

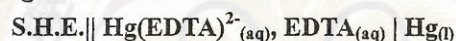
1. A solution containing 3.47 mM X (analyte) and 1.72 mM S (standard) gave peak areas of 3473 and 10222, respectively, in a chromatographic analysis. Then 1.00 mL of 8.47 mM S was added to 5.00 mL of unknown X, and the mixture was diluted to 10.0 mL. This solution gave peak areas of 5428 and 4431 for X and S, respectively.

- Calculate the response factor for the analyte.
- Find the concentration of X in the original unknown. 16pts

2. a. A chromatography column with a length of 10.3 cm and inner diameter of 4.61 mm is packed with a stationary phase that occupies 70.0% of the volume. If the volume flow rate is 1.13 mL/min, find the linear flow rate in cm/min.

- How long does it take for solvent which is the same as unretained solute to pass through the column?
- Find the retention time for a solute with a capacity factor of 10.0. 18 pts

3. The following cell is used to measure the formation constant of $\text{Hg}(\text{EDTA})^{2-}$:



The right-hand compartment contains 0.500 mmol of Hg^{2+} and 2.00 mmol of EDTA in 0.100 L buffered to pH 6.00. The voltage is 0.300 V. Find the value of K_f for $\text{Hg}(\text{EDTA})^{2-}$. Given $\text{Hg}^{2+} + 2e^- \rightleftharpoons \text{Hg}_{(\text{l})}$ $E^0 = 0.852 \text{ V}$ and $\alpha_{Y4-} = 1.8 \times 10^{-5}$ at pH 6.00. 16pts

4. A compound with molecular mass 292.16 g/mol was dissolved in a 5 mL volumetric flask. A 1.00 mL aliquot was withdrawn, placed in a 10 mL volumetric flask, and diluted to the mark. The absorbance at 340 nm was 0.427 in a 1.00 cm cuvet. The molar absorptivity at 340 nm is $6130 \text{ M}^{-1}\text{cm}^{-1}$.

- Calculate the concentration of compound in the cuvet.
- How many milligrams of compound were used to make the 5 mL solution? 16pts

5. If the $^3P_{2,1,0}$ states of Hg are thermally populated in a flame at 3000 K, calculate the ratio of the populations of the 3P_2 and 3P_0 levels. The splitting is 6398 cm^{-1} . Boltzmann constant, $k = 1.38 \times 10^{-16} \text{ erg K}^{-1}$, $1 \text{ cm}^{-1} = 1.986 \times 10^{-16} \text{ erg}$. 16 pts

6. Calculate pCo^{2+} at each of the following points in the titration of 25.00 mL of 0.020 M Co^{2+} by 0.038 M EDTA at pH 8.00:

- 12.00 mL;
- equivalent point;
- 14.00 mL.

Given at pH 8.00: $K_f = 2.82 \times 10^{17}$; $\alpha_{Y4-} = 4.2 \times 10^{-3}$. 18 pts