15.3: Weight, Tension and Normal Force

Weight

Another important force was mentioned earlier in Chapter 2: weight is the force on an object due to the Earth's gravity. If the object is near the surface of the Earth, then its weight W is given by

$$W = mg \tag{15.3.1}$$

where m is the mass and $g = 9.80\ \mathrm{m/s^2}$ is the acceleration due to gravity.

Tension

If a force is applied to both ends of a rope or wire in opposite directions (so as to stretch the rope or wire), then we say it is under tension. Tension, like other forces, is measured in newtons, and is equal to the force applied at either end.

Normal Force

If an object is resting on a table, then there are two forces acting on it: a gravitational force (its weight) acting downward toward the center of the Earth, and an upward force of equal magnitude acting upward, due to the mutual electromagnetic repulsion between the outermost electrons in the object and the outermost electrons in the table. This latter force is called the normal force. For an object sitting on a horizontal surface, the normal force is given by $n = mg$ so that it exactly balances the weight. This isn't always the formula for the normal force, though. For example, if an object is sitting on a surface that's inclined by an angle θ to the horizontal, then the normal force will be $n = mg\cos\theta$, and will exactly balance the component of the weight normal to the surface, which is $W_\perp = mg\cos\theta$.