Forces Problems

Fun With Fiziks

July 5, 2022

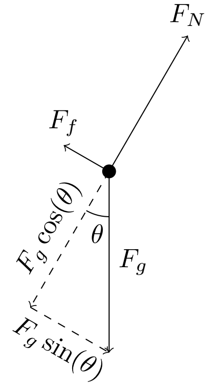
Practice Problems

Easy Problems

1. (a) 49 N
   (b) 1.73
2. 4 N
3. 3.27 m/s^2
4. F
5. 160 m/s^2
6. 9.9 m/s
7. 3.16 m/s
8. 204.08 m

Hard Problems

9. First we use draw the free body diagram:



Where F_N is the normal force, $F_f \leq \mu_s F_n$ is the frictional force, and $F_g = mg$ is the gravitational force. Let θ be the maximum angle we are trying to find. At this angle, friction will be maximized and it will perfectly balance out with the F_g component along the plane

$$F_f - F_g \sin(\theta) = \mu_s F_n - mg\sin(\theta) = 0.$$

The block is also not accelerating perpendicular to the plane so

$$F_n - mg\cos(\theta) = 0 \implies F_n = mg\cos(\theta).$$

This means that

$$\mu_s mg\cos(\theta) - mg\sin(\theta) = 0 \implies \mu_s = \tan(\theta)$$

so

$$\theta = \boxed{\tan^{-1}(\mu_s)}.$$

10. (a) The acceleration along the plane is $g\sin(\theta)$ (when there is no friction) and the distance the block travels is $h/\sin(\theta)$. Therefore, we use the following kinematics formula: $v^2 = v_0^2 + 2a\Delta x$. Plugging in the appropriate values, we have

$$v = \sqrt{2g\sin(\theta) \cdot \frac{h}{\sin(\theta)}} = \boxed{\sqrt{2gh}}$$

(b) The new acceleration is $g(\sin(\theta) - \mu_k\cos(\theta))$ so

$$v = \boxed{\sqrt{\frac{2gh(\sin(\theta) - \mu_k\cos(\theta))}{\sin(\theta)}}}.$$

11. $a_1 = 3g/7$ and $a_2 = g/7$