Energy Homework Problems:
p134: #15, 18, 23, 35

Problems taken from the school's old textbook:
Giancoli, D. (1980). *Physics*, 2nd Ed. Englewood Cliffs, NJ: Prentice Hall.

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15. The tennis ball may leave the racket of a top player on the serve with a speed of 65.0 m/s. If the ball's mass is 0.0600 kg and is in contact with the racket for 0.0300 seconds, what is the average force on the ball? Would this force be large enough to lift an average size person?

18. A 150-kg astronaut (including space suit) acquires a speed of 2.35 m/s by pushing off with her legs from a 2200-kg space capsule.
   a) What is the change in speed of the space capsule?
   b) If the push lasts 0.200 seconds, what was the average force exerted by each on the other? As the reference frame, use the position of the capsule before the push.

23. A ball of mass 0.440 kg moving with a speed of 8.10 m/s collides head-on with a 0.220-kg ball at rest. If the collision is perfectly elastic, what will be the speeds and directions of the two balls after the collision?

35. A meteor whose mass was about 10^8 kg struck the earth ($m = 6.0 \times 10^{24}$ kg) with a speed of about 15 km/s and came to rest in the earth.
   a) What was the earth's recoil speed?
   b) What fraction of the meteor's KE was transformed to KE of the earth?
   c) By how much did the earth's KE change as a result of this collision?

ANSWERS:

15. 130 N; to lift an average person (65 kg) a force equal to that person's weight (65 x 9.8 = 673 N) would be required. So – no, this would not be sufficient to lift an average person.
18a. 0.16 m/sec in the direction opposite of the astronaut
18b. 1762.5 N
23. the 0.440 kg ball will move at 2.7 m/s to the right; the 0.220 kg ball will move at 10.8 m/s to the right
35a. 2.56×10^{-16} km/s
35b. 1.67×10^{-17}
35c. .189 J (the rest of the lost KE becomes thermal energy – wow – things are cooking now!)