

NORTHERN ILLINOIS UNIVERSITY

PHYSICS DEPARTMENT

Physics 210 – Mechanics & Heat

Spring 2022

Problem Set #5

Problem Set Due: Thurs., Feb. 24, 2022

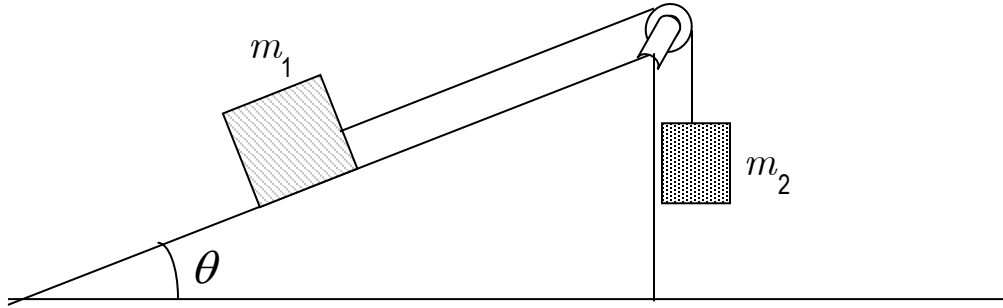
Read OpenStax: Chapter 6.1,6.2,6.3, Chapter 10.1,10.2, Lecture Notes #5

Show explicitly all your work for full credit.

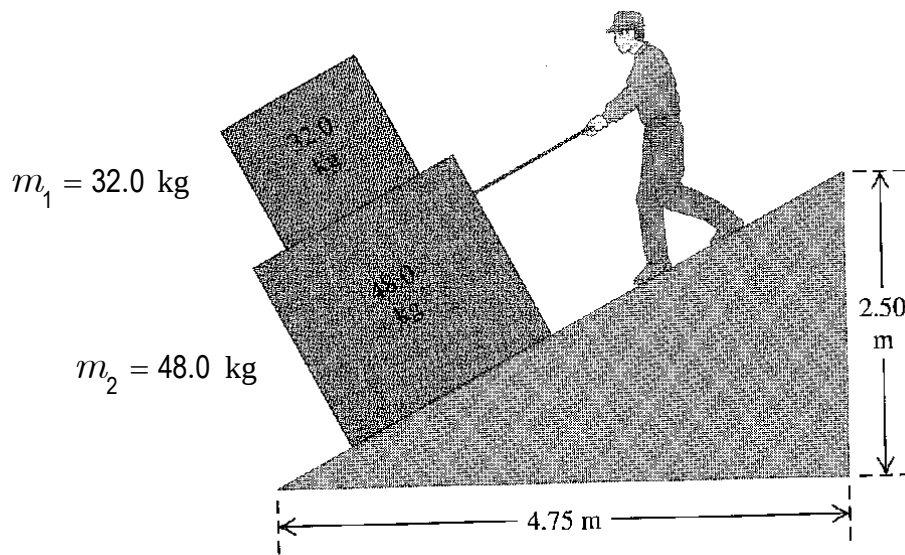
- | | |
|-----------------------------|-----------------------------------|
| 1. Expert TA: c6.2.1 | <i>conceptual problem—explain</i> |
| 2. Expert TA: 6.1.5 | <i>conceptual problem—explain</i> |
| 3. Expert TA: 6.1.2 | show calculation and figure |
| 4. Expert TA: 6.1.9 | show calculation and figure |
| 5. Expert TA: 6.1.20 | show calculation and figure |
| 6. Expert TA: 6.1.36 | show calculation and figure |
| 7. Expert TA: 6.1.39 | show calculation and figure |

Problem #8 & #9 are on the next pages

Staple WebAssign Problems separately from “My Problems” below.



8. A block of mass m_1 on a ramp inclined at an angle θ is connected by a cord over a massless, frictionless pulley to a second block of mass m_2 . The coefficient of kinetic friction between block m_1 and the ramp is μ_k .
- (a) Draw the free body diagram *for each block*. Draw **large** diagrams and *clearly show components* of any vectors that make an angle θ with the axes.
 - (b) Write down Newton's 2nd law *for each block*.
 - (c) What is the acceleration of mass m_1 in terms of m_1 , m_2 , θ , μ_k and g ? Simplify your algebra as much as possible.



9. An NIU student's job is to lower two blocks down a ramp as shown above at a constant speed of 15.0 cm/sec (the rope is pulled perpendicular to the block's surface). μ_k is 0.444 between the ramp and the lower block, and μ_s between the two blocks is 0.800 .
- Draw the free body diagram for each block.
 - Write down Newton's 2nd Law for each block along the two perpendicular axes in your free body diagrams.
 - What force does he need to exert to accomplish this? (57.1087098)
 - What are the magnitude and direction of the friction force on the upper box? (146.0580813)