Introduction to Physics : Notes/W.S.-40

Newton's Laws of Motion

Sir Isaac Newton discovered the three laws of motion.

The First Law: If the net force on an object is zero, the object will remain stationary, or continue moving in a straight line at a constant speed.

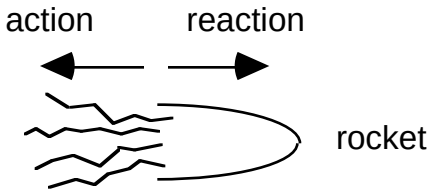
ball rolling
on floor
(friction is zero)

the net force is zero
the ball continues moving
in a straight line
at a constant speed

The Second Law: The net force on an object equals the mass multiplied by the acceleration. F = m a.

falling ball
net force is not zero
ball accelerates downward
force = mass x (-9.8)

The Third Law: For every action, there is an equal and opposite reaction.



there is a force on the gases pushing the gas out the back of the rocket

the reaction force pushes the rocket forward

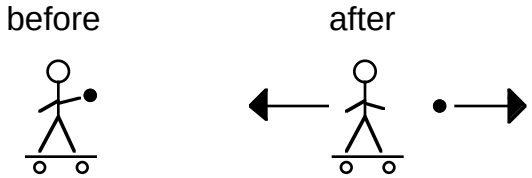
Problems:

1) If you push against a wall with a force (action) of 75 N, the wall pushes back with an equal but opposite force (reaction) of -75 N. Which of Newton's laws is being obeyed here? _____ .

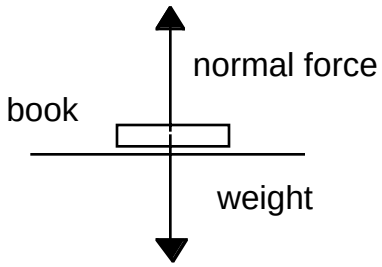
2) A 16 kg object is accelerated by a single force of 24 N. The acceleration is _____. Which of Newton's laws is being obeyed here? _____ .

3) A rocket travels in a straight line at a constant speed of 8500 m/s. The engines are off. Which one of Newton's laws is obeyed here? _____ .

4) A boy on a skateboard throws a heavy ball to the right. He moves off to the left. Which of Newton's laws is illustrated here? _____

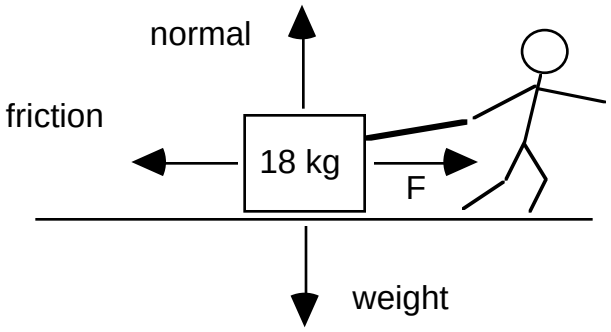


5) A book sits on the floor. The mass of the book is 2.3 kg. The weight of the book is _____ . The floor exerts a force on the book called the normal force. The normal force is _____ . The net force is _____ .Which two of Newton's laws are illustrated here? _____ .

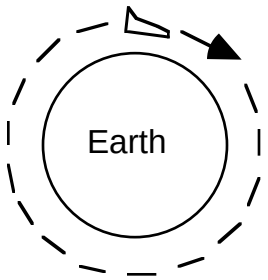


6) A marble rolls down an incline. The mass is 0.035 kg. The acceleration is 0.40 m/s^2. The net force is _____ . Which law is illustrated here? _____ .

7) A man pulls an 18 kg box with a force of 75 N at a constant speed across a floor as shown below. There is a friction force. (Friction is a force that opposes motion). The weight is _____ . The normal force is _____ . The force of friction is _____ .The net force is _____ . Which law is illustrated? _____ .



8) The shuttle travels with a constant speed of 8100 m/s in a circular orbit. The engines are off once the shuttle is in the proper orbit. The height above the Earth's surface is 100 to 200 kilometers. Which law is illustrated here? _____ .



Answer: 1) 3, 2) 1.5 m/s^2, 2, 3) 1, 4) 3, 5) -22.5 N, +22.5 N, 0.0 N, 1 and 3, 6) 0.014 N, 2, 7) -176 N, +176 N, -75 N, 0.0 N, 1, 8) 2.