

# Midterm Problems

January 21, 2022

1. **Barometric Formula** The barometric formula is given by

$$P_h = P_0 e^{-\frac{Mgh}{RT}}$$

where  $P_h$  is the pressure at height  $h$ ,  $P_0$  is the pressure at ground level,  $M$  is the molar mass of air (28.97 g/mol),  $R$  is the gas constant, and  $T$  is the temperature. This formula has been used to approximate the elevations of mountains.

(a) A hiker brings a mercury barometer to measure the height of Mount Everest. At the summit, the hiker reports the barometric pressure to be 253.0 Torr at  $-9^\circ\text{C}$ . Use the derived barometric formula to approximate the height of Mount Everest.

(b) Mount Everest has an official height of 8,485 meters. Is the calculated height in (a) overestimated or underestimated? Explain potential errors.

(c) Given the barometric pressure in (a), compute the partial pressure of  $\text{O}_2(\text{g})$  assuming that the atmosphere is made of 20%  $\text{O}_2$ . Given the oxyhemoglobin dissociation curve, estimate the percent hemoglobin saturated with  $\text{O}_2$ .

