Question 3: Long Answer | 10 points

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

$$\text{Ba}^{2+}(aq) + \text{SO}_4^{2-}(aq) \rightarrow \text{BaSO}_4(s)$$
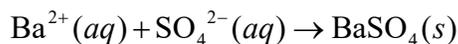
(b)	For the correct calculated value of the mass of precipitate (may be implicit):	**1 point**

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

	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**

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

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

(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:

- $y = mx = \dfrac{0.63}{0.1000}x = 6.3x$

  $x = \dfrac{y}{6.3} = \dfrac{0.219 \text{ M}}{6.3} = 0.035 \text{ M}$
- *Estimated value from the graph within the specified range.*

| **(g)** | For the correct answer: | **1 point** |
| | *The concentration will be <u>less than</u> that determined in part (f).* | |

| For a valid justification: | **1 point** |
| *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$_4$.* | |

Total for part (g)   **2 points**

Total for question 3   **10 points**