Physics 201 Mid-Term Sample Problems

1. Two objects start moving at the same time. Object A, which has a mass of 8.0 kg, is 100 meter above the ground and moves straight up with an initial speed of 33.0 meter/sec. Object B, which has a mass of 50.0 kg, moves on the horizontal surface with an initial speed of 33.0 meter/sec. The horizontal surface has a coefficient of friction (\( \mu \)).
   (a) At what time will object A reach its highest point?
   (b) Determine the coefficient of friction so that the objects stop at the same time.

2. An object is thrown from a cliff that is 38.0 meter above a horizontal ground surface. The initial speed is 20.0 meter/second.
   (a) If the object is thrown horizontally, calculate the horizontal distance it will travel before it hits the ground.
   (b) Calculate the angle at which it should be thrown so that it will travel the maximum horizontal distance before it hits the ground.

3. An object of mass 6.5 kg moves in a circular horizontal path around a radius \( R = 0.80 \) meter at a speed of 75.0 meter/sec.
   (a) Calculate the centripetal acceleration.
   (b) If the speed of the object abruptly decreases to 65.0 meter/sec., what radius should it follow to be on a circular path with the same centripetal acceleration?

4. Suppose that the mass of the Earth was increased by 10%. Assuming that the Sun is fixed in position, and thus that the Earth moves in a circular orbit rather than an elliptical one, determine the percentage change in the Earth’s orbit so that the Earth would come to a stable circular orbit.

5. An object moves along a flat, horizontal surface. The mass of the object is 8.0 kg. The initial speed of the object is 12.0 meter/sec. The object is pulled by an external, horizontal force of 6.0 newtons.
   (a) Determine the coefficient of friction so that after 5.0 seconds, the speed of the object is 15.0 meter/sec.
   (b) If the coefficient of friction is zero, what would be the speed of the object after 5.0 seconds?

6. An object of 6.0 kg falls from rest. It begins at a height 100.0 meter above the ground. Gravity acts on the object. In addition, there is an external force equal to 50.0 newton opposing gravity.
   (a) What is the final speed of the object?
   (b) How long does it take the object to reach the ground?

7. Two objects, object A of 5.0 kg mass and object B of 12.0 kg mass, are moving. Object A is moving horizontally at a constant speed of 25.0 meter/sec. Object B is moving vertically at a constant speed of 18.0 meter/sec. The objects collide and stick together.
   (a) What is the total kinetic energy before the collision?
   (b) What is the total kinetic energy after the collision?