FYSP101 Physics 1

Final exam 29.10 2010

Present your solutions clearly, give proper justifications, and inspect your final results. Start each solution from a new page. All problems are worth 12 points.

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1. Are the statements right or wrong? Answer either R or W, and give an explanation with a *single sentence*. (2p/per item)

   a) A stone, after you kicked it, slides on the road. While sliding, the stone is acted upon by gravitation, inertial force along the direction of motion, friction, and normal force.

   b) If the acceleration vector of a particle points at all times towards a given point, the particle must be going through a circular motion.

   c) In the earth, ignoring drag, a projectile with a given initial speed gets the largest range with an initial angle of 45°. In the moon the acceleration downwards is smaller, so the initial angle for the largest range is smaller.

   d) A box lies on a rough surface. You pull it by stretching a 4 cm long spring by 2 cm, and the box gets an acceleration of 1 m/s^2. When you stretch the spring by 4 cm, the acceleration can get considerably larger than 2 m/s^2.

   e) When you hit a baseball with a bat, the impulse given by the ball to the bat is larger than the impulse given by the bat to the ball.

   f) A work done by a force depends on how long the force acts.

2. A box lies on a table, and is attached to a spring. The mass of the box is m, the static and kinetic coefficients of friction between the table and the box are μ_s and μ_k, and the spring constant is k.

   a) You stretch the spring so that the box is at rest, but just about to start moving. Draw the free body diagram for the box. (4p)

   b) You stretch the spring just a little bit more, and the box starts to move. Draw the free body diagram for the box right after the box starts moving. (4p)

   c) What is the acceleration of the box right after it started to move? (4p)

3. A baseball (mass 160 g) was thrown at 30° initial angle for 50 meters.

   a) What was the initial speed of the baseball? (4p)

   b) How much larger the initial kinetic energy of the ball should have been, if the range would have been twice as large? (3p)

   c) While the ball was being thrown, a hand exerted a constant force on it for a distance of about 50 cm. What was the magnitude of this force? (You can ignore gravitation here.) (3p)

   d) How large impulse was given to the ball by the hand? (2p)

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4. The 100 kg block in figure below takes 6.0 s to reach the floor after being released from rest. What is the mass of the block on the left?

m

100 kg

1.0 m