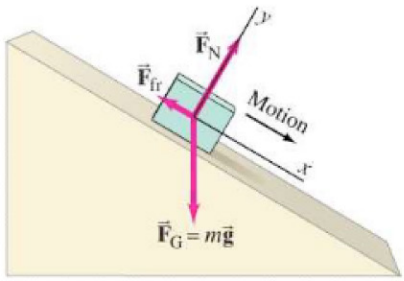

FIGURE 4–33 Forces on an object sliding down an incline.

Inclines

➥ PROBLEM SOLVING
Good choice of coordinate system simplifies the calculation

Now we consider what happens when an object slides down an incline, such as a hill or ramp. Such problems are interesting because gravity is the accelerating force, yet the acceleration is not vertical. Solving problems is usually easier if we choose the xy coordinate system so the x axis points along the incline and the y axis is perpendicular to the incline, as shown in Fig. 4–33. Note also that the normal force is not vertical, but is perpendicular to the sloping surface of the plane in Fig. 4–33.

EXERCISE C Is the gravitational force always perpendicular to an inclined plane? Is it always vertical?

EXERCISE D Is the normal force always perpendicular to an inclined plane? Is it always vertical?

PHYSICS APPLIED
Skiing

EXAMPLE 4–21 **The skier.** The skier in Fig. 4–34 has just begun descending the 30° slope. Assuming the coefficient of kinetic friction is 0.10, calculate (*a*) her acceleration and (*b*) the speed she will reach after 4.0 s.

APPROACH We choose the x axis along the slope, positive pointing downslope in the direction of the skier's motion. The y axis is perpendicular to the surface as shown. The forces acting on the skier are gravity, $\vec{F}_G = m\vec{g}$, which points vertically downward (*not* perpendicular to the slope), and the two forces exerted on her skis by the snow—the normal force perpendicular to the snowy slope (*not* vertical), and the friction force parallel to the surface. These three forces are shown acting at one point in Fig. 4–34b, for convenience, and is our free-body diagram for the skier.

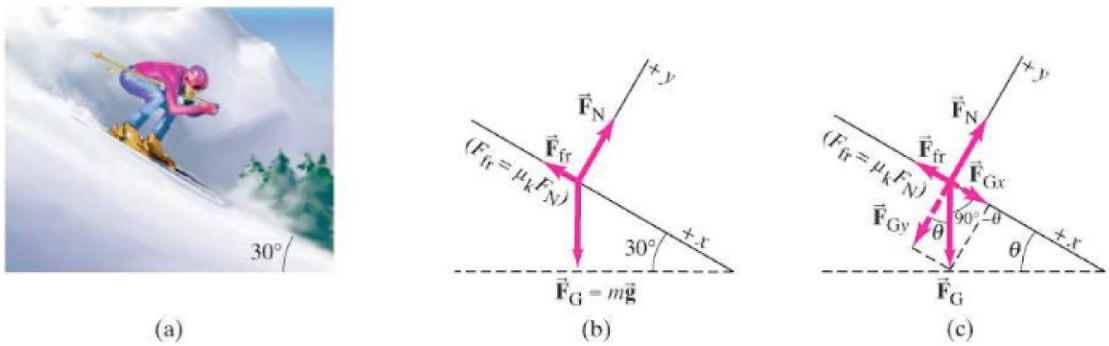

FIGURE 4–34 Example 4–21. A skier descending a slope; $\vec{F}_G = m\vec{g}$ is the force of gravity (weight) on the skier.