5 Newton's Third Law of Motion

Solutions to Chapter 5 Exercises

4. Action; hammer hits nail. Reaction; nail hits hammer. (b) Action; Earth pulls down on a book. Reaction; book pulls up on Earth. (c) Action; helicopter blade pushes air downward. Reaction; air pushes helicopter blade upward. (In these examples, action and reaction may be reversed—which is called which is unimportant.)

9. When the ball exerts a force on the floor, the floor exerts an equal and opposite force on the ball—hence bouncing. The force of the floor on the ball provides the bounce.

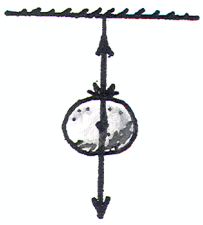
13. The scale will read 100 N, the same it would read if one of the ends were tied to a wall instead of tied to the 100-N hanging weight. Although the net force on the system is zero, the tension in the rope within the system is 100 N, as shown on the scale reading.

20. The forces do not cancel because they act on different things—one acts on the horse, and the other acts on the wagon. It's true that the wagon pulls back on the horse, and this prevents the horse from running as fast as it could without the attached wagon. But the force acting on the wagon (the pull by the horse minus friction) divided by the mass of the wagon, produces the acceleration of the wagon. To accelerate, the horse must push against the ground with more force than it exerts on the wagon and the wagon exerts on it. So tell the horse to push backward on the ground.

26. The winning team pushes harder against the ground. The ground then pushes harder on them, producing a net force in their favor.

31. Vector quantities are velocity and acceleration. All others are scalars.

44. (a) As shown.
(b) Yes.
(c) Because the stone is in equilibrium.



Chapter 5 Problem Solutions

2. The wall pushes on you with **40 N**.
   $a = F/m$ = 40 N/80 kg = **0.5 m/s²**.

4. $a = F/m$, where $F = \sqrt{[(3.0\text{ N})^2 + (4.0\text{ N})^2]} = 5$ N. So $a = F/m$ = 5 N/2.0 kg = **2.5 m/s²**.