

# Force, Motion, and Simple Machines Study Guide



## **What is gravity?**

Gravity is a force between objects that pulls them toward one another and keeps things from floating into space. Gravity pulls things to the ground.

**What are balanced forces?** When the motion of an object doesn't change (meaning it remains stationary or keeps on moving at the same speed in the same direction), it means the forces are balanced.

**Which tool do you use to measure force?** A spring scale is used to measure force.

**Compare a push to a pull.** Both are forces and cause a change in direction. Pushes move things forward, but pulls move things backward.

**What happens when you apply force to an object?** It changes direction or moves.

**What facts showed balanced forces acting on the water bottle?** I was pulling on the spring scales with the same amount of force; therefore, the water bottle remained still.

**What would result if you increased the ramp height in the Explore activity to 50 cm?** The toy car would travel farther than it did at the other two ramp heights. It would roll for a longer amount of time. It would gain speed.

**How could you make an object move faster or go farther?** To make an object go farther or faster I would need to apply more force.

**Describe a situation in which balanced forces are acting on an object.** Gravity is exerting force down on the object. The floor is exerting an equal and opposite force pushing up on the object.

**What is the relationship between forces and motion?** Forces and motion are related because an object can't move without a force.

**Based on what you know, how would you explain forces acting on a door being opened?** To open a door requires unbalanced forces. The force being applied to pull open the door is greater than the force keeping the door shut.

**How can we use arrows in an illustration of forces?** We can use arrows to show the direction of the force.

**What changes would you make to cause your object go farther or faster? How about slower or travel less distance?** Possible answers: increase/decrease ramp height or increase/decrease force. Use a stronger or weaker magnet.

**What other investigation can you design to test a force that was not tested by you or your classmates?** Answers will vary. Possible answers: Dropping a ball from various heights and measuring how high it bounces, measuring the speed of a falling object, and investigating more examples of balanced/unbalanced forces.

**What are some simple machines?** Some simple machines are lever, pulley, wedge, inclined plane, wheel and axle, and screw.

**What happens when a simple machine is used to lift a load?** The amount of force needed to lift the load is less than if the load were lifted directly up from the hard surface.

**Explain how an inclined plane or pulley works to change the amount of force required to move an object.** Inclined planes and pulleys both lower the amount of force needed to raise a load or object. Inclined planes reduce the amount of force required by increasing the distance an object must travel. Simple pulleys change the direction of the force used to lift an object over a distance.

**Explain some uses of simple machines.** Simple machines can be used to lift loads, cut objects, connect higher and lower areas, and move objects forward.

**How do you think the amount of force needed to chop a log in half would change using a wedge?** The amount of force needed to chop a log is reduced when using a wedge. A wedge allows for the log to be split in half with less force.

**How would you use a lever to complete a task?** By providing downward force on one side of a lever, the load is lifted up on the other side of the lever.

**How do pulleys compare with wheel and axles?** Both pulleys and wheel and axles involve multiple parts that move around a round object. Pulleys move objects up and down, while wheel and axles move objects forward and backward.

**How can you distinguish between a wedge and an inclined plane?** Wedges have one flat edge and are used for cutting, while inclined planes have two flat edges and are used for moving objects from one level to another.

**How would you justify how simple machines change the amount of force required to lift or move a load?** Simple machines function to change the magnitude of a force or the direction of a force. They use mechanical advantage, which is also known as leverage, to multiply the amount of force exerted on a load. One of the trade-offs with simple machines is that as the amount of force required to lift a load decreases, there is a proportional increase in the distance that the load must be moved.

**What method could you use to measure the change in force when simple machines are used to complete tasks?** You can use a spring scale to measure the difference in pulling a load with and without the use of a simple machine.

**How could you test how forces change when changing the angle of incline planes?** Using a spring scale, you could measure how much force is required to pull the load up each of the different inclined planes. The steeper the inclined plane, the more force is required.

**A screw is an inclined plane wrapped around a rod, usually made of wood or metal, with a wedge at the tip. How could you combine other simple machines to create a new machine?** Answers will vary. Sample student response: I would stretch an inclined plane over several wheel and axles and make a conveyor belt.