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1. Because of matrix effects, a multiple standard addition method was used to determine potassium concentration on a large (100 ml) pooled blood sample. Flame emission spectroscopy was the technique used. After appropriate correction for the background signal from the flame at 768 nm, a small aliquot of the original sample was aspirated into the instrument and a relative response of 10 units was observed. Addition of 0.1 mmoles of solid KCl to the original 100 ml sample yielded a response of 15 units. Two subsequent additions of 0.2 mmoles of KCl yielded responses of 24 and 37 units respectively. Using a linear least squares fit of the data, determine the original concentration of potassium in the blood. Compare this value to the one that would have been obtained if only the first 0.1 mmole addition of KCl was used for the determination. (Assume that initial volume of blood sample remains constant, e.g., very little blood is taken for each measurement in the flame based instrument).

2. For the following circuit, what would be the % error in the measurement of the voltage across resistor R_1 if the internal resistance of the voltmeter was only 1 k and Vs. - 12 V.
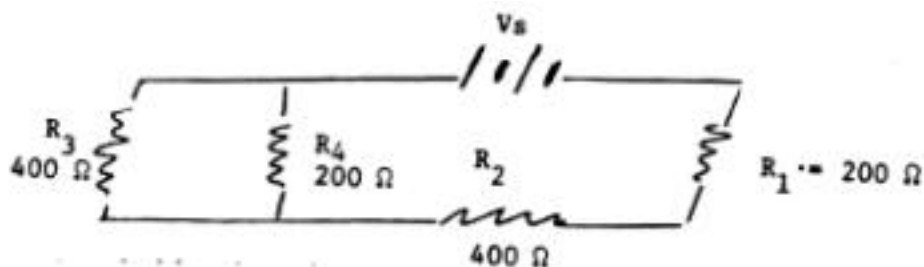
3. A 24 V dc potential was applied across a 10 M resistor and a 0.02 µF capacitor in series. Calculate the current after 0, 0.01, 0.1, 1.0 and 10 sec.

4. Design an appropriate operational amplifier-based detector which could be used to measure the conductance of the effluent from an ion-chromatography experiment. Assume you have a strip chart recorder with a full scale 1-volt input which you wish to use to record the chromatogram as the ions are eluted. Assume that the resistance of the solution is on the order of 10 M when no ions are being eluted.

5. An amperometric method useful for the determination of ascorbic acid (vitamin C) in fruit juices displays a sensitivity of 10 µA per milli molar concentration of ascorbate. Assuming that the standard deviation of the blank signal (no ascorbate) is ±20 nA, calculate the molar detection limits of the method assuming that S/N = 3 defines the lower limit of detection.

6. Besides responding to ascorbic acid, the above amperometric method also exhibits some response to uric acid and acetaminopher. Specifically the sensitivity to uric acid is 1.5 µA/mM and the sensitivity toward acetaminophen is 2.5 µA/mM. Calculate the selectivity coefficient of this acetaminophen relative to the major analyte, ascorbic acid.