

Answers

Review

(1) Gravitational forces are created between the Sun and planets that move a soccer ball are created by your muscles when you kick it; and (3) forces that pull a thrown football toward the ground are gravity.

$22.24 \text{ N} > 5 \text{ pounds}$ is a greater force.

Forces include friction, normal forces, and forces that involve ropes or pulleys. Action-at-a-distance forces involve two objects touching one another. Action-at-a-distance forces include gravity, magnetism, and electricity and involve forces between objects that are not touching. The interacting objects are the forces around them through which the interactions occur.

$163 \text{ N} \div 6 = 1.63 \text{ N/kg}$
 $100 \text{ kg}(1.63 \text{ N/kg}) = 163 \text{ N}$
 weighs 163 newtons.
 $29.4 \text{ N} \div 9.8 \text{ N/kg} = 2.94 \text{ kg}$

Friction Forces

Friction resists motion.

A normal force is perpendicular to a surface that a surface exerts on an object that is in contact with it.

A spring force is that is exerted by a spring (a coil that resists being pushed or pulled).

When students begin to look for springs in their classroom, you may find that the mechanical parts of a retractable pen include a spring (a coil). Bed frames and trampolines use extension springs.

2: MOTION AND FORCE

Solve It!

1. $35 \text{ N} \div 9.8 \text{ N/kg} = 3.6 \text{ kg}$

2. $50 \text{ kg} \times 9.8 \text{ N/kg} = 490 \text{ N}$

A mass of 50 kg is 490 N so it has more weight at Earth's surface than a 100-N object.

3. $0.5 \text{ kg} \times 9.8 \text{ N/kg} = 4.9 \text{ N}$

5.2 Section Review

- Oil is a liquid substance that helps reduce friction between the mechanical parts of a car. Without oil, the friction between the mechanical parts would cause the car to overheat.
- b and d
- b
- Sample answers: ball bearings in a bicycle; oil lubricant in a car; wheels (substituting the lower rolling friction for sliding friction)
- Sample answers: the braking system on an elevator; using a "sticky" material like rubber on the end or bottom of an object (like a shoe); gymnasts use chalk on their hands to help them from slipping on the apparatus and ballerinas use rosin on their toe shoes to prevent slipping.
- False. You can reduce friction with oil, but you cannot eliminate it.
- D
- False. Friction changes energy, it does not make it vanish. Friction may change the energy of a force into heat energy.
- True. Electronic machines experience friction. Electricity moving through wires causes the wires to heat up. This is because of friction between the free electrons and the atoms in the wire.
- Sample answer: Friction is caused by contact between objects and the resulting resistance to motion. The presence of water between two touching surfaces of objects will reduce friction between the objects but water doesn't eliminate friction. When water runs over rocks it can cause the rocks to wear down (this is called physical weathering). Also, water can cause other small particles to bump against the rock so that it weathers more. Finally, water is also involved in the chemical weathering of rocks so that they break down even more.