

MEASURING FORCES

KEY IDEAS

- Forces can have different strengths and directions
- Forces are measured in newtons (N)
- The size and direction of a force affects the way it moves

EXAMPLE QUESTIONS

- Do you think a single force can push or pull in several directions at the same time?
- How do you think the size of a force will affect the way something moves?
- How can you measure forces?

FORCES CAN OPPOSE EACH OTHER

- Two forces acting against each other are opposing (the two different pulls in a tug of war, for example).
 - If one of these forces is stronger than the other one, it will always win.
 - If the opposing forces are pushing or pulling something with equal strength, the object will not move because the two forces are balancing each other.
- Change in movement depends upon forces being unbalanced.

THE SIZE AND DIRECTION OF FORCES AFFECTS THE WAY OBJECTS MOVE

- The movement of an object depends upon both the size and direction of the forces acting upon it.
- The greater the unbalanced forces are on an object, the greater the effects.
- An unbalanced force (where one force is greater than the other forces) produces motion in an object.

- As long as the unbalanced forces act on an object, that object will increase in speed (or accelerate), moving in the direction that the force is pushing or pulling.

FORCES CAN BE MEASURED

- Pushes and pulls can be of different strengths.
- The strength of a force can be measured in newtons (N) with a balance.
- A medium-sized apple weighs approximately one newton.
- It takes about 4 N to lift an average-sized book.
- A tug-of-war team pulls at about 1000 N.
- A space rocket exerts a force of about 30,000,000 N to get off the Earth's surface and into space.

A SPECIAL NOTE ABOUT MASS AND WEIGHT

- Mass and weight are frequently used to mean one and the same thing, but in modern science they have very different and precise meanings.
- Mass is the amount of matter in a body (substance) and is measured in kilograms/grams.
- Weight is the measure of the force of gravity acting on a mass, and it is measured in newtons.
- Think of astronauts and other objects floating in space or being on the moon.
- Everyday objects that have familiar weight on the Earth weigh much less in space.
- A brick will have the same mass on Earth or the moon, but it will weight much less on the moon because the pull of gravity on the moon is much less than that on the Earth.

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