16. \( A = e b c \)

a. \( C = \frac{A}{eb} = \frac{0.427}{(6130 \text{ M}^{-1} \text{ cm}^{-1}) (1.00 \text{ cm})} = 6.97 \times 10^{-5} \text{ M} \)

b. \( 6.97 \times 10^{-5} \text{ M} = 6.97 \times 10^{-4} \text{ M} \)

\( \frac{1}{10} \)

c. \( \frac{5.00 \text{ mL}}{1000 \text{ mL}} \frac{6.97 \times 10^{-4} \text{ mol}}{1 \text{ mL}} \frac{292.16 \text{ g}}{1000 \text{ mg}} = 1.02 \text{ mg} \)

18. \( A = e b c \)

a. \( \varepsilon = \frac{A}{eb} = \frac{0.267 - 0.019}{(1.00 \text{ cm}) (3.15 \times 10^{-6} \text{ M})} = \frac{78730 \text{ M}^{-1} \text{ cm}^{-1}}{100 \text{ cm}} \)

b. \( \frac{c}{e b} = \frac{0.175 - 0.019}{(78730 \text{ M}^{-1} \text{ cm}^{-1}) (1.00 \text{ cm})} = 1.98 \times 10^{-6} \text{ M} \)

19. a. Absorbance \( A \) due to known amount of \( \text{NO}_2^- \)

\( = 0.967 - 0.622 = 0.345 \)

Concentration of known \( \text{NO}_2^- = 7.50 \times 10^{-3} \text{ M} (10.0 \text{ mL}) \)

\( \varepsilon = \frac{A}{eb} = \frac{0.345}{(5.00 \text{ cm})(1.39 \times 10^{-6} \text{ M})} = \frac{7.5 \times 10^{-5} \text{ mol}}{0.0547} = 1.39 \times 10^{-6} \text{ M} \)

\( = 49680 \text{ M}^{-1} \text{ cm}^{-1} \)

b. \( \frac{7.50 \times 10^{-8} \text{ mol}}{0.467} \times 10^7 \text{ mol} = 1.02 \times 10^{-7} \text{ mol} \text{ NO}_2^- \)

\( 1.02 \times 10^{-7} \text{ mol} \text{ NO}_2^- \frac{46 \text{ g}}{1 \text{ mol}} \frac{10^6 \mu g}{1 \text{ g}} = 4.69 \mu g \text{ NO}_2^- \)
Fluorescence is emission of a photon with an electronic transition from an excited singlet state to the ground singlet state. The lifetime of the excited singlet state is very short. Phosphorescence is emission of a photon with an electronic transition from a triplet state to a singlet state. The lifetime of the excited triplet state is relatively long.

Luminescence results after a molecule absorbs light. Chemiluminescence results from the product of a chemical reaction that is in the excited state.

For an excitation spectrum the λ of the spectrometer’s light source is varied and light of a specific emission λ is monitored. For an emission spectrum, the excitation λ is held constant and the measured emission λ is varied. The excitation spectrum resembles an absorption spectrum because emission is proportional to absorption.