Physics HW#5 Problems

{Ch 6: Q 14, 33, 39; E: 12, 17, 20;
{Ch 7: Q 3, 9; E: 3, 6.

14. Two balls are dropped on the floor from the same height. The balls are made of different types of rubber so that one bounces back to nearly the same height while the other does not bounce at all. Assuming both balls have the same mass, which of the balls experiences the greater impulse in colliding with the floor? Why?

33. The figure shows two air-track gliders held together with a string. A spring is tightly compressed between the gliders and is released by burning the string. The mass of the glider on the left is twice that of the glider on the right, and they are initially at rest. What is the total momentum of both gliders after the release?

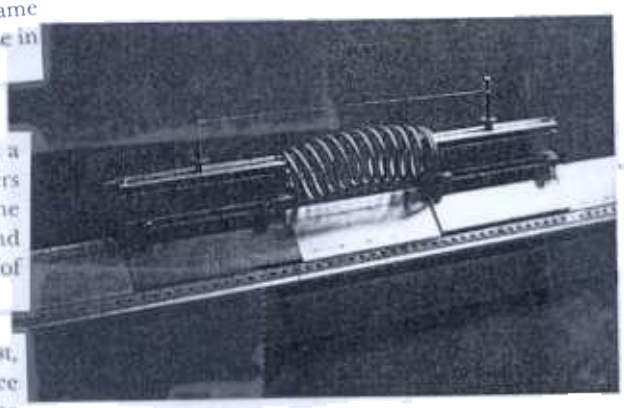

Figure 33

39. Two objects, one moving north and the other moving east, collide and stick together. If the eastbound object has three times the mass and is initially moving half as fast as the northbound object, which of the indicated paths represents the most likely final motion of the pair? Justify your answer using the concept of linear momentum.

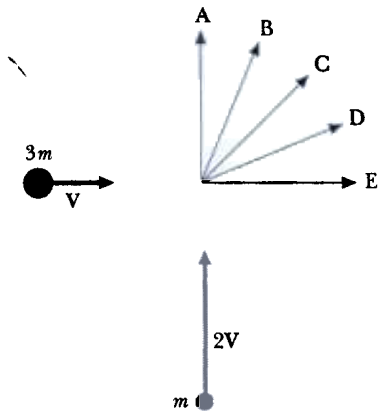

Fig. 39

12. A tennis ball ($m = 0.2$ kg) is thrown at a brick wall. It is traveling horizontally at 16 m/s just before hitting the wall and rebounds from the wall at 8 m/s, still traveling horizontally. The ball is in contact with the wall for 0.04 s. What is the magnitude of the average force of the wall on the ball?

17. A 1200-kg car traveling north at 14 m/s is rear-ended by a 2000-kg truck traveling at 25 m/s. What is the total momentum before and after the collision?

20. A boxcar traveling at 10 m/s approaches a string of three identical boxcars sitting stationary on the track. The moving boxcar collides and links with the stationary cars, and the four move off together along the track. What is the final speed of the four cars immediately after the collision? (You may take the mass of each boxcar to be 18,537 kg.)

3. You have been asked to analyze a collision at a traffic intersection. Will you be better off to begin your analysis using conservation of momentum or conservation of kinetic energy? Why?

9. Assume that a minivan has a mass of 2000 kilograms and a sports car has a mass of 1000 kilograms. If both vehicles are traveling at the same speed, which vehicle has the higher kinetic energy? Why?

3. In reviewing her lab book, a physics student finds the following description of a collision: "A 4-kg air-hockey puck with an initial speed of 6 m/s to the right collided head-on with a 1-kg puck moving to the left at the same speed. After the collision, both pucks traveled to the right, the 4-kg puck at 2 m/s and the 1-kg puck at 10 m/s." Is momentum conserved in this description? Is kinetic energy conserved in this description? Could this collision actually have taken place as described?

6. A 4-kg toy car with a speed of 5 m/s collides head-on with a stationary 1-kg car. After the collision, the cars are locked together with a speed of 4 m/s. How much kinetic energy is lost in the collision?