# Physics 1114 - General Physics I
Midterm

Name: _____

1. (10 pts) Your cat drops from a shelf 1.22 m above the floor and lands on all four feet. His legs bring him to a stop in a distance of 12 cm. Ignoring air resistance, calculate his speed when he first touches down on the floor. Furthermore, what is his acceleration while he stopped himself over those 12 cm?

2. (10 pts) A balloon carrying a basket is descending at a constant velocity of 20.0 m/s. A person in the basket throws a stone with an initial velocity of 15.0 m/s horizontally perpendicular to the path of the descending balloon, and 4.00 s later, this person sees the rock strike the ground. (a) How high was the balloon when the rock was thrown? (b) How far horizontally does the rock travel before it hits the ground? (c) at the instant the rock hits the ground, how far is it from the basket?
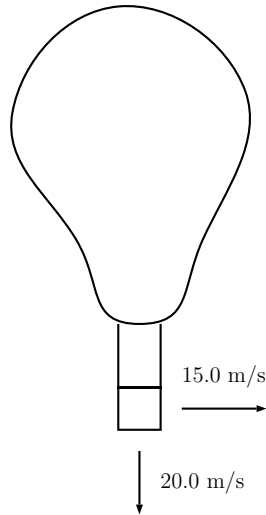
3. (10 pts) A tennis ball travelling horizontally at 22 m/s suddenly hits a vertical brick wall and bounces back with horizontal velocity of 18 m/s. Make a free-body diagram of this ball (a) just before it hits the wall, (b) just after it has bounced free of the wall, and (c) while it is in contact with the wall.

4. (10 pts) An unstretched spring is 12.00 cm long. When you hang a 0.876 kg weight from it, it stretches to a length of 14.40 cm. (a) What is the force constant (in N/m) of this spring? (b) What total mass must you hang from the spring to stretch it to a total length of 17.72 cm?

5. (10 pts) If two tiny identical spheres attract each other with a force of 3.0 nN when they are 25 cm apart, what is the mass of each sphere?

6. (10 pts) The mass of the moon is about 1/81 the mass of the earth, its radius is 1/4 that of the earth, and the acceleration due to gravity at the earth's surface is 9.80 m/s^2. Without looking up either body's mass, use this information to compute the acceleration due to gravity on the moon's surface.

7. (10 pts) You observe an object in free fall. When you first notice it, you determine that it is traveling at 15 m/s. A short time later, the object is traveling at 30 m/s. How much has gravitational potential energy changed during this time? (Here you may assume that wind resistance is negligible and that gravity is the only force acting on the stone in free fall.)

8. (10 pts) An unstretched spring has a force constant of 1200 N/m. How large a force and how much work are required to stretch the spring: (a) by 1.0 m from its unstretched length, (b) by 2.0 m, and (c) how much additional work did it take stretch the spring from 1.0 m to 2.0 m?

9. (10 pts) A rifle bullet with mass 8.00 g strikes and embeds itself in a block with a mass of 0.992 kg that rests on a frictionless, horizontal surface and is attached to a coil spring. The impact compresses the spring 15.0 cm. Calibration of the spring shows that a force of 0.750 N is required to compress the spring 0.250 cm. (a) Find the magnitude of the block's velocity just after impact. (b) What was the initial speed of the bullet?

10. (10 pts) How many problems have you posted on the discussion board thus far (remember you can post as many as you want)? What would you like to do on the discussion board for the last four weeks to help with your learning in this class?