

Question 6: Short Answer**4 points**

(a) For the correct answer: **1 point**

525 nm

(b)(i) For the correct answer: **1 point**

92.0 mL

(ii) For the correct calculated value: **1 point**

$$V_1 = \frac{M_2 V_2}{M_1} = \frac{(1.68 \times 10^{-3} M)(100.0 \text{ mL})}{(2.40 \times 10^{-3} M)} = 70.0 \text{ mL}$$

Total for part (b) 2 points

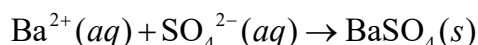
(c) For the correct answer and a valid justification: **1 point**

The student could have improperly executed step 3. If the cuvette was not rinsed with the standard solution prior to being filled for the measurement of absorbance, the standard solution would be diluted by the remaining distilled water, and the absorbance would be lower than what it should be.

Total for question 6 4 points

Question 3: Long Answer**10 points**

- (a) For the correct balanced equation (state symbols not required): **1 point**



- (b) For the correct calculated value of the mass of precipitate (may be implicit): **1 point**

$$1.136 \text{ g} - 0.764 \text{ g} = 0.372 \text{ g BaSO}_4$$

- For the correct calculated value of the number of moles, consistent with mass of precipitate: **1 point**

$$0.372 \text{ g} \times \frac{1 \text{ mol}}{233.39 \text{ g}} = 0.00159 \text{ mol}$$

Total for part (b) 2 points

- (c) For the correct calculated value, consistent with part (b): **1 point**

$$0.00159 \text{ mol BaSO}_4 \times \frac{1 \text{ mol CuSO}_4}{1 \text{ mol BaSO}_4} = 0.00159 \text{ mol CuSO}_4$$

$$\frac{0.00159 \text{ mol CuSO}_4}{0.0500 \text{ L}} = 0.0318 \text{ M CuSO}_4 \quad (0.0319 \text{ M if decimals are carried})$$

- (d) For the correct calculated value: **1 point**

$$M_1V_1 = M_2V_2$$

$$V_1 = \frac{(0.0500 \text{ M})(50.00 \text{ mL})}{(0.1000 \text{ M})} = 25.0 \text{ mL}$$

- (e) For a correct technique to measure the volume of solution: **1 point**

First, measure out the correct volume of 0.1000 M CuSO₄ solution with a 25.0 mL volumetric pipet (graduated cylinder or buret is acceptable).

- For a correct technique to dilute the solution to the final volume: **1 point**

Transfer the 25.0 mL of solution to a 50.00 mL volumetric flask and dilute the solution with water up to the 50.00 mL mark.

Total for part (e) 2 points

- (f) For the correct value (between 0.032 M and 0.038 M): **1 point**

Accept one of the following:

$$\bullet \quad y = mx = \frac{0.63}{0.1000} x = 6.3x$$

$$x = \frac{y}{6.3} = \frac{0.219 \text{ M}}{6.3} = 0.035 \text{ M}$$

- *Estimated value from the graph within the specified range.*

(g)	For the correct answer:	1 point
<i>The concentration will be <u>less than</u> that determined in part (f).</i>		
For a valid justification:		1 point
<i>The additional water will decrease the concentration of CuSO_4 in the cuvette. Therefore, there will be a decrease in absorbance (according to the Beer-Lambert law). This dilution results in a lower estimated concentration of CuSO_4.</i>		
Total for part (g)		2 points
Total for question 3		10 points