

CEE-233 Homework 1

1. As you go through the reading material, make notes to answer the following questions.
 - a. In your own words, define the terms aerosol, particle, fume, mist, ultrafine particle, droplet, homogeneous aerosol, monodisperse aerosol, nanoparticles, equivalent diameter, mass concentration, number concentration.
 - b. Define homogeneous and heterogeneous nucleation
 - c. Name four areas of research where aerosols are important.
 - d. What are important measures of aerosol concentration?
2. In smoking one non-filter cigarette, a person inhales 350 mL of aerosol containing 20 mg of tobacco smoke particles. If these particles are standard-density spheres $0.4\ \mu\text{m}$ in diameter, how many particles does the smoker inhale from one cigarette? What is the mass concentration of the smoke? What is the ratio of this smoke concentration to the U.S. $\text{PM}_{2.5}$ standard (annual average)?
Answer: [6×10^{11} , $57\ \text{g m}^{-3}$, 4.8×10^6]
3. How many molecules are in a $0.1\ \mu\text{m}$ diameter water droplet?
Answer: [1.8×10^7]
4. Derive an expression for the surface area per kilogram of material as a function of particle size. Assume that the material is divided into spheres, each having diameter D and a density of $1000\ \text{kg m}^{-3}$. What is the surface area of 1 g of $0.1\ \mu\text{m}$ diameter particles?
Answer: [$60\ \text{m}^2$]