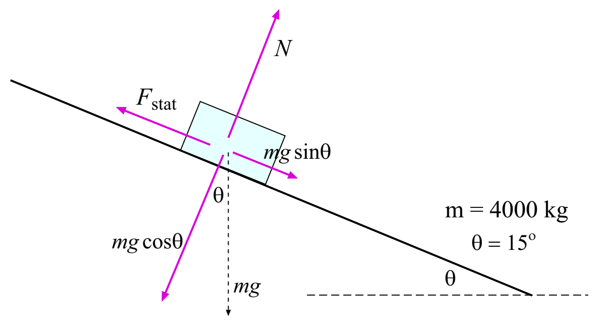

Figure 5.5: Forces acting on a 4000 kg truck is parked on a slope.

where M is the mass of the sun. This tells us:

$$\frac{T^2}{r^3} = \quad \text{the same for all planets} \tag{5.12}$$

We can use 5.12 to get the period or distance of a planet if we know both the period and distance of *another* planet orbiting the same central object.

5.2 Worked Examples

5.2.1 Friction Forces

1. A 4000 kg truck is parked on a 15° slope. How big is the friction force on the truck? [KJF 5-26]

The forces which act on the truck are shown in Fig. 5.5. With $m = 4000\,\mathrm{kg}$ and $\theta = 15^\circ$, the downward force of gravity mg has been decomposed into components along and perpendicular to the slope as we've done before. There is a normal force from the road with magnitude N. The truck has *no* acceleration so there is no net force and so there must be a force going *up* the slope, which of course is from static friction, denoted by $F_{\rm stat}$.

For the forces along the slope to cancel we must have

$$F_{stat} = mg\sin\theta = (4000\,\mathrm{kg})(9.80\,\tfrac{\mathrm{m}}{\mathrm{s}^2})\sin 15^\circ = 1.01\times 10^4\,\mathrm{N}$$

so that is the magnitude of the friction force.

What about Eq. 5.1? That equation only gives the *maximum* value that the force of static friction can take on. No one said that this was the case in this problem. (The problem

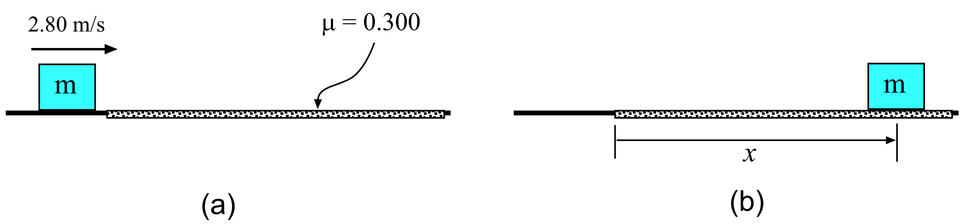

Figure 5.6: (a) Block is sliding on a smooth surface with a speed of $2.80\,\frac{\mathrm{m}}{\mathrm{s}}$. It encounters a surface which is rough, with $\mu_{\mathrm{k}} = 0.300$. (b) Block has come to a halt after moving a distance x on the rough surface.

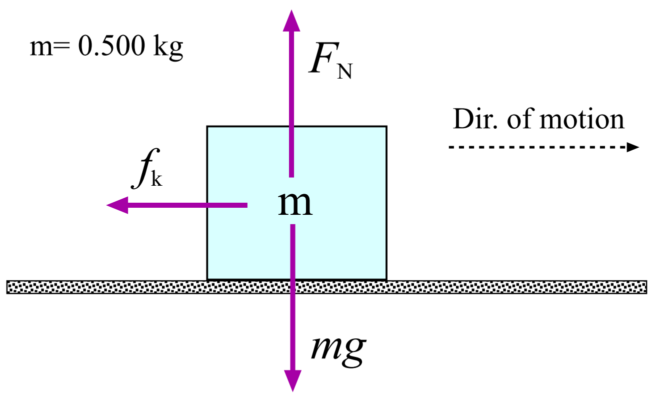

Figure 5.7: Forces acting on the mass in Example 2 while it is sliding on the rough surface.

did not say the truck is on the verge of slipping.) So while that equation is true, it's not relevant to the problem.
