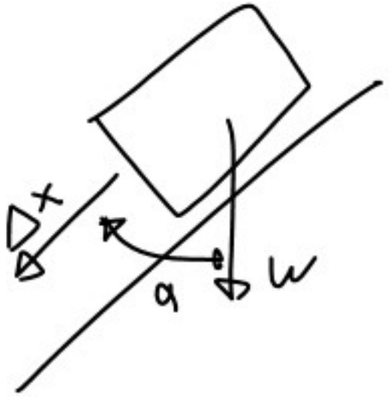
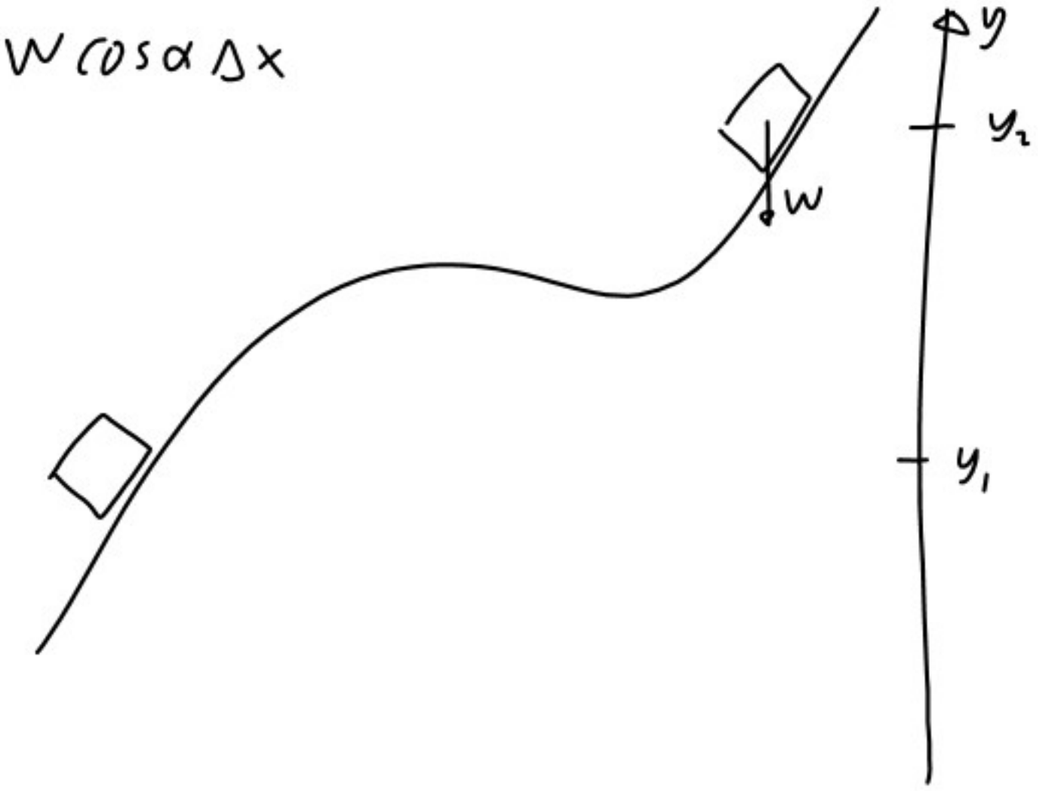
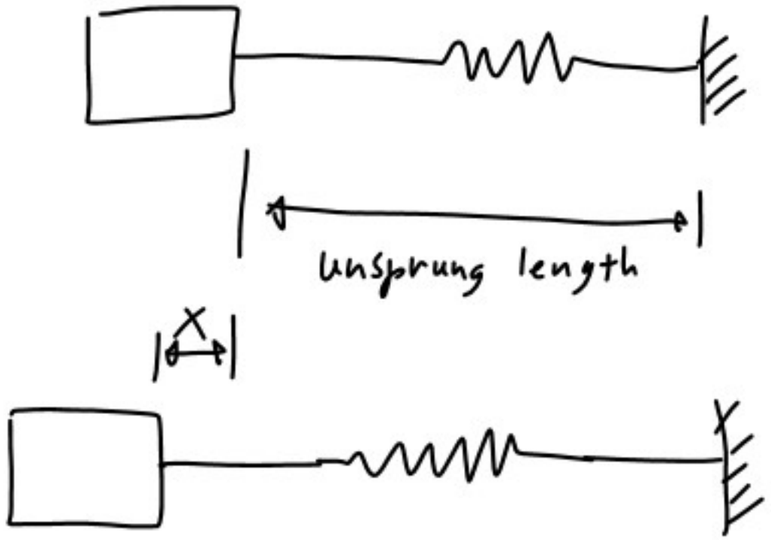


$$W = \Delta V = w \cos\alpha \, \Delta x$$



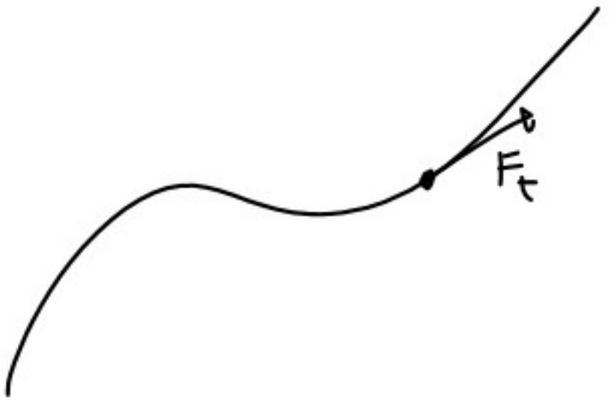
$$\Delta V = -w\Delta y$$

$$= wy_1 - wy_2$$



$$F = kx$$

$$W = \Delta V = \int_{x_1}^{x_2} \vec{F} \cdot d\vec{r} = \int_{x_1}^{x_2} -kx\,dx = \frac{-kx^2}{2}\Big|_{x_1}^{x_2} = \frac{1}{2}kx_1^2 - \frac{1}{2}kx_2^2$$



$$F_t = ma = m\frac{dv}{dt} = m\frac{dv}{ds}\frac{ds}{dt} = mv\frac{dv}{ds}$$

$$\int F_t\, ds = \int_{v_1}^{v_2} mv\, dv$$

$$W = \frac{mv^2}{2}\Bigg|_{v_1}^{v_2} = \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2$$

$$T = \frac{1}{2}mv^2$$

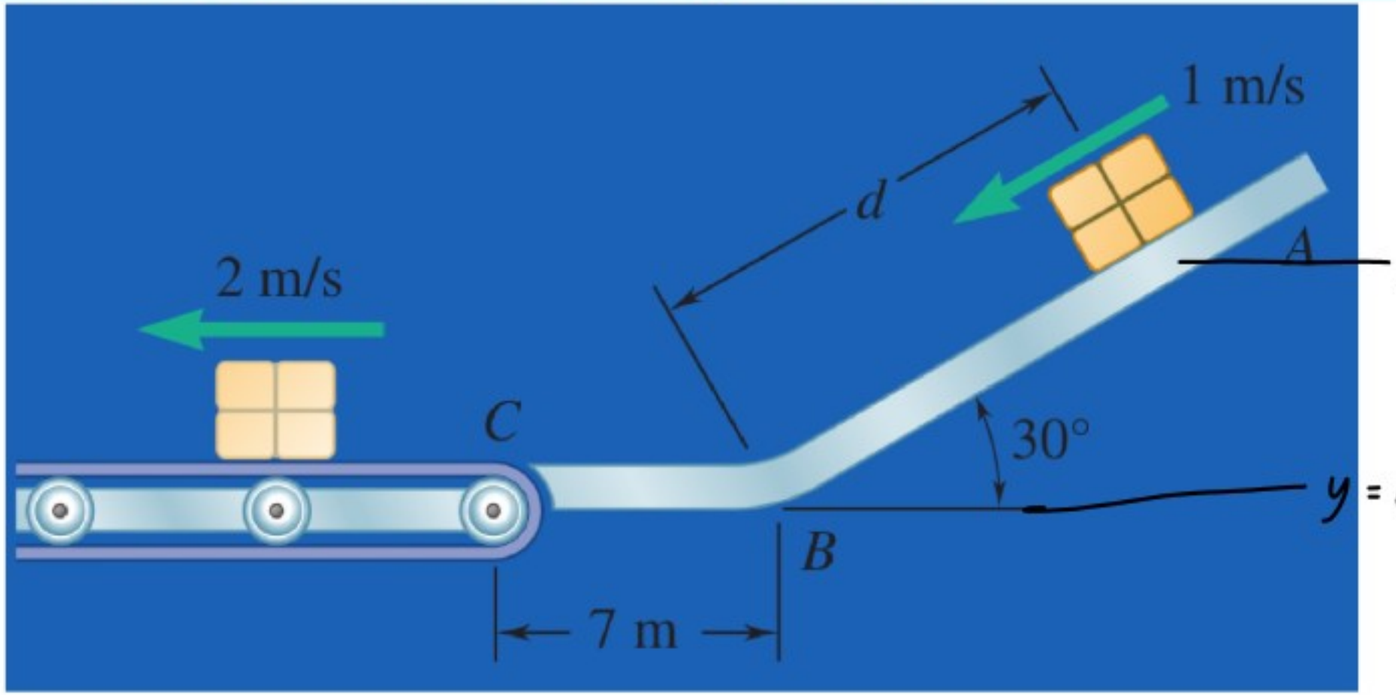
$$W = \Delta U = T_2 - T_1$$

Power

$$\text{Power} = \frac{dU}{dt} = \frac{F \cdot dr}{dt} = \frac{d}{dt} F \cdot dr = \frac{dF}{dt} \cdot dr + F \cdot \frac{dr}{dt} = F \cdot \frac{dr}{dt} = F \cdot v$$

$\frac{dF}{dt} \to 0$

Packages are thrown down an incline at A with a velocity of 1 m/s. The packages slide along the surface ABC to a conveyor belt which moves with a velocity of 2 m/s. Knowing that $\mu_k = 0.25$ between the packages and the surface ABC, determine the distance d if the packages are to arrive at C with a velocity of 2 m/s.

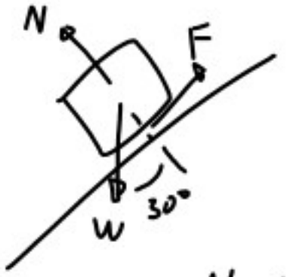


$$\Delta U = T_2 - T_1$$

$$T_2 = \frac{1}{2} m v_C^2 = \frac{1}{2} m 2^2 = 2m$$

$$T_1 = \frac{1}{2} m v_A^2 = \frac{1}{2} m 1^2 = \frac{m}{2}$$

$$\frac{3m}{2} = 2m - \frac{m}{2}$$

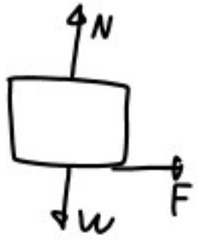


$$N = W\cos 30°$$

$$F = \mu_K N = 0.25 W \cos 30°$$

$$W = \Delta U = -F d = -0.25 d W \cos 30°$$

$$\Delta U = -W\Delta y = W y_1 - W y_2 = W d \sin 30 - 0 W = W d \sin 30$$



$$N = W$$

$$F = 0.25N = 0.25W$$

$$W = -Fd = -0.25(7)W$$

$$\frac{3m}{2} = W d \sin 30 - 0.25 d W \cos 30 - 0.25(7)W \qquad W = mg = m\,9.8$$

$$\frac{3\cancel{m}}{2} = \cancel{m}\,9.3 d \sin 30 - 0.25\, d \cancel{m} 9.8 \cos 30 - 0.25(7)\cancel{m}\,9.8$$

$$\frac{3}{2} = d(9.8 \sin 30 - 0.25(9.3)\cos 30) - 0.25(7)\,9.8$$

$$3/2 + 0.25(7)(9.3) = d(9.8 \sin 30 - 0.25(9.8)\cos 30)$$

$$\frac{3/2 + 0.25(7)(9.8)}{9.3 \sin 30 - 0.25(9.3)\cos 30} = \boxed{6.71\ m} = d$$

13.16 A trailer truck enters a 2 percent uphill grade traveling at 72 km/h and reaches a speed of 108 km/h in 300 m. The cab has a mass of 1800 kg and the trailer 5400 kg. Determine (*a*) the average force at the wheels of the cab, (*b*) the average force in the coupling between the cab and the trailer.