

Physical Science

UNIT 2 – FORCES AND MOTION

Standards, Elements & Skills:

S8P3. Students will investigate relationship between force, mass, and the motion of objects.

a. Determine the relationship between velocity and acceleration.

Skills:

- Define motion as a change in position as a result of applied net force.
- Explain speed, velocity, and displacement.
- Interpret a time-distance graph and an acceleration graph.
- Predict the effect of acceleration on the motion of an object.
- Explain the relationship between velocity and acceleration.

b. Demonstrate the effect of balanced and unbalanced forces on an object in terms of gravity, inertia, and friction.

Skills:

- Explain the difference between friction and inertia.
- Distinguish between mass and weight.
- Identify forces present in a given set-up (gravity, friction, inertia).
- Distinguish between balanced and net forces.
- Demonstrate the law of inertia (Newton's First Law of Motion).
- Explain why direction of force is important.
- Determine the effect of friction on balanced and unbalanced forces.

c. Demonstrate the effect of simple machines (lever, inclined plane, pulley, wedge, screw, and wheel and axle) on work.

Skills:

- Demonstrate the effect of simple machines on work.
- Explain the relationship between input force and output force.
- Give an explanation for the components of the formula $\text{work} = \text{force} \times \text{distance}$.

S8P5. Students will recognize characteristics of gravity, electricity, and magnetism as major kinds of forces acting in nature.

a. Recognize that every object exerts gravitational force on every other object and the force exerted depends on how much mass the objects have and how far apart they are.

Skills:

- Explain the relationship of mass and distance to the gravity between objects.

Key Learnings

Students will know that:

- The motion of an object is determined with respect to some other object or point. It is seen as a change in position.
- An object will maintain its direction of motion and its speed unless another force such as friction or gravity acts on it.
- An object will speed up, slow down, or change direction when an unbalanced force acts on it. This change is acceleration.
- When forces are balanced, there is no change in acceleration.
- When an unbalanced force acts on an object, the greater the mass of the object, the smaller its acceleration.
- Every object exerts a gravitational force on every other object.
- The force of gravity depends on the mass of an object and the distance between objects.
- Motion is a change in position. Objects change their motion only when a net force is applied.
- Speed describes how fast an object moves. (distance/time)
- Velocity describes both speed and direction.
- Acceleration is any change in velocity.
- Force is the cause of acceleration or change in an object's velocity.
- Inertia is the tendency of an object to remain at rest or in motion with a constant velocity.
- The force between two objects in contact is friction. Friction opposes the motion unless acted on by an unbalanced force.
- Balanced forces completely cancel each other, thus the combined force is equal to zero. Balanced forces result in an object remaining at rest or moving at a constant velocity.
- An unbalanced force acting on an object equals the object's mass times its acceleration.
- For every action there is an equal and opposite reaction.
- When an unbalanced force acts on an object, the greater the mass of the object, the smaller its acceleration. The force of attraction that two objects exert on each other is gravity.
- Every object exerts a gravitational force on every other object.
- The force of gravity between two objects depends on their masses and the distance between them.
- Work is done only when a force causes an object to move in the same direction as the force.
- Work equals force times distance.
- When force is decreased, distance must be increased.
- Machines make work easier by decreasing force input while increasing distance.

Vocabulary:

- speed - The distance an object travels per unit of time.
- velocity - Speed in a given direction.
- acceleration - The rate at which velocity changes.
- mass - A measure of how much matter is in an object.
- inertia - The tendency of an object to resist any change in its motion.
- momentum - The product of an object's mass and velocity.
- law of conservation of momentum - The rule that in the absence of outside forces the total momentum of objects that interact does not change.
- force - A push or pull exerted on an object.
- net force - The overall force on an object when all the individual forces acting on it are added together.
- balanced forces - Equal forces acting on an object in opposite directions.
- unbalanced forces - Forces that produce a nonzero net force, which changes an object's motion.
- friction - The force that one surface exerts on another when the two surfaces rub against each other; a method of charging an object by rubbing it against another object.
- weight - A measure of the force of gravity on an object.
- work - Force exerted on an object that causes it to move.
- input force - The force exerted on a machine.
- output force - The force exerted on an object by a machine.
- gravity - The force that pulls objects toward each other.
- inclined plane - A simple machine that is a flat, sloped surface.
- wedge - A simple machine that is an inclined plane that moves.
- screw - A simple machine that is an inclined plane wrapped around a central cylinder to form a spiral.
- lever - A simple machine that consists of a rigid bar that pivots about a fixed point.
- wheel and axle - A simple machine that consists of two attached circular or cylindrical objects that rotate about a common axis, each one with a different radius.