Phy 113: Physics of Sports
Homework Problems
Set #8: Due Wednesday, October 31, 2018
(No late homework allowed)

Note: Students are encouraged to work together and discuss the problems. However, each student must arrive at her/his own final answers. Show all your work. Simply copied homework will result in zero.

1. (10 points) (a) What is the momentum of a 0.14 kg baseball thrown by Aroldis Chapman at 105 mph? (b) If the ball is caught by Gary Sanchez, NY Yankees’ catcher, during a 3 ms period, what is the force exerted on the ball by Sanchez?

2. (15 points) Prof. Jung drops an egg from 0.9 m above a table. (a) What is the velocity of the egg right before it hits the table? (b) What is the momentum at that instance? The mass of the egg is 50 g. (c) What is the impulse when the egg hits the table? (d) If the time of contact between the egg and the table-top is 0.7 ms, what is the force exerted on the egg by the table? (e) If the egg is dropped on to a sponge instead and thereby the contact time is lengthened to 16 ms, what is the force exerted on the egg by the sponge and the table?

3. (10 points) A bullet with a mass of 70 g is shot by a rifle and has a speed of 270 m/s. If the recoil speed of the rifle is 6 m/s, what is the mass of the rifle as the bullet is fired?

4. (10 points) During the 2018 Winter Olympics Men’s 5000 m short track speed-skating relay race, Viktor Knoch (Hungary) pushes his teammate from behind to give him a boost as they relay the race. Just before the push Knoch is skating at a speed of 10.0 m/s and his teammate, Csaba Burjan, is skating at a speed of 5 m/s. After the push Knoch slows down to 3 m/s. If Knoch has a mass of 75 kg, and Burjan has a mass of 70 kg, what is Burjan’s speed after he is pushed? Hungary won the historic gold medal in the race.

5. (15 points) At the Giants-Falcons football game played on Oct. 22, Giants' running back Saquon Barkley with a mass of 234 lbs and running at 9 m/s was tackled by a Falcons’ linebacker with a mass of 285 lbs. Right after the tackle the two were stuck together and moved in the same direction as the initial direction of Barkley at a speed of 1.7 m/s. (a) What is the speed and direction of the linebacker before the tackle? (b) What is the impulse applied to the linebacker by Barkley? (Assume that at the moment of collision both players were up in the air. Namely, their feet were not applying force on the ground. Consider only horizontal direction in this problem.)