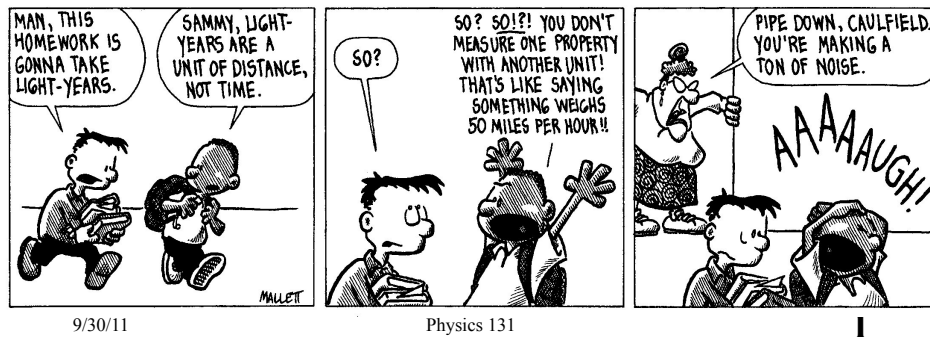


September 30, 2011

Physics 131

Prof. E. F. Redish

■ Theme Music: It's a Drag*Eric Lindell***■ Cartoon: Jef Mallett***Frazz*

Outline

- Resistive Force
- Modeling a real physical situation

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Resistive forces

- Resistive forces oppose the relative motion of two interacting surfaces.
 - Friction
 - Viscosity
 - Drag

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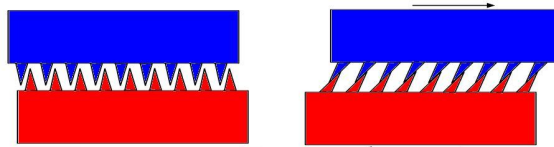
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Friction

- When the surfaces are not sliding on each other, the friction force may take any value up to a maximum. $f_{A \rightarrow B} \leq f_{A \rightarrow B}^{\max} = \mu_{AB}^{\text{static}} N_{A \rightarrow B}$
- When the surfaces are sliding on each other, the friction force is a constant value (usually less than the maximum possible).

$$f_{A \rightarrow B} = \mu_{AB}^{\text{kinetic}} N_{A \rightarrow B}$$

$$\mu_{AB}^{\text{kinetic}} \leq \mu_{AB}^{\text{static}}$$



10/8/01

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Viscosity

- When sheets of fluid move over each other there is an “internal friction” that resists the sliding – but it’s proportional to the relative speed.
- When a solid moves through a fluid it drags the fluid with it – which drags the fluid over fluid leading to a resistive force.
- For a sphere moving through a liquid

$$F_{liquid \rightarrow sphere}^{viscous} = -6\pi\mu Rv$$

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Questions from reading

- The text states “the viscous force is inversely proportional to the distance between the moving plate and the fixed plate” therefore according to this the force increases as the plates get closer. Why is this? The plates aren’t interacting so shouldn’t their relative distance have no effect on each other?
- The text described viscosity as the fluid to fluid interactions that result from some fluid sticking to a solid, but wouldn’t there actually be 2 sets of reactions between the solid and fluid and the fluid with fluid?

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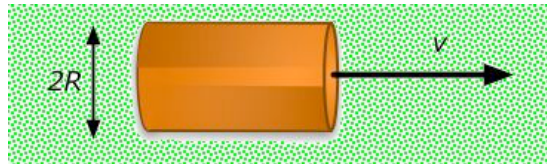
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Drag

- When a solid object moves through a fluid it has to speed up the fluid in front of it.
- It has to exert a force on the bits of the fluid in front of it to bring it up to the object's speed. By N3, the fluid exerts a force back on the object.
- For a sphere moving through a fluid

$$F_{fluid \rightarrow sphere}^{drag} = -CdAv^2$$



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When a coffee filter falls, which resistive force dominates?



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