HW #2 – Due February 25
Chapters 4-6; 8 points total
Questions

1. Two boxes weighing 100 N each move towards each other at 20 m/s. Describe the motions of the boxes and the initial and final momentum of the system a) if the collision between the boxes if perfectly elastic, and b) if the collision between the boxes is inelastic. Assume no friction.
2. A railroad diesel engine weighs 2 times as much as a freight car. If the engine coasts at 3 m/s into the freight car that is initially at rest, what is the final speed of the coupled engine and car?
3. Describe the work-energy theorem.
4. An iron ball and a wooden ball have the same size but different masses. If both move with the same kinetic energy, can you say which has the greater speed? Explain your answer in terms of kinetic energy.
5. Consider a pendulum swinging to and fro. At what point in its motion is the kinetic energy (KE) of the pendulum bob at a maximum? At what point is its potential energy (PE) at a maximum? When its KE is at half-maximum value, how much PE does it have?
6. A box weighing 100 N is dropped from a height of 5 m. What is its final velocity?
7. How much power is used when a 5 N book is lifted 1.5 m in 4 seconds?
8. The cost of electricity is 10 cents per KW-hr. If a 40-Watt bulb is turned on for 8 hours, how much does it cost to light the bulb?
9. Can a simple machine multiply input force? Input distance? Input energy? Explain.
10. A 10 kg box is slid up an inclined plane (a simple machine) to a height of 2 m. If this requires 320 J of energy, what is the efficiency of this simple machine?
11. What is the change in the force of gravity between two objects if a) the masses of both objects are doubled but the distance between their centers of mass remains the same; and b) if the masses of both objects remained the same but the distance between them were halved.
12. If you were freely falling in an elevator and dropped a pencil, it would hover in front of you rather than fall to the floor. Is there a force of gravity acting on that pencil? Explain.
13. Do problem #46 on p.118 in your textbook.
14. Two golf balls are hit off a tee at the same initial speed but at different launch angles -- 30º and 45º. Which golf ball will travel farther? Explain.
15. Students in a lab roll a steel ball off the edge of a table. They measure the speed of a horizontally launched ball to be 2.0 m/s. They also know that if they drop the ball from rest at the same height it would take 0.5 seconds to reach the floor. How far from the edge of the table should they place a target so that the ball will hit it when it lands?
16. Why doesn't the Leaning Tower of Pisa topple?
17. How would the weight measured on a spring scale change if you weighted yourself in an elevator that moves *upward* at constant velocity? That moves *downward* at constant velocity? That moves *downward* with constant acceleration? That moves *upward* with constant acceleration?
18. Why does the speed of a satellite moving in an elliptical orbit vary?
19. Explain how the escape speed from the Earth would change if the radius were doubled but the mass remained the same? [Hint: bottom of page 114.]
20. What is thermal energy? What is heat?
21. Describe the three ways that heat can be transferred.
22. How much thermal energy is required to warm 200 kg of water by 20ºC?
23. What will be the final temperature of a mixture of 100 g of 40ºC water and 75 g of 30ºC water? [Hint: See p.131.]
24. What are the three laws of Thermodynamics?
25. When you touch a cold surface, does cold travel from the surface to your hand or does energy travel from your hand to the cold surface? Explain.
26. How does the Law of Conservation of Energy relate to the First Law of Thermodynamics?
27. What is the definition of absolute zero? What is the numerical temperature in Kelvin? In Celsius?
28. How does the frequency of radiant energy relate to the absolute temperature of the radiating source?