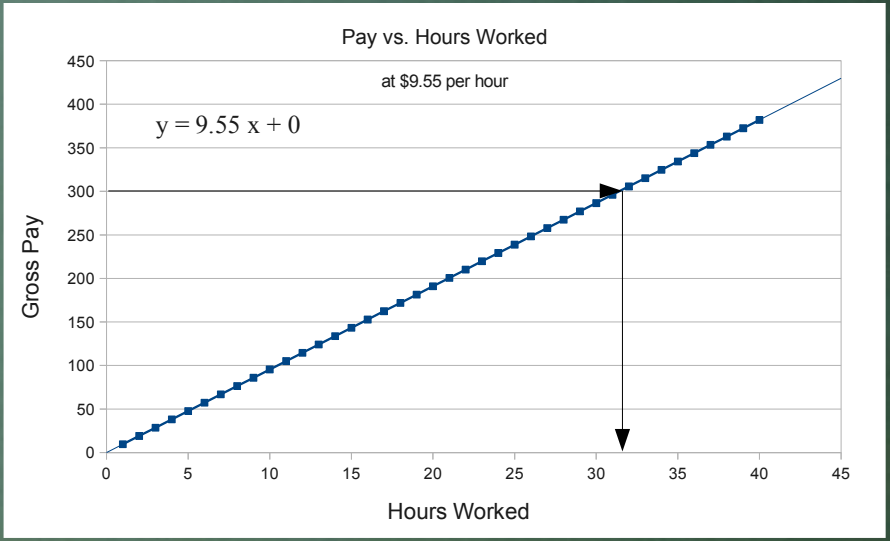
Linear Relationships

- If worked 21.5 hrs, how much do you earn?
  - pay = $9.55(21.5) = $205.32



Linear Relationships

- If need $300, how many hours to work?
  - $300 = $9.55 (hrs) hrs = $300/$9.55 = 31.4



Beer-Lambert Law

$$A = \varepsilon \times c \times l$$

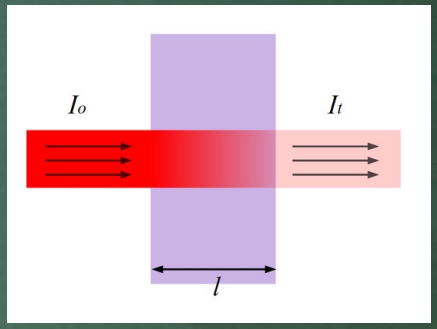
A = Absorbance (no units)
c = concentration (M)
l = path length (cm)
ε = molar absorptivity ($M^{-1} \cdot cm^{-1}$)

Figures from http://www.tau.ac.il/~phchlab/experiments_new/kinetics/kinetics.html

What is Absorbance?

$$A = \varepsilon \times c \times l$$

Transmittance (T) = I_t / I_0



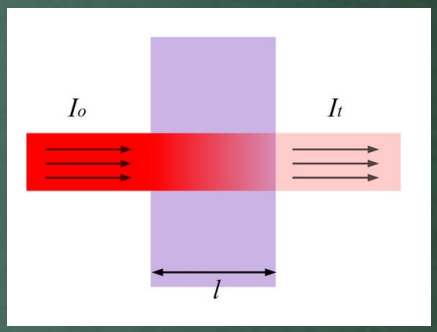
Absorbance (A) = - log(T)

Figures from http://www.tau.ac.il/~phchlab/experiments_new/kinetics/kinetics.html
http://chemwiki.ucdavis.edu/Physical_Chemistry/Kinetics/Reaction_Rates/Experimental_Determination_of_Kinetcs/Spectrophotometry

Absorbance and Transmittance

Transmittance (T) = I_t / I_0

$I_0 = 10$, $I_t = 5$ $T = 0.5$ (50%)



Absorbance (A) = - log(T)

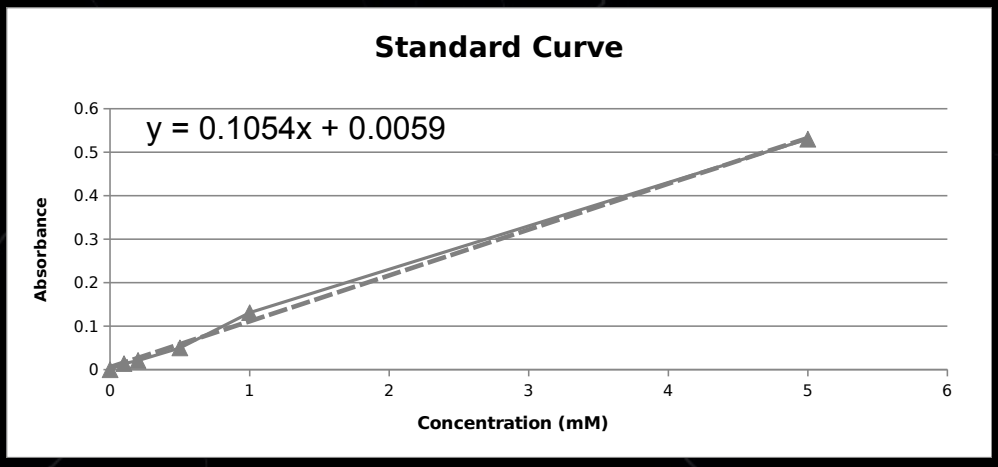
A = -log(0.5) = 0.30

T = 0 – 1 (0 – 100%)

A = 0 – ~2

Figures from http://www.tau.ac.il/~phchlab/experiments_new/kinetics/kinetics.html
http://chemwiki.ucdavis.edu/Physical_Chemistry/Kinetics/Reaction_Rates/Experimental_Determination_of_Kinetcs/Spectrophotometry

Standard Curves



- Make series of standards of known concentration
- Measure absorbances of standards
- Measure absorbance of unknown
- Plot standard curve using standards
- Determine unknown concentration

Today's Lab

Determine Iron Concentration in a Vitamin

- Digest vitamin in acid (Unknown Digested Soln)
- Make standards of known Fe conc (µg/L)
- Prepare Unknown Stock then Unknown Sample
- Measure absorbances with Spec 20
- Plot standard curve and determine Fe in Unknown Sample Soln
- Calculate Fe conc in Unknown Stock then Unknown Digested
- Calculate MASS Fe in Unknown Digested then vitamin