1. A 10 µm diameter particle of unit density falls through air starting from rest. Calculate the time required for the particle to attain 95% of the final terminal speed and the distance traveled by the particle during this time.

2. Calculate the rate of settling in air of a 200 µm diameter glass bead of density 2.5 g/cm$^3$. Calculate the beads settling velocity in water at 20°C. Repeat air and water settling calculation for a 2 µm bead.

3. A cyclone is used to measure PM2.5 by capturing all particles with aerodynamic diameter larger than 2.5 µm. If the particle is spherical with a density of 2.6 g/cm$^3$, what is the geometric diameter of the particles captured by the cyclone? Aerodynamic diameter is the diameter of a unit density (1 g/cm$^3$) sphere with same settling velocity as the particle.

4. An impactor is designed to remove particles larger than 1.0 µm diameter for aircraft measurements of PM1.0. The design assumed an ambient temperature of 20°C, 1 atm pressure, and sqrt(Stks50) = 0.48. Calculate the cut size (Dp50) of the impactor when the aircraft is sampling at higher altitudes where the ambient T is now 0°C and 1/2 atm pressure. Stks50 is a dimensionless number equal to the particle stopping distance divided by a characteristic dimension (impactor jet diam/2).

5. A bursting bubble at the ocean surface ejects a 20-µm diameter droplet vertically upwards at a speed of 10 cm/s. What is the maximum height the drop will reach in still air. (Assume Stoke’s law applies, hint: derive equations for v(t) and x(t) and note that at the maximum height, the particle velocity is zero).

6. Hinds 3.22

7. Hinds 5.8