

ENV 407 – Atmospheric Processes: From Clouds to Global Scales
Hydrostatic Equilibrium – Hypsometric Equation

1. Using the equation we derived for barometric pressure as a function of altitude calculate H for a dry atmosphere with an effective temperature of 273°K.

2. For the value of H calculated above determine the altitude where $P = 0.5 \text{ atm}$.

3. For the value of H calculated above what is the air pressure in atmospheres at the top of Mt Everest (8.85km)?

4. On Mars the atmosphere is mainly CO₂, the temperature is 220°K and the acceleration of gravity is 3.7 m/s². What is the scale height of the Martian atmosphere? Compare the scale height to the Earth's atmosphere and explain why they scale heights are different.

5. A barometer with a cross sectional area of 1.00 cm^2 at sea level measures a pressure of 76.0 cm of mercury. The pressure exerted by this column of mercury is equal to the pressure exerted all the air on 1 cm^2 of earth's surface. Given the density of mercury of 13.6 g/cm^3 and the average radius of the earth of 6371 km , calculate the total mass of the Earth's atmosphere in kilograms.
6. An air bubble with a radius of 1.5 cm at the bottom of a lake where the temperature is 8.4°C and the pressure is 2.8 atm rises to the surface, where the temperature is 25°C and the pressure is 1.0 atm . Calculate the radius of the bubble when it reaches the surface. Assume ideal gas behavior. The volume of a sphere is $(4/3)\pi r^3$ where r is the radius.