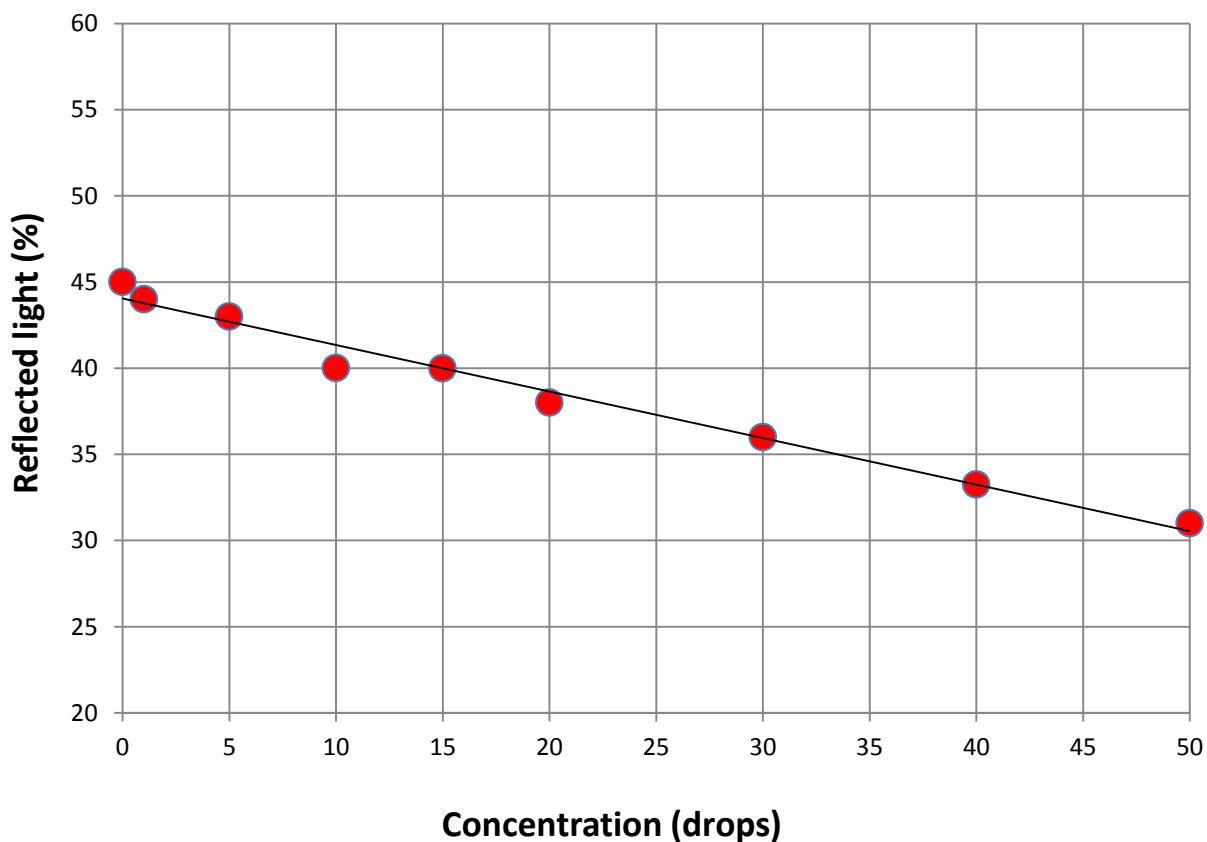


Determining Concentration Worksheet **Answers**

Fill in this table with the reflected light values for standards A-G and the two unknown samples.

	Sample	Concentration (drops/20 ml)	Reflected light (%)
Standards	A	50	31
	B	30	36
	C	20	38
	D	10	40
	E	5	43
	F	1	44
	G	0	45
Unknowns	1	?	40
	2	?	33

Plot the reflected light values for the standards versus the concentration below.



Name: _____ Date: _____ Class: _____

Instructions for determining the concentrations of your unknown solutions:

1. Plot a straight line through as many of the points that you plotted for the standards as you can. Use a ruler to draw a line that best fits the data. Look at all the points and line up the ruler so that some of the points fall above the line, and some below. Draw a single line that that passes through the *middle* of the points.
2. Locate the reflected light value for Unknown 1 on the y-axis. Match it to the location on the standards line; then see what the corresponding concentration is.

Concentration of Unknown 1: 15 drops/vial

Repeat for Unknown 2.

Concentration of Unknown 2: 40 drops/vial

Answer the following questions.

1. Determine the percent change between the reflected light value of Standard A and Standard D.

$$\text{percent change} = \left(\frac{|\text{Reflected light}_{\text{Standard A}} - \text{Reflected light}_{\text{Standard D}}|}{\text{Reflected light}_{\text{Standard A}}} \right) \times 100$$

$$\text{percent change} = \left(\frac{|A - D|}{A} \right) \times 100$$

$$\text{percent change} = \left(\frac{|31 - 40|}{31} \right) \times 100 = \left(\frac{9}{31} \right) \times 100 = 0.2903 \times 100$$

$$\text{percent change} = 29.0 \%$$

2. Determine the percent change between the concentration of Standard A and Standard D.

$$\text{percent change} = \left(\frac{|\text{Concentration}_{\text{Standard A}} - \text{Concentration}_{\text{Standard D}}|}{\text{Concentration}_{\text{Standard A}}} \right) \times 100$$

$$\text{percent change} = \left(\frac{|A - D|}{A} \right) \times 100$$

$$\text{percent change} = \left(\frac{|50 - 10|}{50} \right) \times 100 = \left(\frac{10}{50} \right) \times 100 = 0.2000 \times 100$$

$$\text{percent change} = 20.0 \%$$

3. Compare your answers to questions 1 and 2. What do you notice?

The percent change between reflectivity values and the concentrations are very similar, being 29% and 20%, respectively. (Ideally these values should be equal, but they are unequal due to experimental error.)

4. The actual concentration for Unknown 1 is **15 drops/cuvette**, and the actual concentration for Unknown 2 is **40 drops/cuvette**.

Calculate the *percent error* for the concentration you determined for your Unknowns. Use the following formula:

$$\text{percent error} = \left(\frac{|\text{experimental} - \text{actual}|^1}{\text{actual}} \right) \times 100$$

Unknown 1

$$\begin{aligned} \% \text{ error} &= (15-15)/15 \times 100 \\ &= 0 \times 100 \\ &= 0 \% \end{aligned}$$

Unknown 2

$$\begin{aligned} \% \text{ error} &= (40-40)/40 \times 100 \\ &= 0 \times 100 \\ &= 0 \% \end{aligned}$$

(Expect students to obtain experimental errors not equal to 0 since their experimental values will differ from the actual values.)

¹ At this point (but not before), provide actual values to the class.