

Ground Level Air Pollution III– Particulate Matter

Topics covered in today’s class.

We will discuss the effect of particle pollution in the environment

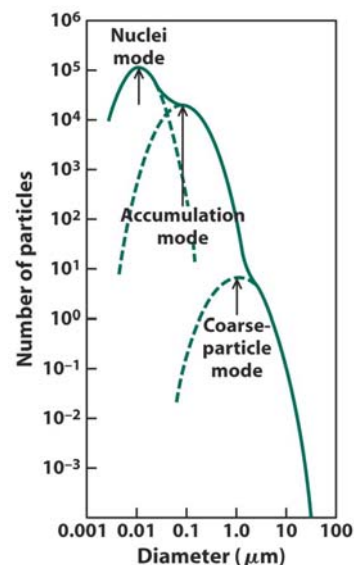
- **Common Airborne particles**
- **Distribution of particles**
- **Why particle matter matters/ health hazard**

Note:

- The presentation schedule is posted on the class website <http://www.nd.edu/~pkamat/chem20204.html>

Keypoints :

- Particulate matter is the term used for a complex mixture of solid particles and liquid droplets found in the air.
- Air pollution regulations address two size categories of particles, PM10 and PM2.5
- Since most of the fine particles in urban air are secondary, their number can only be controlled by reducing primary pollutants (NO, VOCs and SO₂)
- Distribution of Particle Sizes: Nuclei Mode, Accumulation Mode, Coarse Particle Mode
- Atmospheric particles increase the risk of cardiovascular diseases and mortality.



Solve

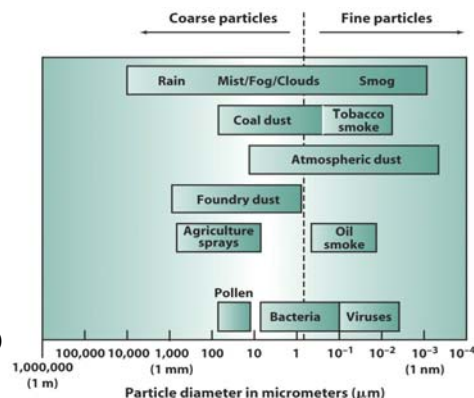
Stokes' Law describing partial sedimentation is given by

$$\text{Rate} = \frac{gd^2(\Delta\rho)}{18\eta}$$

where $g = 9.81 \text{ m s}^{-2}$ is gravitational acceleration, $\Delta\rho$ is the density difference between particles and the air, air viscosity of $\eta = 1.76 \times 10^{-4} \text{ g cm}^{-1} \text{ s}^{-1}$ and d is the particle diameter in centimeters.

- Calculate the weight of one cubic centimeter of air at 1.0 atm and 15°C.
- Assume particles have a density of 2.40 g cm^{-3} and are being released by a 200 smokestack. How long does it take a $2.5\mu\text{m}$ particle to settle to the ground?

(Hint Calculate the density of air by determining the mass of the air – assume fraction of N₂ as 0.79 and O₂ 0.21)



Have you seen buses idling in the parking lot during football home games? What will be your opinion when you see a diesel truck or a bus idling next time? Can this extra pollution be avoided?

Remember to replace the air filters in your car and furnace filter in your home regularly.