# Midterm exam

### FY0001 Brukerkurs i fysikk
### Friday March 4, 2011

**Time:**            1 hour (10.30 - 11.30)
**Allowed help:**   *Tabeller og formler i fysikk, 2FY og 3FY*
                     *Tabeller og formler i fysikk, Fysikk 1 og Fysikk 2*
                     Calculator Citizen SR-270X eller HP30S

A person is pulling a sled with a box up an incline which makes an angle $\theta = 20°$ with the horizontal. The rope is parallel to the incline. The combined mass of the box and the sled is $m = 15$ kg, and the kinetic coefficient of friction between the sled and the ground is $\mu = 0.1$. The person pulls the sled with a constant speed of 1 m/s.

**a)** How large is the force from the rope?

**b)** What power is delivered by the person in order to move the sled? (We ignore the power needed to move the person.)

**c)** The height from the bottom of the slope to the top is $h = 15$ meters. How much work is required to pull the sled from the bottom to the top of the slope?

**d)** At the top of the slope, the person lets go of the sled. It has a speed $v_0 = 0$ at the top, and slides down with increasing speed. How large is the speed of the sled at the bottom of the slope?
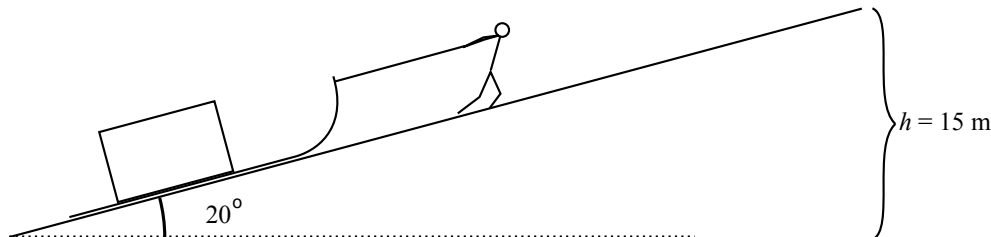


Figure 1: Person pulling sled up incline.

# Formulæ

| | |
|---|---|
| Work | $W = \vec{F} \cdot \vec{S}$ |
| Power | $P = \vec{F} \cdot \vec{V}$ |
| Fricton | $F_R = \mu N$ |
| Kinetic energy | $K = \frac{1}{2}mv^2$ |
| Newton's second law | $\vec{F} = m\vec{a}$ |
| Potential energy in constant gravity | $U = mgh$ |

# Constants

| | |
|---|---|
| Acceleration of gravity | $g = 9.81 \text{ m/s}^2$ |