Friction Forces

Ch 5.18, 5.19, 5.20

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Objectives

- Define friction force
- Distinguish between static and kinetic friction

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Initial investigation

- Determine which factors affect $F_{f,k}$ and $F_{f,s}$
- ~5 minutes
- Equipment: spring scales, wood, masses

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Kinetic Friction

- Friction between moving surfaces
- Opposes motion
- Kinetic friction force equals coefficient of kinetic friction (μ_k) times normal force
- Normal force is perpendicular to surface
- $F_{f,k} = \mu_k F_N$
- Coefficients (μ) have no units

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Static Friction

- Force exerted on one surface by another when there is NO MOTION
- Opposes motion
- Static friction force is less than or equal to coefficient of static friction (μ_s) times normal force
- $F_{f,\,s\ max} = \mu_s F_N$

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- When do you need friction?
- When is friction not useful?

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Steps for Problem Solving

- Draw free body diagram
- Identify knowns, unknowns, eqns
- Determine net forces
- Calculate weight (F_g)
- Calculate F_N
- Solve

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1. You push a 25.0 kg box across the floor at a constant speed of 1.0 m/s. How much force do you exert on the box? (The coefficient of kinetic friction is 0.20.)

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2. A 32 kg crate rests on a horizontal surface. It requires 75 N of force to set it in motion. Calculate the coefficient of static friction.

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3. A 23 kg chair initially at rest on a horizontal floor requires a 365 N force to set it in motion. Once in motion, a 327 N force keeps it moving at constant velocity.
   a. Calculate the coefficient of static friction between the chair and floor.
   b. Calculate the coefficient of kinetic friction between the chair and floor.

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Additional Problem

- A hockey puck on a frozen pond has an initial velocity of 20.0 m/s. If the puck travels 115 m before stopping, determine the coefficient of friction between the puck and ice.
  - Kinetic or static friction?
  - Diagram, knowns, unknowns, eqns,
  - No, you don't really need the mass!
  - Answer = .177

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Investigation

- Determine coefficients of static and kinetic friction
- Consider:
  - How will you observe static friction?
  - How will you observe kinetic friction?
  - What parameters will you need to define?

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Investigation

- Analyze your data using LoggerPro

- 1 paper per group of **2**
- Turn in methods, data, approved sketch of graph, conclusion

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