

NORTHERN ILLINOIS UNIVERSITY

PHYSICS DEPARTMENT

Physics 210 – Mechanics & Heat

Fall 2021

Problem Set #8

Problem Set Due: Thurs., Oct. 28, 2021

Read OpenStax: Chapter 8.1-8.5, 10.4, 10.5, Lecture Notes #8

Show explicitly all your work for full credit.

Staple solutions to Problems #1-10 together

1. OpenStax: **Example 8.1** show figure and calculation
2. OpenStax: **Example 8.2** show figure and calculation
3. OpenStax: **Example 8.4** show figure and calculation – **do the algebra asked for**
4. OpenStax: **Example 8.5** show figure and calculation
5. OpenStax: **Example 8.6** show figure and calculation

6. OpenStax: **Example 10.8** show figure and calculation
7. OpenStax: **Example 10.9** show figure and calculation
8. OpenStax: **Example 10.10** show figure and calculation
9. OpenStax: **Example 10.11** show figure and calculation
10. OpenStax: **Example 10.14** show figure and calculation

Problems #11 & 12 are on the next page

Staple solutions to Problems #11 & #12 together

Read the 1st part of Lecture Notes #6b (pages 1-5) for discussion on center of mass.

- 11 Three solid, uniform boxes are aligned as in Figure P8.10. Find the x - and y -coordinates of the center of mass of the three boxes, measured from the bottom left corner of box A.

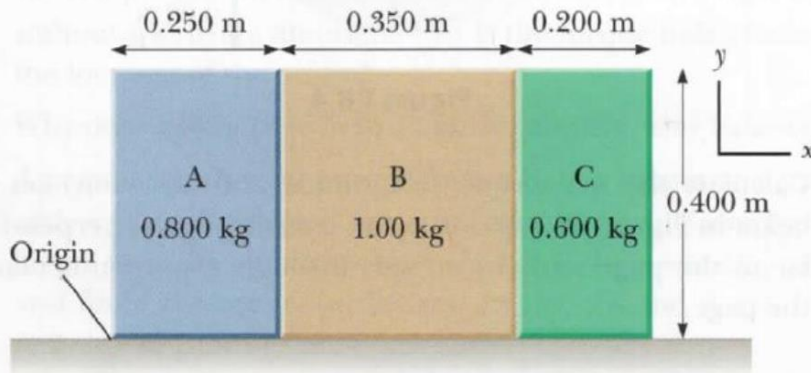
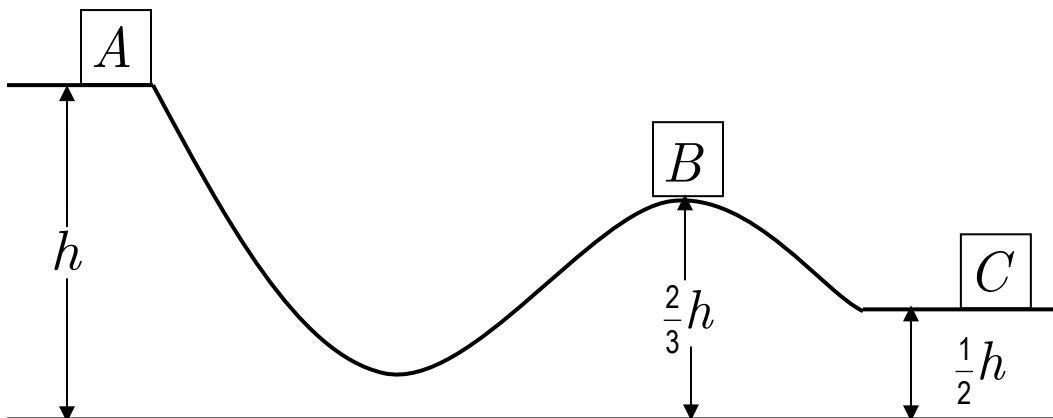


Figure P8.10



12. You and your friends decide to go on a roller coaster at the county fair. Unfortunately, the roller coaster fails and 3 cars collide with each other. Let each car have mass m and assume the track is frictionless for this problem. After your car A is released from rest it makes an inelastic collision with car B stopped on the track due the failure (they both stick together), and the two of them in turn collide with and stick to car C which is also stopped at the end of the track. Fortunately, nobody got hurt.

(a) Find the final velocity of your car A in terms of g and h . (solution: $\frac{1}{3}\sqrt{2gh}$)

(b) Find the total energy converted to heat in this entire process in terms of m , g , and h . (solution: $\frac{1}{3}mgh$)