

FYSP101 Fysiikka 1

Exam 12.11 2010

Present your solutions clearly, give proper justifications, and inspect your final results. Start each solution from a new page. All problems are worth 10 points.

1. Are the statements right or wrong? Answer either R or W, and give an explanation with a *single sentence*. (2p/per item)
 - a) When the speed of a particle changes, the acceleration must be nonzero.
 - b) An elevator, supported by a cable, is moving downwards with increasing speed. The tension in the cable is hence larger than elevator's weight.
 - c) A particle slides down a ramp with a constant 0,55 m/s speed. The vector sum of the forces acting on the particle is hence directed down the ramp.
 - d) If a force is perpendicular to the direction of motion of the particle, the force will not change the kinetic energy.
 - e) The impulse on a body due to a force depends on the distance the body moves while acted upon by that force.
2. A large sphere made of styrofoam is hanging from a long spring and is in equilibrium. You pull the sphere somewhat downwards, and the sphere will start a vertical oscillatory motion. Draw realistic free body diagrams for the sphere in the following cases (add also explanations):
 - a) You just let go of the sphere.(3p)
 - b) The sphere passes the equilibrium point for the first time.(4p)
 - c) The sphere reaches the highest point for the first time.(3p)
3. A ball is thrown downwards of a slope, with a constant angle 45° , with horizontal initial speed of 10 m/s. (You may assume that the ball leaves from ground level.) How far will the ball fly along the slope?

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4. A ball with a 500 g weight is rotating freely at the end of a 1,5 m-long string in a vertical plane, so that the energy is conserved. The tension in the string, as the ball passes the lowest point, is 30 N. (6p/item)
- What is the speed of the ball at the lowest point?
 - What is the speed of the ball at the highest point? What can you say about this speed?
5. In a ballistic test, a 25 g bullet traveling horizontally at 1200 m/s goes through a 30 cm-thick 350 kg stationary target and emerges with a speed of 900 m/s. The target is free to slide on a smooth horizontal surface.
- How long is the bullet in the target? (4p)
 - What average force does it exert on the target? (3p)
 - What is the target's speed just after the bullet emerges? (3p)
6. The following problem must be solved using the concepts of work and energy. A 1,02 kg-block is lifted up by a cable that has a constant tension of 20,0 N during the lifting. What is the velocity of the block when it is at the 2,00 m height? (5p/kohta)
- Solve the problem by inspecting a system consisting of *the block alone*.
 - Solve the problem by inspecting a system consisting of *the block and the Earth*.