

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Physics

Physics 8.01L

Fall 2005

Problem Set 6: Work and Energy

Due Friday, October 28 at the start of class at 10am.

Please write your name, recitation number, table number, and tutor name on the top right corner of the first page of your homework solutions. Please place your solutions in the Problem Set Solution hand-in bin at the entrance of the classroom.

Reading:

Young & Freedman Chapter 6 (Sections 6.1-6.3) & Chapter 7 (Section 7.1)

Problem 1 Two Working Tugboats

Young & Freedman Problem 6.7 (Page 233)

Problem 2 Working on a Rock

Young & Freedman Problem 6.14 (Page 233)

Problem 3 How to Score a Goal

Young & Freedman Problem 6.21 (Page 234)

Problem 4 Stopping a Cow

Young & Freedman Problem 6.32 (Page 234)

Problem 5 Working on a Toy Car

Young & Freedman Problem 6.37 (Page 235)

Problem 6 Pulling a String

Young & Freedman Problem 6.69 (Page 237) (Hint: Parts (a) and (b) might confuse you into not realizing how easy part (c) is.)

Problem 7 Why Nuclear Physics is Hard

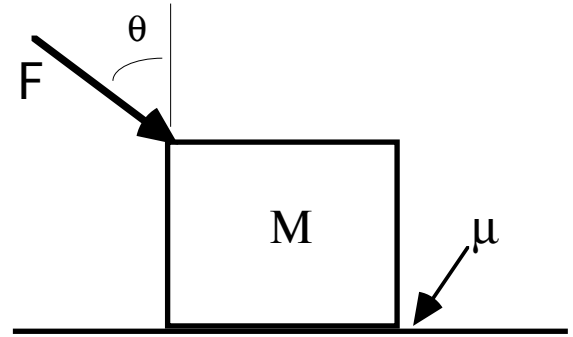
Young & Freedman Problem 6.70 (Page 237)

Problem 8 Rock and Bowl

Young & Freedman Problem 7.9 (Page 274)

Problem 9 Working with a Block

Consider the situation shown in the drawing at the right. A block of mass M is pushed along a horizontal surface by a force F making an angle θ with the vertical. The coefficients of static and kinetic friction are identical and equal to μ .



- Make a clear drawing showing the direction of all the forces acting on the mass, and find the magnitude of all the forces in terms of F , M , g , μ , and θ .
- Assume that the object moves a distance B to the right. Find the work done by each force you listed in part (a).
- If the block has a velocity, V_1 , to the right initially, find its velocity, V_2 , after it has moved the distance B to the right.
- Explain how you would decide if the final velocity, V_2 , is larger than, equal to, or smaller than the initial velocity, V_1 .

Problem 10 Who is Right?

Adapted from Giancoli Physics for Scientists and Engineers

A wooden crate slides down a wooden ramp. The angle of the ramp and the kinetic coefficient of friction are chosen so that the crate slides down the ramp at constant speed. The crate is watched by two observers, one standing on the ramp and one sitting on the crate. Both observers make measurements in a coordinate system fixed with respect to themselves.

- Are either of these observers in a non-inertial frame?
- Do the two observers agree on the kinetic energy of the crate?
- Do the two observers agree on the work done by any of the forces acting on the crate?
- How would the two observers explain the generation of heat at the surface between the crate and the ramp.