

PhET Name	Forces and Motion: Basics
PhET Simulation Link	https://phet.colorado.edu/en/simulations/forces-and-motion-basics
Topic Covered using the Simulation	Force and motion; balanced and unbalanced forces; net force; effect of force on acceleration; effect of mass on acceleration; friction; Newton's Laws of Motion
Class	9
Learning Focus	Understand force as a push or pull that can affect the motion of an object. Identify balanced and unbalanced forces. Understand the concept of net force. Explain how an unbalanced force changes the state of motion. Explore the relationship between force, mass and acceleration. Understand that greater net force produces greater acceleration for the same mass. Understand that greater mass produces less acceleration for the same net force. Distinguish between zero net force and zero motion. Understand the role of friction in affecting motion.

Task 1: Net Force

1. Open **Forces and Motion: Basics**.
2. Select an object that can be pushed/pulled.
3. Apply a force to the object in one direction.
4. Observe the **force arrow**.
5. Apply a force in the opposite direction.
6. Make the two forces **equal**.
7. Observe the **net force**.
8. Now increase one of the forces.
9. Observe how the net force changes.
10. Observe the direction of the object's acceleration.

Force Right	Force Left	Net Force	What do you observe?
50 N	50 N		
80 N	50 N		
100 N	30 N		

Task 2: Motion

Select an object.

Start with the object **at rest**.
Apply a force to make it move.
Observe its motion.
Continue applying the force.
Observe what happens to its speed.
Now remove the applied force.
Observe the net force.
Observe what happens to the object's motion.
Compare the two situations.

Situation	Net Force	Acceleration	What happens to motion?
Force applied			
Force removed			

Task 3: Friction

Select an object.

Set friction to **low/no friction**.
Apply a force and observe the motion.
Now introduce friction.
Apply the same force.
Observe the frictional force.
Observe the net force.
Increase the friction.
Compare the object's motion.
Try to balance the applied force with friction.

Applied Force	Friction	Net Force	Motion
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Task 4 : Acceleration

Steps A — Change Force

1. Select an object.
2. Keep its **mass constant**.
3. Apply a small net force.
4. Record the acceleration.

5. Increase the net force.
6. Record the new acceleration.
7. Repeat with another force.
8. Compare the values.

Mass	Net Force	Acceleration
Constant		
Constant		
Constant		

Steps B — Change Mass

1. Keep the **net force constant**.
2. Select a smaller mass.
3. Record the acceleration.
4. Increase the mass.
5. Keep the same net force.
6. Record the acceleration.
7. Compare the results.

Net Force	Mass	Acceleration
Constant		
Constant		
Constant		

Misconceptions:

1. "A force is required to keep an object moving."

→ Challenge: Can an object continue moving when the **net force is zero**?

2. "If the net force is zero, the object must be at rest."

→ Challenge: Create a situation where an object is **moving with zero net force**.

3. "Greater force means greater velocity."

→ Challenge: Investigate whether force directly determines **velocity** or causes **acceleration (change in velocity)**.

4. "A heavier object accelerates more when the same force is applied."

→ Challenge: Keep net force constant and systematically increase mass. Use evidence to explain the change in acceleration.

5. "Equal and opposite forces always cancel, so the object cannot accelerate."

→ Challenge: Investigate **Newton's Third Law** and determine why equal and opposite interaction forces do not necessarily mean zero acceleration of the interacting objects.