

Worksheet answers

Part 1

1. A car is parked on a level driveway. Are the forces on it balanced or unbalanced?

Forces are balanced so the car remains at rest on the driveway.

Horizontal forces: none

Vertical forces: gravity (down) and normal force (up) – shown by equal length arrows

2. A rock is dropped from the top of a cliff. Are the forces on it balanced or unbalanced?

Forces are unbalanced.

Horizontal forces: none

Vertical forces: gravity (down) is much greater than air resistance (up), so the rock accelerates down.

3. A skydiver is descending on a parachute at constant speed. Are the forces on him balanced or unbalanced?

Forces are balanced. The parachute descends at constant speed.

Horizontal forces: none

Vertical forces: gravity (down) and air resistance (up) are equal strength but in opposite directions, so they balance each other.

Part 2

4. Why does the boy have to push against the ground to start the skateboard moving?

Vertical forces on the skateboard - gravity (down) and the path's normal force (up) - balance each other, so they have no effect on the skateboard's motion. The rider's push against the ground applies an unbalanced force to overcome friction and start the board moving.

5. This skateboard is moving at constant speed. What does this tell us about the vertical and horizontal forces acting on it?

When the skateboard is moving along the path at constant speed, the vertical forces - gravity (down) and the path's normal force (up) - are balanced. There are no horizontal forces to speed up or slow down the skateboard so it travels along the path at constant speed.

6. What happens to the skateboard when it starts rolling down the slope? What forces make this happen?

The skateboard accelerates down the slope. The forces acting are gravity, the normal force and friction (in the skateboard's wheels and air resistance). Gravity (down the slope) is much stronger than friction (up the slope), so the skateboard accelerates down the slope.

7. On a level path, the skateboard eventually slows down and stops. What makes it stop?

Friction stops the skateboard. The vertical forces (gravity and the normal force) are balanced, so they have no effect on the board's motion. The only horizontal force is friction at the skateboard's wheels. Because friction acts in the opposite direction to motion, it eventually stops the skateboard.

8. Complete the following statements:

- a) Forces are balanced when they are equal in **strength** but opposite in **direction**.
- b) **Gravity** is a force that acts on all objects on Earth.
- c) When balanced forces act on a stationary object, the object will **remain stationary**.
- d) When balanced forces act on a moving object, the object will **keep moving at the same speed**.
- e) When an unbalanced force acts on a stationary object, the object will **accelerate in the direction of the unbalanced force**.
- f) When an unbalanced force acts on a moving object, the object will **either accelerate or decelerate, depending on the direction of the unbalanced force**.