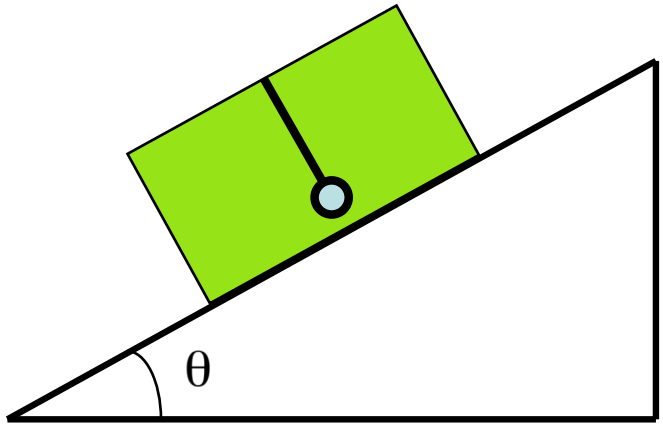
Problem 4.73

m = .1 kg

The car on an incline goes from zero to 30 m/s in 6 seconds. The .1 kg toy hangs at 90° to the incline.



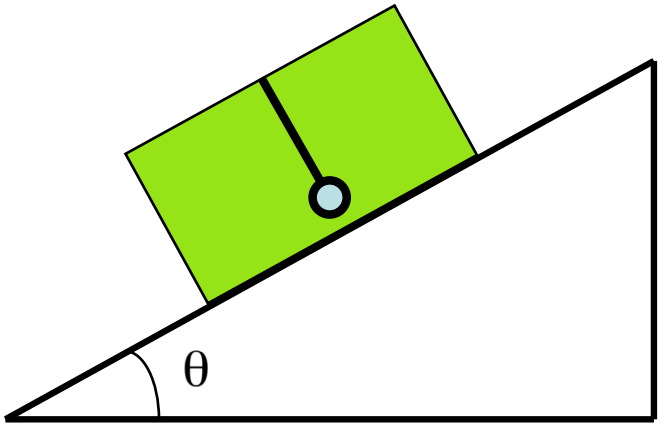
a.) In what direction is the car accelerating?

b.) What is the incline's angle and the tension in the line?

Problem 4.73

m = .1 kg

The car on an incline goes from zero to 30 m/s in 6 seconds. The .1 kg toy hangs at 90° to the incline.



a.) In what direction is the car accelerating?

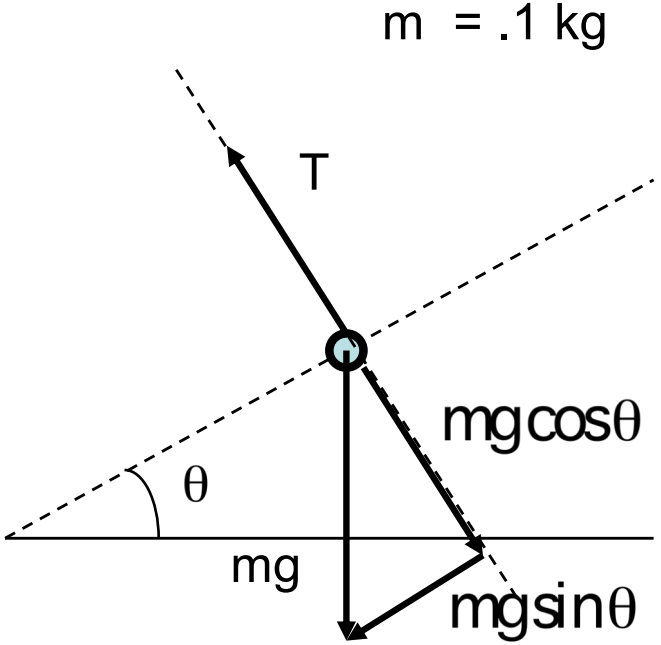
The bob would normally be hanging straight down. It is hanging back to the right due to the acceleration, which means the acceleration must be to the left down the incline. A f.b.d. shows this must be true (see below) as the only force acting on the bob along the line of the incline is a component of gravity *down the incline*.

b.) What is the incline's angle and the tension in the line?

See next page.

Using kinematics:

$$a = \frac{v_2 - v_1}{t}$$
$$= \frac{(30\ \text{m/s}) - 0}{(6\ \text{s})}$$
$$= 5\ \text{m/s}^2$$



Using N.S.L. in the "x" direction:

$$\sum F_x:$$
$$mg\sin\theta = ma$$
$$\Rightarrow \quad \sin\theta = \frac{a}{g} = \frac{(5\ \text{m/s}^2)}{(9.8\ \text{m/s}^2)}$$
$$\Rightarrow \quad \theta = 30.7^\circ$$

Using N.S.L. in the "y" direction:

$$\sum F_y:$$
$$T - mg\cos\theta = ma_y$$
$$\Rightarrow \quad T = mg\cos\theta$$
$$= (.1\ \text{kg})(9.8\ \text{m/s}^2)\cos 30.7^\circ$$
$$= .84\ \text{N}$$