FLINN SCIENTIFIC

Name_____

Laboratory Report

Observation Table

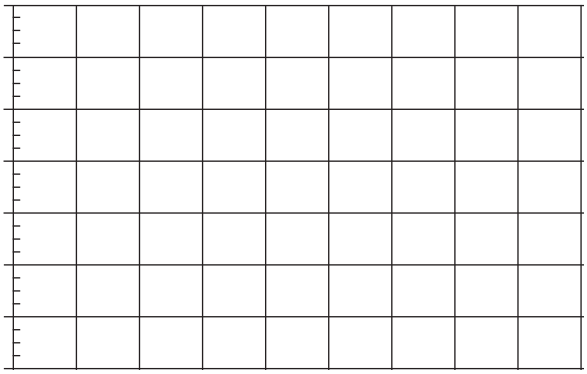
Reduction of gold(III) (step 5)	
Color and appearance of colloidal gold (step 8)	
Interaction of colloidal gold with light (step 9)	
Dilution of colloidal gold with NaCl versus water (step 11)	

Spectrum of Colloidal Gold

Wavelength (nm)	Absorbance	Wavelength (nm)	Absorbance	Wavelength (nm)	Absorbance
420		520		620	
440		540		640	
460		560		660	
480		580		680	
500		600		700	

1. Compare the Tyndall effect observed in colloidal gold (step 9) with what happens when light is shone through water. What is responsible for the Tyndall effect?

2. Plot the absorbance of colloidal gold versus wavelength on the following graph.



Red blood cell (Scale: 1 μm = 220 mm)

3. Relate the wavelength(s) of maximum light absorption to the observed (transmitted) color of the liquid.

4. Adding sodium chloride causes the gold nanoparticles in colloidal gold to clump together into larger particles. Based on the observed color change when NaCl was added to colloidal gold, would you expect its wavelength of maximum absorption to shift toward higher or lower wavelengths?

5. The colloidal gold in this experiment was prepared starting with 20 mL of 1×10^{-3} M $HAuCl_4$.

   a. How many grams of gold (Au = 197 g/mole) are contained in the flask of colloidal gold?

   b. At a current price of $1225 per Troy ounce (1 Troy ounce = 31.1 g) for gold, how much is the gold in the flask worth?

6. **Estimate** the number of gold atoms in a single gold nanoparticle that is 40 nm in diameter. Use the following assumptions: (a) The radius of a gold atom is 0.15 nm. (b) Both particles are the shape of a sphere. The volume of a sphere is $4/3\pi r^3$, where r is the radius. (c) Only 74% of the total volume of the nanoparticle is physically occupied by gold atoms. (The rest of the volume is "empty space" between atoms.)