Key Terms

binding energy the energy equivalent of the difference between the mass of a nucleus and the masses of its nucleons

ether scientists once believed there was a medium that carried light waves; eventually, experiments proved that ether does not exist

frame of reference the point or collection of points arbitrarily chosen, which motion is measured in relation to

general relativity the theory proposed to explain gravity and acceleration

inertial reference frame a frame of reference where all objects follow Newton's first law of motion

length contraction the shortening of an object as seen by an observer who is moving relative to the frame of reference of the object

mass defect the difference between the mass of a nucleus and the masses of its nucleons

postulate a statement that is assumed to be true for the purposes of reasoning in a scientific or mathematic argument

proper length the length of an object within its own frame of reference, as opposed to the length observed by an observer moving relative to that frame of reference

relativistic having to do with modern relativity, such as the effects that become significant only when an object is moving close enough to the speed of light for to be significantly greater than 1

relativistic energy the total energy of a moving object or particle $E = \gamma mc^2$, which includes both its rest energy mc^2 and its kinetic energy

relativistic factor $\gamma = \frac{1}{\sqrt{1-\frac{\mathbf{u}^2}{c^2}}}$, where $\mathbf{u}$ is the velocity of a moving object and c is the speed of light

relativistic momentum $\mathbf{p} =$ $m\mathbf{u}$, where is the relativistic factor, m is rest mass of an object, and $\mathbf{u}$ is the velocity relative to an observer

relativity the explanation of how objects move relative to one another

rest mass the mass of an object that is motionless with respect to its frame of reference

simultaneity the property of events that occur at the same time

special relativity the theory proposed to explain the consequences of requiring the speed of light and the laws of physics to be the same in all inertial frames

time dilation the contraction of time as seen by an observer in a frame of reference that is moving relative to the observer