Temperature and Pressure Calibration

A. Pressure

1. *Reference*: Hg manometer $\rightarrow$ 1 Torr $\approx$ 1 mm Hg

   1 Torr $\equiv \frac{1}{760}$ atm $\equiv \frac{1}{760}$ 101 325 Pa

2. *Temperature correction* (for T dependence of ρ for Hg)

   [Eqs. (6), p. 34 of CP; 2nd form adequate]

3. *Open-ended manometer*: Δh(mm) for Hg $\approx P_{atm} - P_{sys}$ (Torr); get P_{atm} from *barometer*.

4. *Device*: *Capacitance Manometer*

   a. $V \sim$ linear in P for any gas

   b. Gives 10.0 V full scale (0-100 Torr or 0-1000 Torr)

5. *Correction Plot*: $\Delta P \equiv P_{true} - P_{app}$ vs. P_{app}; then

   $$P_{true} = P_{app} + \Delta P$$

B. Temperature

1. *Reference*: Hg thermometer → must check at ice point or refer to calibration data from manufacturer.
2. *Device*: *Thermistor* ("thermally sensitive resistor")
   a. $R \approx R_\infty \exp(\Delta E/2kT)$ (T in K !!)
   b. Very sensitive but not very accurate.
3. *Correction Plot*: $\Delta T \equiv T_{\text{true}} - T_{\text{app}}$ vs. T_{app}; then

   $$T_{\text{true}} = T_{\text{app}} + \Delta T$$ [*i.e.*, same approach]

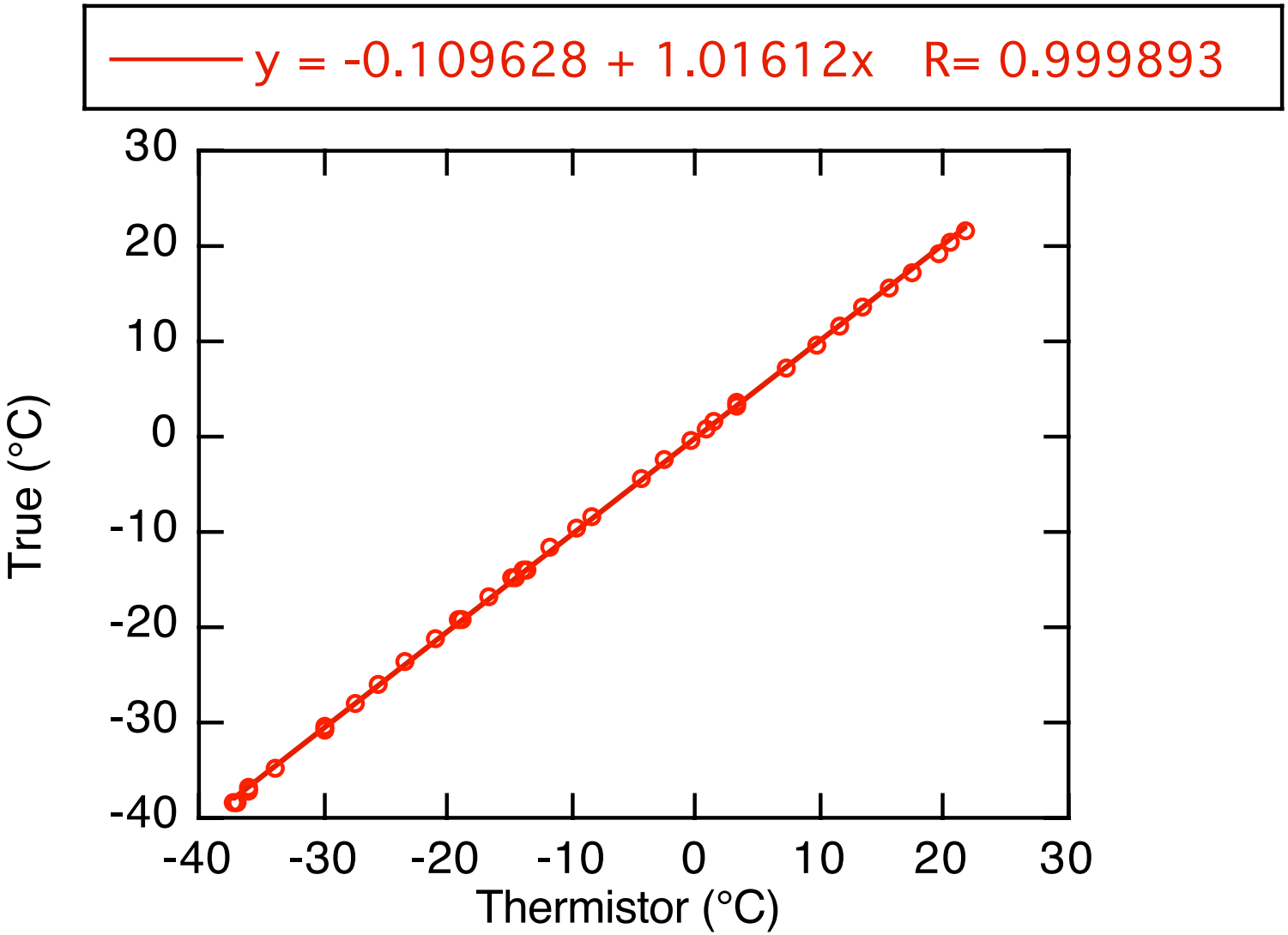
C. Two-Point Formulas

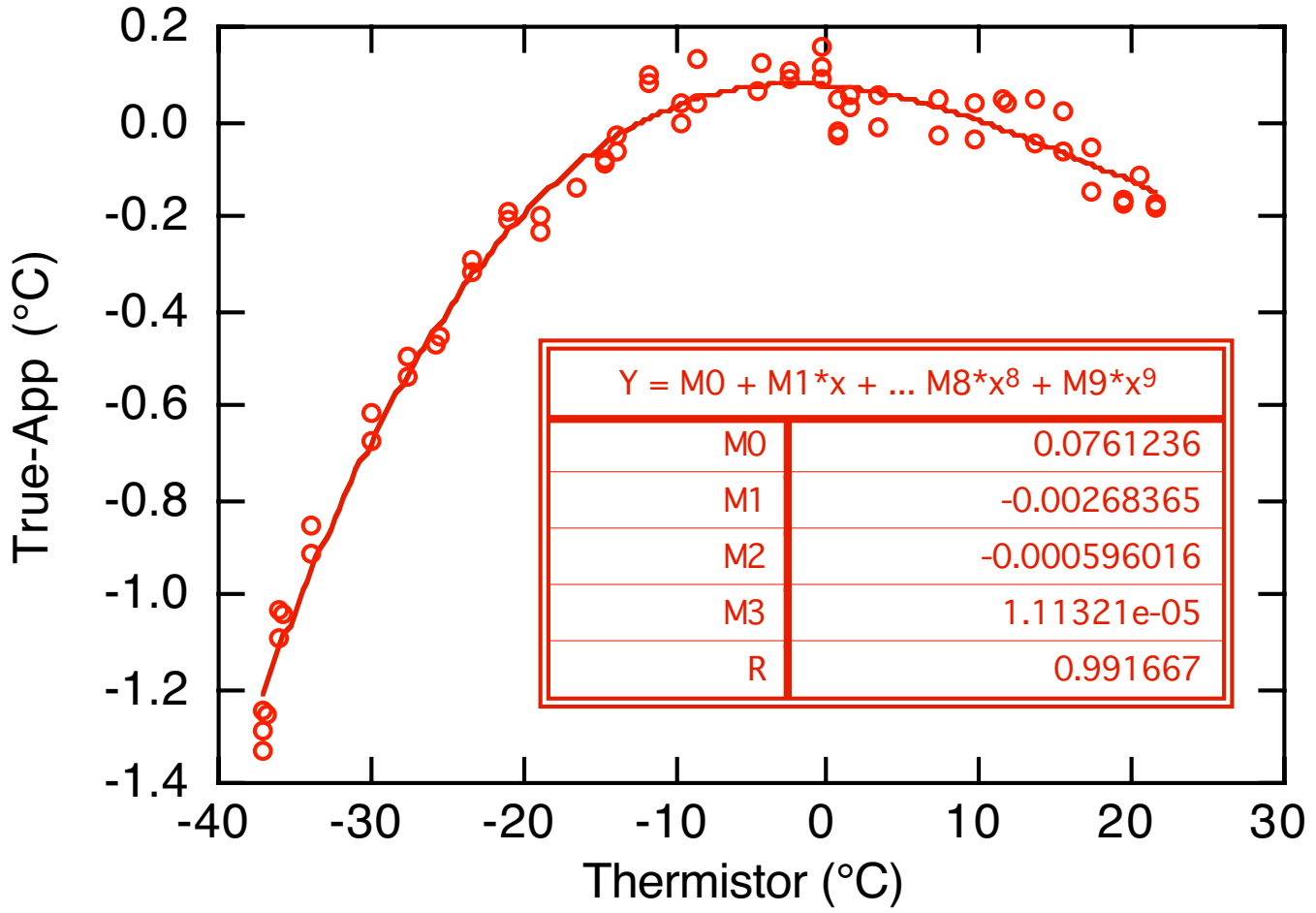
1. *Linear*: $y = a + b\,x \;\rightarrow\; y_1 = a + b\,x_1$ & $y_2 = a + b\,x_2$

   solve for a and b → calculate y_i for any x_i.
2. *Exponential*: Use logarithms and do same →

   $$\ln(R) = \ln(R_\infty) + \Delta E/2kT \equiv a + b/T\,.$$

D. Illustrations





E. Required Submission? — virtually NO writeup here, but we do want figures and tables with good, descriptive, self-contained *captions*.

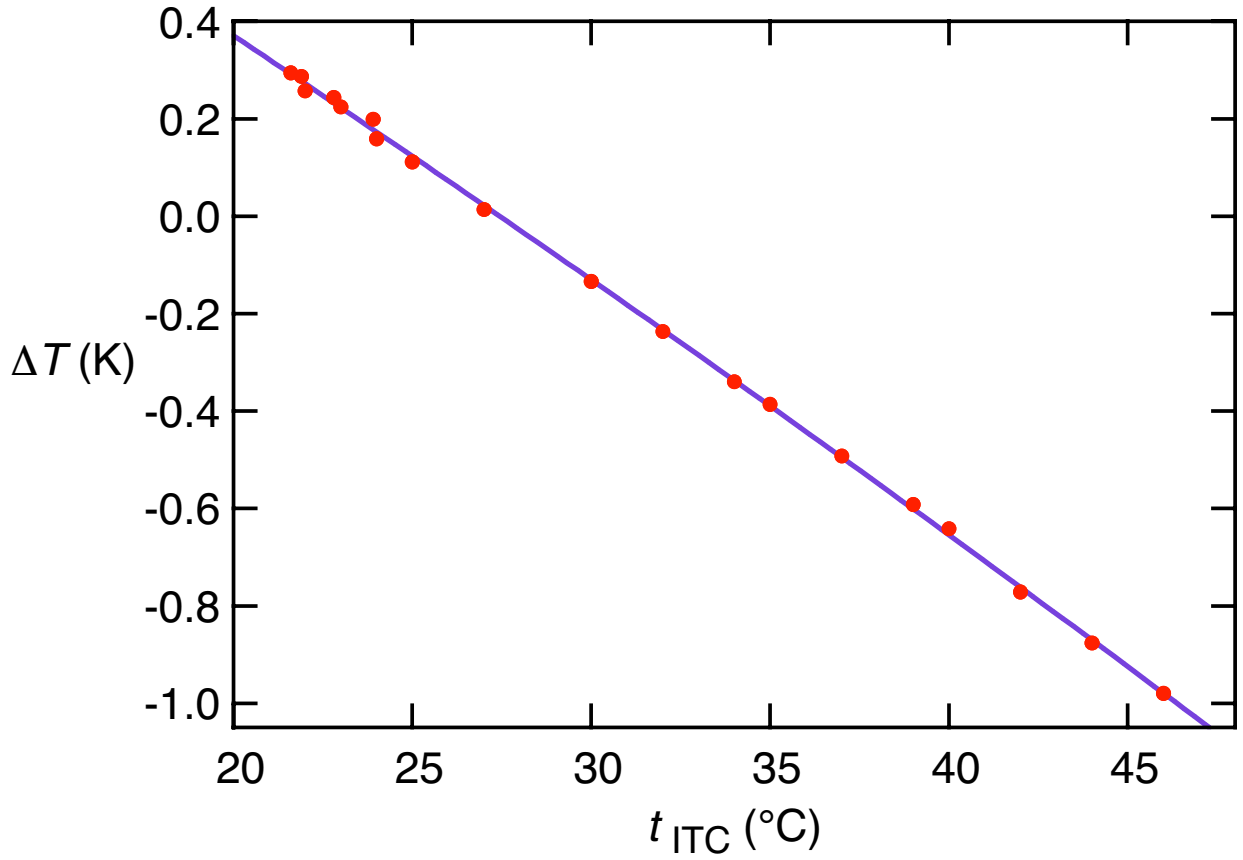


Figure 5. VP-ITC temperature correction (true - fiducial) over the stated range. The curve is a fitted quadratic in the argument (*t* - 25°) and gives an error of 0.123(3) K at 25°C. Most values beyond 25° were recorded after the VP-ITC instrument had equilbrated at the specified temperature.