Answer on Question #67139-Physics-Mechanics-Relativity

3. Mary (m = 50 kg) and Harry (M = 75 kg) are tied together by a rope. She is standing on a frictionless horizontal sheet of wet ice when Harry slips off of a cliff. Assuming the rope is horizontal as it pulls her towards the edge of the cliff, find the tension in the rope and the acceleration she experiences towards the cliff. What would happen to them if she cut the rope?

Solution

$$ma = T$$

$$Ma = Mg - T$$

$$\frac{MT}{m} = Mg - T$$

The tension is

$$T = \frac{Mg}{1 + \frac{M}{m}} = \frac{75(10)}{1 + \frac{75}{50}} = 300\ N$$

The acceleration is

$$a = \frac{T}{m} = \frac{300}{50} = 6\frac{m}{s^2}.$$

If she cut the rope she would move towards the cliff with constant velocity, and he would fall due to the gravity.

4. A hiker in Outdoor Ed stands on the rock face of a mountain. The soles and heels of her boots have a coefficient (fs) of 1.0. What is the steepest slope she can stand on without slipping? Assuming her pants have a coefficient (fs) of 0.30, what happens if she sits down to rest?

Solution

$$\tan\alpha = \mu$$

$$\alpha = \tan^{-1}\mu = \tan^{-1}1 = 45°$$

If $\alpha = 45°$ then

$$\mu' = 0.30 < \tan\alpha = 1.$$

Thus, she will move downwards with constant acceleration.