A. (10) Calibration.

1. (2) It is generally satisfactory to correct Hg manometer and barometer readings by taking into account just the dependence on the Hg thermal expansivity $\alpha$. If $\alpha = 6.0 \times 10^{-5} \text{ K}^{-1}$, what is the pressure difference in Torr when a manometer shows a difference of 306.2 mm Hg at $t = 23^\circ\text{C}$?

2. (2) Calibration data for a thermistor are as shown in the accompanying graph. If the true temperature is $-30.0^\circ\text{C}$, what does the thermistor read?

3. (6) A thermistor has a resistance of 13.27 k$\Omega$ at 10.0$^\circ\text{C}$ and 1.557 k$\Omega$ at 50.0$^\circ\text{C}$. The resistance is measured to be 8.93 k$\Omega$ when the thermistor is immersed in a bath of unknown $T$. What is the apparent temperature of the bath?
B. (16) Smucrose\(^{-1}\).

1. (4) Getting Started. Polarimetry is used to study the inversion process for a newly discovered sugar, smucrose. Initially a 20.0-cm polarimeter tube is charged with a solution of smucrose and \(\text{HCl}(aq)\) prepared by mixing 15.0 mL of a stock smucrose solution with 25.0 mL of 4.0 M HCl. At the start of the inversion reaction, the measured rotation of the polarimeter is 10.4°, and after a very long time, the rotation is measured to be –15.2°. The specific rotation \(\alpha_T^\lambda\) for smucrose is 36.4 degree dm\(^{-1}\) mL g\(^{-1}\) at the temperature and wavelength used in the experiment. Calculate the initial concentrations in the polarimeter tube, of (1) smucrose, and (2) HCl. [Assume volumes are additive.]

2. (6) Inverting. The reaction is found to reach the inversion point after 33 min. Calculate (1) the effective rate constant \(k_{\text{eff}}\) and (2) the rate constant \(k_H\).

3. (6) Getting Warmer. The rate constant is found to increase by a factor of 2.55(9) when the temperature is increased from 20.0°C to 40.0°C. Calculate the activation energy \(E_a\) and its uncertainty. \([R = 8.3145 \text{ J mol}^{-1} \text{ K}^{-1}]\).