

NORTHERN ILLINOIS UNIVERSITY

PHYSICS DEPARTMENT

Physics 210 – Mechanics & Heat

Fall 2022

Problem Set #4

Problem Set Due: Thurs., Sept. 22, 2022

Read OpenStax: Chapter 4, Chapter 5.1, Lecture Notes #3 & #4

Show explicitly all your work for full credit.

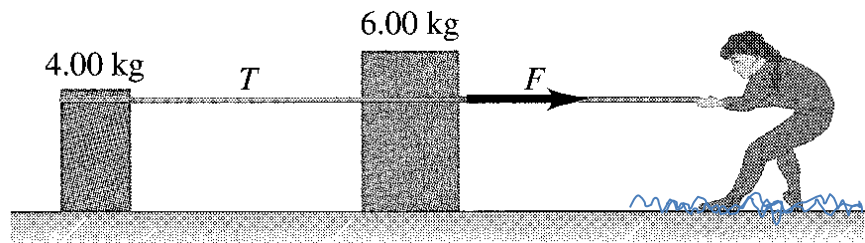
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|--------------------------------|-----------------------------------|
| 1. Expert TA: c2.2.6 | <i>conceptual problem—explain</i> |
| 2. Expert TA: 2.3.1-alt | <i>math problem—explain</i> |
| 3. Expert TA: 2.4.17 | show calculation and figure |
| 4. Expert TA: 5.3.5 | show calculation and figure |
| 5. Expert TA: 5.3.12 | show calculation and figure |
| 6. Expert TA: 5.6.45 | show calculation and figure |
| 7. Expert TA: 5.7.4 | show calculation and figure |
| 8. Expert TA: 5.7.34 | show calculation and figure |
| 9. Expert TA: 5.8.0 | show figure |
| 10. Expert TA: 5.9.12 | show figure |

Staple (Problems #11 & #12) together separately from (Expert TA problems)

Problem # 11 & 12 are on the next pages

11. A person decides to walk due west for 5 km, then northeast (45° east of north) for 4 km, and finally due north for 3 km.

- (a) Write his final position from the origin in terms of unit vectors where $\hat{i}$ points due East and $\hat{j}$ points due North.
- (b) When he completes his walk where is he relative to his starting point (*distance and direction*)? (6.219830504, 110.4345384)



12. Your friend ties two boxes (having the masses shown above) together by a light cord (approximate all light cord as massless). The blocks rest on the frictionless surface of the ice covered NIU pond. She pulls horizontally using a light rope from shore on the 6.00 kg crate with a force F that gives the crate an acceleration of 2.50 m/sec^2 .

- (a) What is the acceleration of the 4.00 kg crate?
- (b) What is the direction of the net force on the 6.00 kg box? Which is larger in magnitude, force T or F ?
- (c) Draw the free-body diagram for each box.
- (d) Write down Newton's 2nd laws for each box.
- (e) Find the tension T in the rope that connects the two boxes.
- (f) Find the force F .