Physics 215 Fall 2019
Problem Set for Week 10

OpenStax Chapter 7:
48, 58, 74, 98
Ch 8: 40, 64, 72, 74
Ch 9: 63, 72, 76

And the following problem:

A 50 kg snowboarder is participating in several X-games competitions: the half-pipe and the boardercross.

a) For her first pass, she just makes it to the top edge of a half pipe (a snow park feature that consists of half a circle, with a radius of 6.7 m). Write an expression for her total energy at the bottom of the half pipe and a second expression for her total energy at the top edge of the half-pipe. Neglect friction.
b) For the situation in part a), what speed does she have at the bottom?
c) For her next trick in the half pipe, she increases her speed at the bottom of the pipe by 20% over the value found in part b). What is her speed at the top of the pipe?
d) At the top edge of the pipe she is moving only in the vertical direction. For the situation in part c), what is the maximum height she attains above the top edge of the pipe?
e) In the boardercross event, there is a flat part of the course where two riders cross each others' paths. Just before they cross, the 50 kg snowboarder (labeled A) is moving at a speed of 8 m/s at an angle of 20 degrees West of North and another 60 kg snowboarder (labeled B) is moving at a speed of 10 m/s at an angle 30 degrees East of North. Draw a bird's eye (top) view of their paths just before they cross, and label your axes. Let north be the positive y-axis and east be the positive x-axis.
f) Write an expression the total momentum of the system composed of the two snowboarders before they cross. Use i-hat, j-hat notation. Neglect friction.
g) Unfortunately, the two snowboarders described in part f) collide and move together across the snow. Neglect friction. What is the speed with which they move? What is the direction in which they move? (Give your answer in degrees West or East of North).