Today, we will:

- Finish talking about boundary layers with pressure gradients (finish Chapter 10)
- Begin Chapter 11 – Flow over Bodies: Drag and Lift
- Do example problems – drag and lift on bodies (cars, bicycles, airplane wings, etc.)

Comparison of two cars with identical engines, transmissions, frontal area, etc., but different aerodynamics

2005 Scion XA

EPA Mileage estimate with manual transmission: **32 City, 37 Highway**.

2005 Scion XB

EPA Mileage estimate with manual transmission: **30 City, 33 Highway**.

Conclusions:

- Mileage estimates in the city do not differ very much, since aerodynamic drag is a small percentage of total drag at low speeds.
- Mileage estimates on the highway differ more significantly, since aerodynamic drag is much more significant at highway speeds.

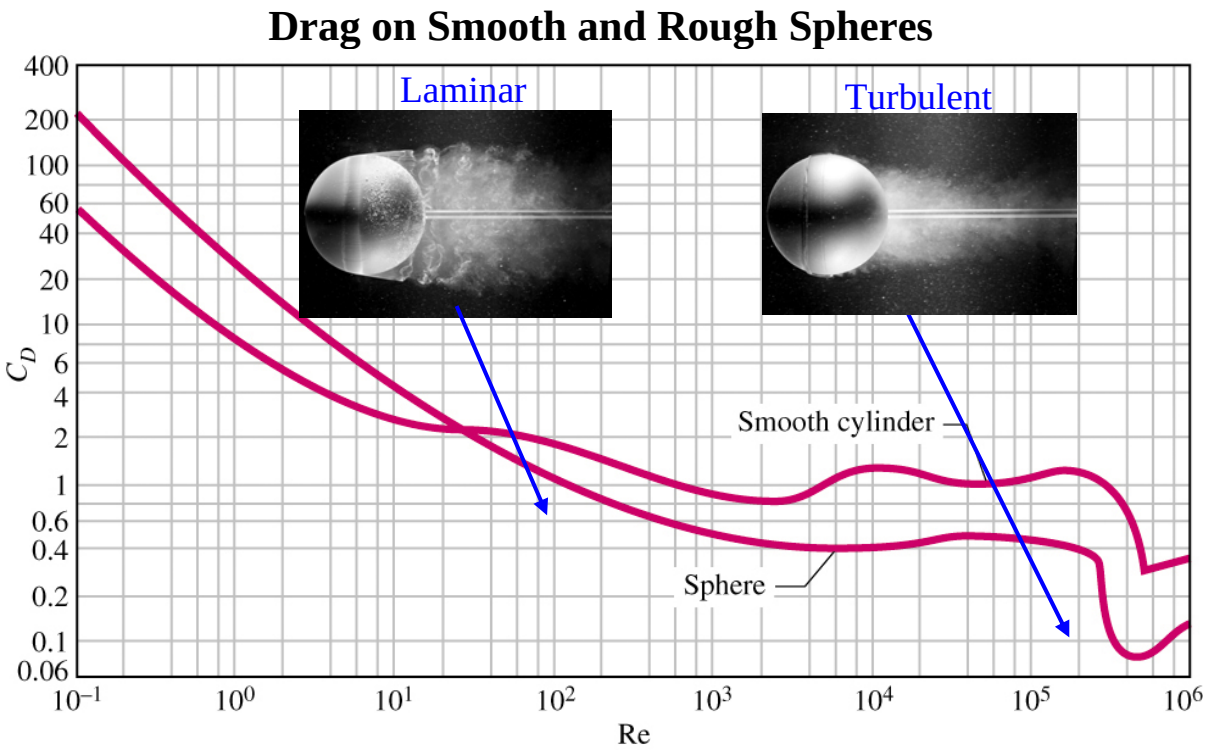

Figure 11-34 & 35. Average drag coefficient for cross-flow over a smooth circular cylinder and a smooth sphere.

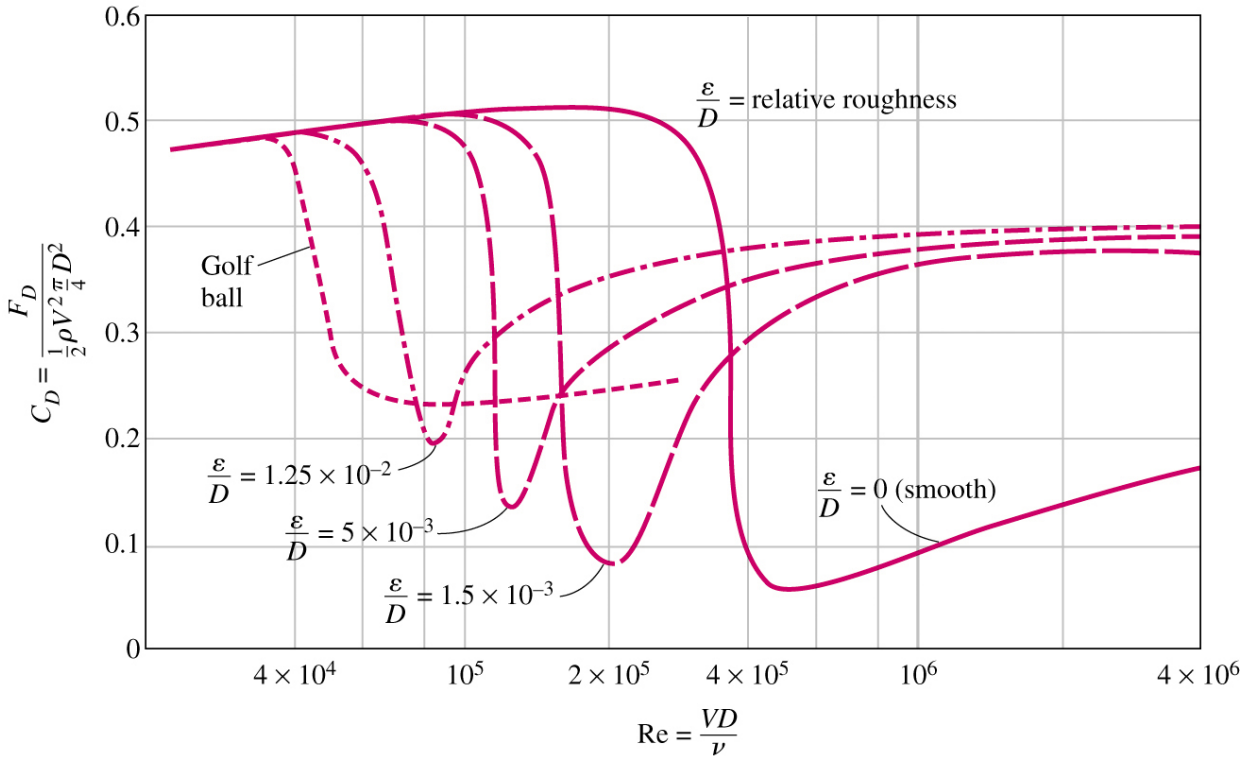

Figure 11-36. The effect of surface roughness on the drag coefficient of a sphere.