Today, we will:

- Finish Powerpoint slide show on particles
- Discuss particle terminology & definitions
- Define and discuss **number concentration** and how to define mean particle size
- Discuss **particle motion** – how particles move through the air; equations of motion

Example: Comparison of arithmetic mean diameter based on diameter vs. mass

Given: Three particles occupy a cubic meter, as shown in the table. The density of the particles is 1000 kg/m^3. [Some people call this *unit density*, which is the density of water.]

To do: Calculate and compare $D_{p,\text{am}}$ (diameter) and $D_{p,\text{am}}$ (mass).

Solution:

Particle ID	D_p (micron)	$m_p = (\rho_p \pi D_p^3)/6$ (μg)
1	1	5.23599×10^{-7}
2	2	4.1887×10^{-6}
3	3	1.41372×10^{-5}

Example: Calculation of number concentration from mass concentration

Given: The $PM_{2.5}$ mass concentration of a sample of city air is right at the NAAQS limit for 24-hour exposure, namely 35 μg/m^3. The density of the particles is 1250 kg/m^3. The mean particle diameter based on mass is measured to be $D_{p,\text{am}}$ (mass) = 1.5 microns.

To do: Calculate the number concentration of particles, $c_{\text{number},j}$ in units of millions of particles per cubic meter. [Be careful with the units – answer should be between 10 and 50.]

Solution:

Terminology (from Chapter 3 of Phalen and Phalen, plus other references):

- **Aerosol** = A suspension of particles in air.

- **Hydrosol** = A suspension of solid particles in water.

- **Cloud** = An aerosol volume that behaves as an ensemble.

- **Dust** = An aerosol of dry solid particles, typically supermicron.

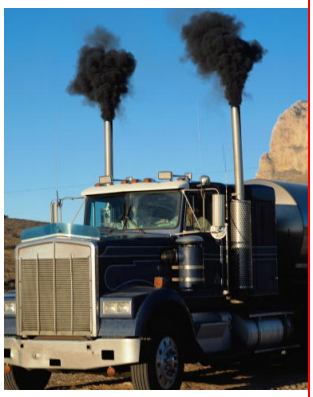
- **Fumes** = An aerosol of submicron particles, typically small condensed liquid particles from liquids or molten metals.

- **Mist** = An aerosol of liquid droplets, typically large (D_p > 20 μm for water).

- **Smoke** = An aerosol formed by combustion, typically condensed vapors plus solid (unburned) particles and soot.

- **Soot** = An aerosol of particles resulting from the incomplete combustion of hydrocarbons, typically due to lack of sufficient oxygen (fuel rich combustion), or **pyrolisis**.

- **Smog** = An aerosol of "smoke" + "fog", typically due to combustion.



Smog over Los Angeles, from http://blacklemag.com/technology/science-explains-what-causes-smog/