20% 1. 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:

    a. 12.00 mL;

    b. equivalent point;

    c. 14.00 mL.

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

20% 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.

    b. How long does it take for solvent which is the same as unretained solute to pass through the column?

    c. Find the retention time for a solute with a capacity factor of 10.0.

20% 3. According to Beer's law, given b = 1cm, $\varepsilon = 10000$ $M^{-1}cm^{-1}$ for a substance measured at $\lambda = 600$ nm, and the acquired $T = 0.20 \pm 0.02$, estimate the concentration of the substance including the uncertainty.

20% 4. Drugs often absorb strongly in the uv. As an example, $\varepsilon_{254} = 16000$ and $\varepsilon_{267} = 19000$ for tetracycline, while $\varepsilon_{254} = 16000$ and $\varepsilon_{267} = 15000$ for epi-tetracycline, an inactive hydrolysis product. If a mixture exhibits absorbances of 0.402 at 254 nm and 0.432 at 267 nm, what is the concentration of each compound ?

20% 5. The following cell is used to measure the formation constant of $Hg(EDTA)^{2-}$:

    S.H.E. ‖ $Hg(EDTA)^{2-}_{(aq)}$, $EDTA_{(aq)}$ │ $Hg_{(l)}$

    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 $Hg(EDTA)^{2-}$.

    Given $Hg^{2+} + 2e^- \Leftrightarrow Hg(l)$　　$E° = 0.852$ V

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