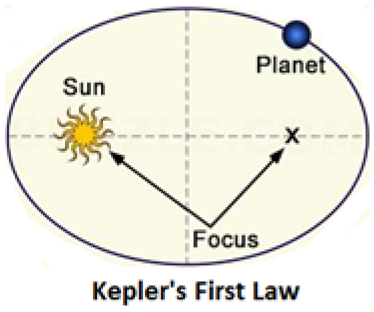
Form	BA - 2, Science, Physics with ESS, SY 24-25
Identifier	F-7ZWBC5_C77252

Item	BA-2_Physics with ESS_01
Identifier	I-SCI-F-S000026_C98781
Standards	SCI.9-12.HS-ESS1-4

Johannes Kepler was a German astronomer who formulated three important laws that describe the motion of planets around the Sun. These laws are known as Kepler's Laws of Planetary Motion.

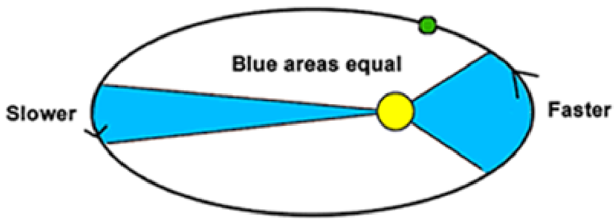
Kepler's First Law: The Law of Ellipses

Kepler's First Law states that the orbit of a planet around the Sun is an ellipse, with the Sun at one of the two foci.



Kepler's Second Law: The Law of Equal Areas

Kepler's Second Law states that a line segment joining a planet and the Sun sweeps out equal areas during equal intervals of time.



Kepler's Third Law: The Law of Harmonies

Kepler's Third Law states that the square of the orbital period of a planet (the time it takes to make one complete orbit around the Sun) is proportional to the cube of the average distance from the Sun (the semi-major axis of the ellipse).

$$\frac{(T_a)^2}{(T_b)^2} = \frac{(R_a)^3}{(R_b)^3}$$

According to Kepler's Second Law, when a planet is closer to the Sun in its orbit, it:

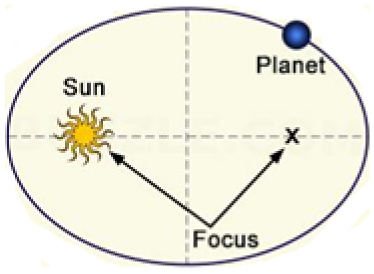
- A moves slower.
- B moves faster.
- C moves at the same speed.
- D moves in a circular path.

Item	BA-2_Physics with ESS_02
Identifier	I-SCI-F-S000026_C92456
Standards	SCI.9-12.HS-ESS1-4

Johannes Kepler was a German astronomer who formulated three important laws that describe the motion of planets around the Sun. These laws are known as Kepler's Laws of Planetary Motion.

Kepler's First Law: The Law of Ellipses

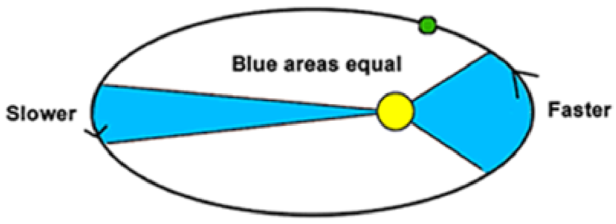
Kepler's First Law states that the orbit of a planet around the Sun is an ellipse, with the Sun at one of the two foci.



Kepler's First Law

Kepler's Second Law: The Law of Equal Areas

Kepler's Second Law states that a line segment joining a planet and the Sun sweeps out equal areas during equal intervals of time.



Kepler's Third Law: The Law of Harmonies

Kepler's Third Law states that the square of the orbital period of a planet (the time it takes to make one complete orbit around the Sun) is proportional to the cube of the average distance from the Sun (the semi-major axis of the ellipse).

$$\frac{(T_a)^2}{(T_b)^2} = \frac{(R_a)^3}{(R_b)^3}$$

Kepler's Third Law relates the orbital period of a planet to its average distance from the Sun. If Earth's orbital period is 1 year, and Mars is 1.5 times farther from the Sun than Earth, what is the approximate orbital period of Mars?

- A 1.52 years
- B 2.25 years
- C 1.84 years
- D 3.56 years

Item	BA-2_Physics with ESS_03
Identifier	I-SCI-F-S000026_C72887
Standards	SCI.9-12.HS-ESS1-4

Here is the equation for Newton’s Law of Universal Gravitation:

$$F = G\frac{m_1 m_2}{r^2}$$

Newton’s Law of Universal Gravitation states that the gravitational force between two objects is directly proportional to:

A the square of the distance between them.

B the sum of their masses.

C the square root of the distance between them.

D the product of their masses.

Item	BA-2_Physics with ESS_04
Identifier	I-SCI-F-S000026_C50153
Standards	SCI.9-12.HS-PS2-4

Coulomb's Law states that the electrostatic force F between two charges q1 and q2 and separated by a distance d is given by:

$$F = \frac{kq_1q_2}{d^2}$$

F is the electric force, k is Coulomb's constant, q1 and q2 are charges, and r is the distance of separation.

From the claims listed below, select **TWO** that are supported by Coulomb's Law.

- A For a constant distance between two charges, as the amount of the charge increases, the size of the electrostatic force will also increase.
- B The size of the electrostatic force will increase as a square of the distance between particles of opposite charge.
- C The strength of the electrostatic force increases as the amounts of charge decrease
- D For a constant distance between two charges, as the amount of the charge decreases, the size of the electrostatic force will also decrease.
- E The product of the strength of the two charges will always be zero.

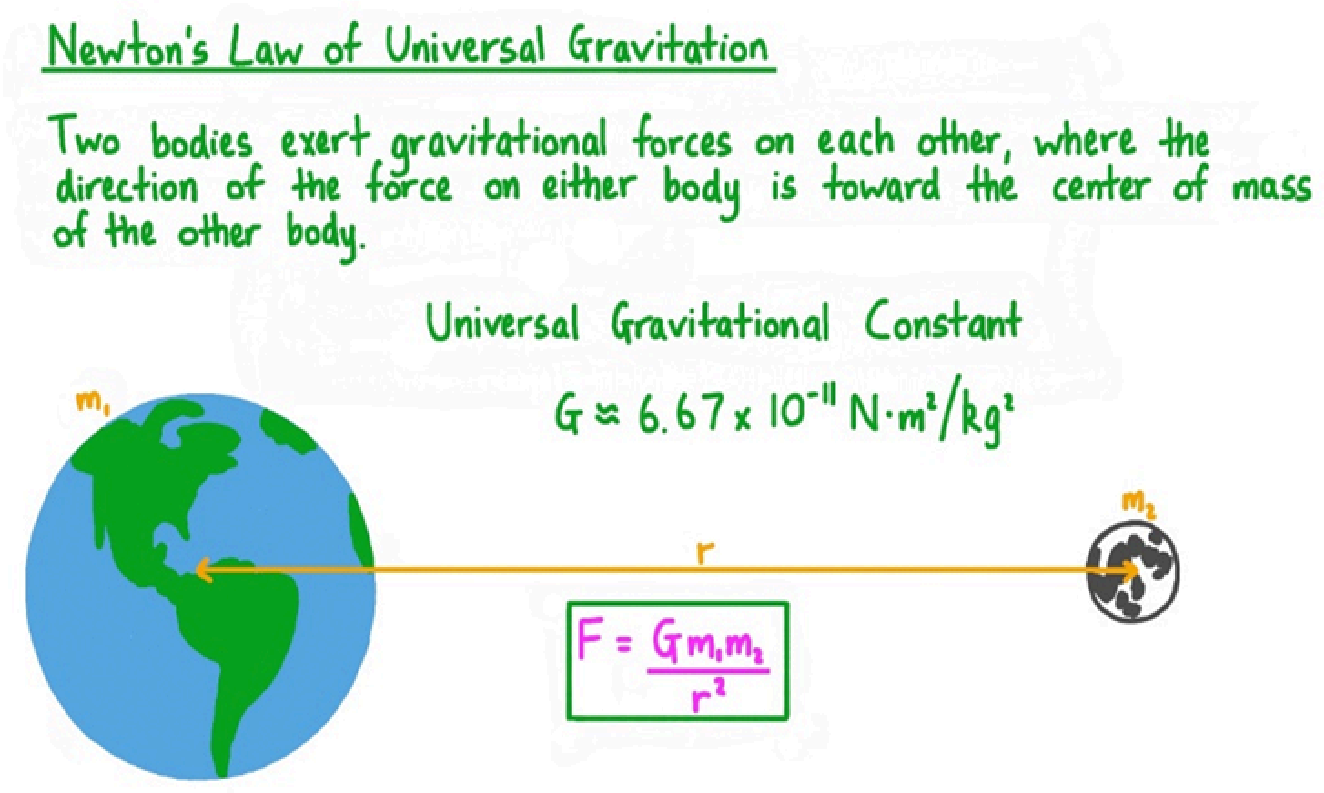
Item	BA-2_Physics with ESS_05
Identifier	I-SCI-F-S000026_C24634
Standards	SCI.9-12.HS-PS2-4

According to Coulomb's Law, if the distance d between the charges is tripled, what happens to the electrostatic force?

(Remember that the equation for Coulomb's Law is $F = \frac{kq_1q_2}{d^2}$)

- A It is divided by 3
- B It is divided by 9
- C It is multiplied by 3
- D It is multiplied by 9

Item	BA-2_Physics with ESS_06
Identifier	I-SCI-F-S000026_C68709
Standards	SCI.9-12.HS-PS2-4



Two objects with masses of 2 kg and 3 kg are separated by a distance of 4 meters. Calculate the gravitational force between them is:

- A 2.5×10^{-11} N.
- B 5.0×10^{-11} N.
- C 1.25×10^{-11} N.
- D 3.75×10^{-11} N.

Item	BA-2_Physics with ESS_07
Identifier	I-SCI-F-S000026_C23449
Standards	SCI.9-12.HS-PS1-3

Which scenario best describes how particles acquire charge and influences the strength of electrical forces between them?

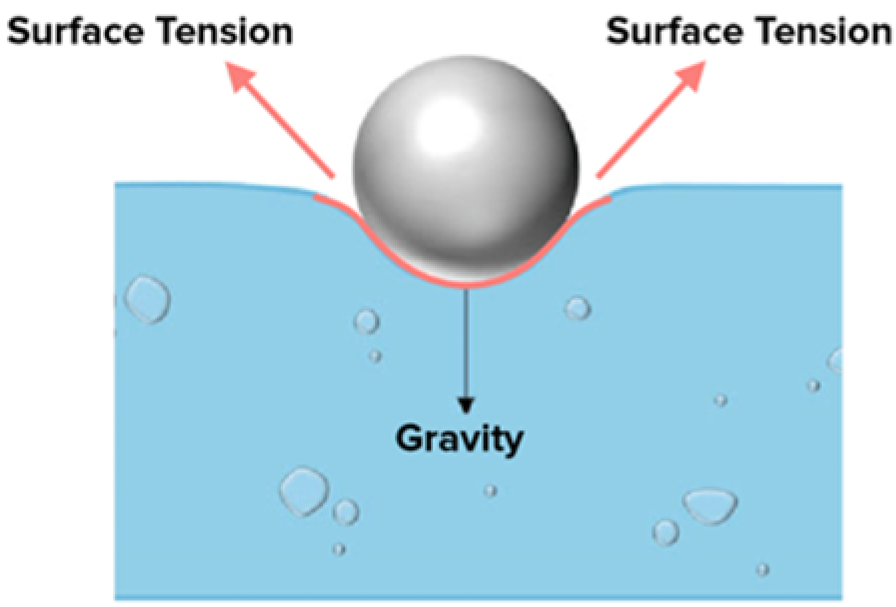
A Molecules share electrons equally, resulting in strong electrical forces in nonpolar covalent bonds.

B Atoms share electrons equally, resulting in weak electrical forces in polar covalent bonds.

C An atom gains or loses electrons, forming ions that create strong electrical forces in ionic bonds.

D Molecules lose electrons to become positively charged, reducing the strength of electrical forces between particles.

Item	BA-2_Physics with ESS_08
Identifier	I-SCI-F-S000026_C12898
Standards	SCI.9-12.HS-PS1-3



In an investigation to compare the surface tension of different liquids, which inference can be made about the strength of electrical forces between particles based on surface tension measurements?

A Liquids with higher surface tension have stronger electrical forces between particles.

B Liquids with higher surface tension have weaker electrical forces between particles.

C Liquids with lower surface tension have stronger electrical forces between particles.

D Surface tension measurements cannot be used to infer the strength of electrical forces between particles.

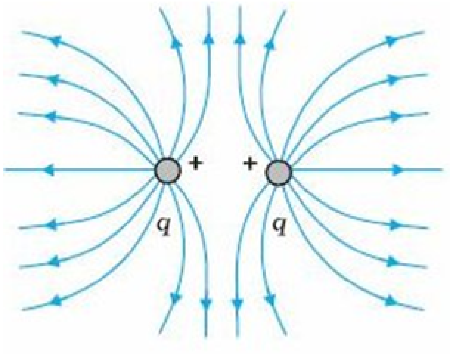
Item	BA-2_Physics with ESS_09
Identifier	I-SCI-F-S000026_C09739
Standards	SCI.9-12.HS-PS1-3

Which of the following statements best explains the relationship between the bulk properties of a substance and the strength of electrical forces between its particles?

- A The melting and boiling points of a substance decrease as the strength of electrical forces between particles increases.
- B The vapor pressure of a substance increases as the strength of electrical forces between particles increases.
- C The surface tension of a substance decreases as the strength of electrical forces between particles increases.
- D The melting and boiling points of a substance increase as the strength of electrical forces between particles increases.

Item	BA-2_Physics with ESS_10
Identifier	I-SCI-F-S000026_C31677
Standards	SCI.9-12.HS-PS3-5

Two positively charged objects are brought close to each other.



According to the model of electric field, what is the nature of the force between them?

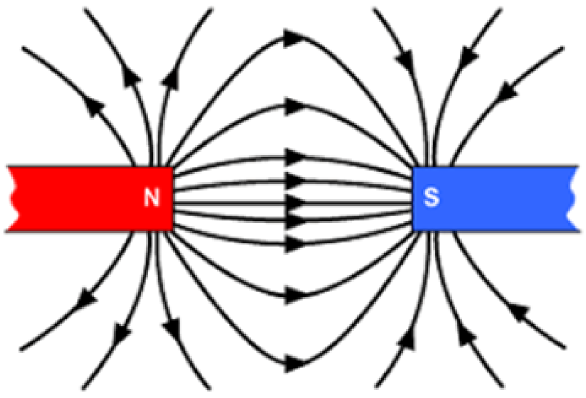
- A Attractive force
- B Repulsive force
- C No force
- D Gravitational force

Item	BA-2_Physics with ESS_11
Identifier	I-SCI-F-S000026_C87202
Standards	SCI.9-12.HS-PS3-5

What happens to the potential energy of two opposite charges as they move closer to each other?

- A Potential energy increases
- B Potential energy remains constant
- C Potential energy decreases
- D Potential energy converts to thermal energy

Item	**BA-2_Physics with ESS_12**
Identifier	I-SCI-F-S000026_C62020
Standards	SCI.9-12.HS-PS3-5



When a north pole of a magnet is brought near the south pole of another magnet, what happens to the energy of the system?

A Energy increases due to repulsion.

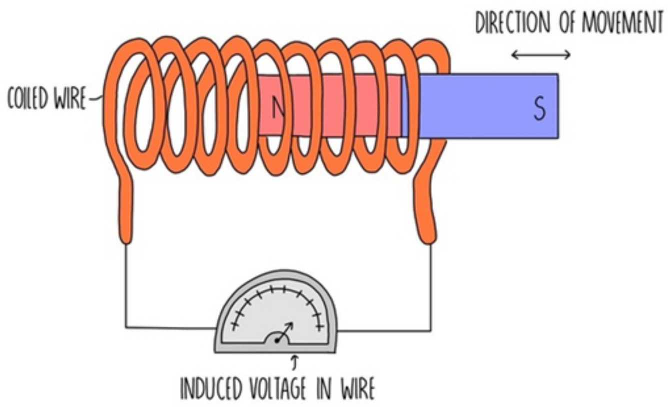
B Energy decreases due to attraction.

C Energy remains constant.

D Energy is converted to thermal energy.

Item	BA-2_Physics with ESS_13
Identifier	I-SCI-F-S000026_C16667
Standards	SCI.9-12.HS-PS2-5

Henrique designs an experiment for his Physics class using a coil of wire and a bar magnet to generate electricity. He acquires 200 cm of copper wire, a bar magnet, and an ammeter. He then wraps the wire in a circular pattern making a coil which is not as long as the magnet length.



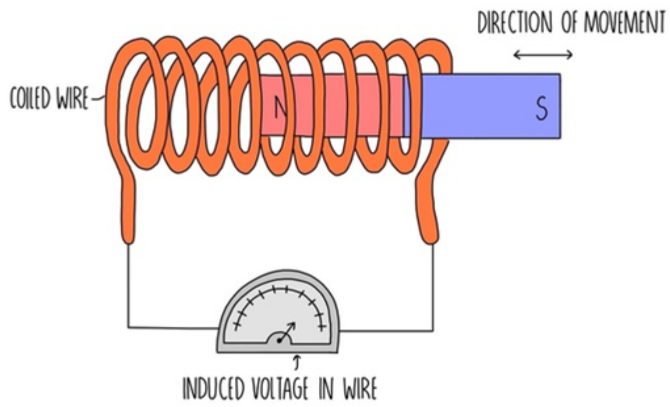
Henrique discovers that when he moves the bar magnet slowly through the coil, that the ammeter indicates that a small amount of electric current is generated. He also notices that if the bar magnet is just placed inside the coil with no movement, no current is generated.

What would **MOST LIKELY** happen to the electric current if the magnet moved very quickly through the cardboard tube?

- A The electrons in the wire would be pushed more quickly thus generating more electric current.
- B The electrons in the wire would be pushed more slowly, but the current generated would be the same.
- C The electrons in the wire would be pushed more quickly but the current generated would be the same.
- D The electrons in the wire would be pushed more slowly thus generating more electric current.

Item	BA-2_Physics with ESS_14
Identifier	I-SCI-F-S000026_C58416
Standards	SCI.9-12.HS-PS2-5

Henrique designs an experiment for his Physics class using a coil of wire and a bar magnet to generate electricity. He acquires 200 cm of copper wire, a bar magnet, and an ammeter. He then wraps the wire in a circular pattern making a coil which is not as long as the magnet length.

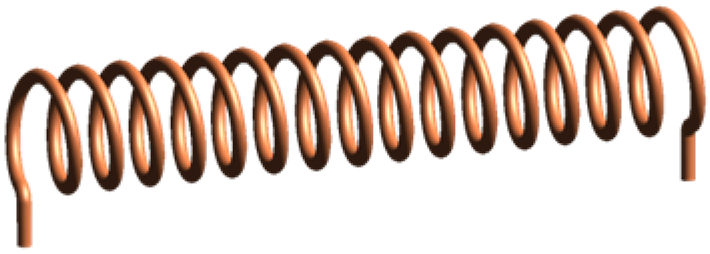


Henrique discovers that when he moves the bar magnet slowly through the coil, that the ammeter indicates that a small amount of electric current is generated. He also notices that if the bar magnet is just placed inside the coil with no movement, no current is generated.

Which of the following **BEST** explains how an electric current can be produced by a changing magnetic field?

- A A magnetic field induces a current by increasing the resistance in a circuit.
- B An electric current is produced by the constant motion of protons and neutrons in the conductor.
- C A stationary magnetic field creates a current by aligning the domains in the conductor.
- D A changing magnetic field creates an electric field, which drives a current in a conductor.

Item	BA-2_Physics with ESS_15
Identifier	I-SCI-F-S000026_C66135
Standards	SCI.9-12.HS-PS2-5

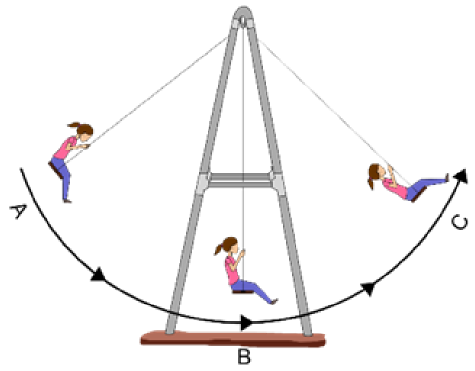


When a current flows through a solenoid (a coil of wire as seen in the image below), which of the following occurs?

- A The solenoid creates a uniform electric field inside it.
- B The solenoid produces thermal energy only.
- C The solenoid becomes a temporary magnet, creating a magnetic field.
- D The solenoid produces light energy.

Item	BA-2_Physics with ESS_16
Identifier	I-SCI-F-S000026_C79407
Standards	SCI.9-12.HS-PS3-2

A child is swinging on a swing on the school playground.



Which off the following descriptions **BEST** describes the primary type of energy transformation taking place?

A Kinetic energy is converted into gravitational potential energy and gravitational potential energy is converted into kinetic energy.

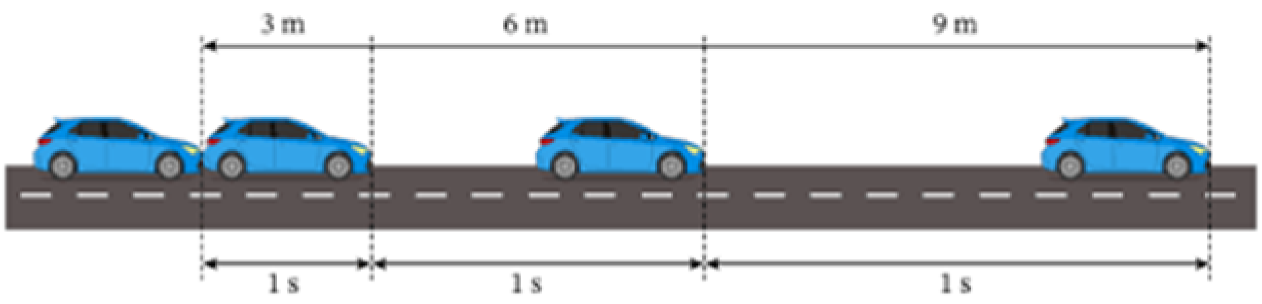
B Gravitational potential energy is converted into regular potential energy and the back to gravitational.

C Chemical energy is converted into thermal energy and thermal energy is converted to gravitational potential energy.

D Energy is always conserved do no energy transformation is occurring.

Item	BA-2_Physics with ESS_17
Identifier	I-SCI-F-S000026_C73870
Standards	SCI.9-12.HS-PS3-2

A car accelerates from rest to a certain speed on a flat road.



Which description **BEST** represents the energy changes in this scenario?

A Kinetic energy is converted into gravitational potential energy.

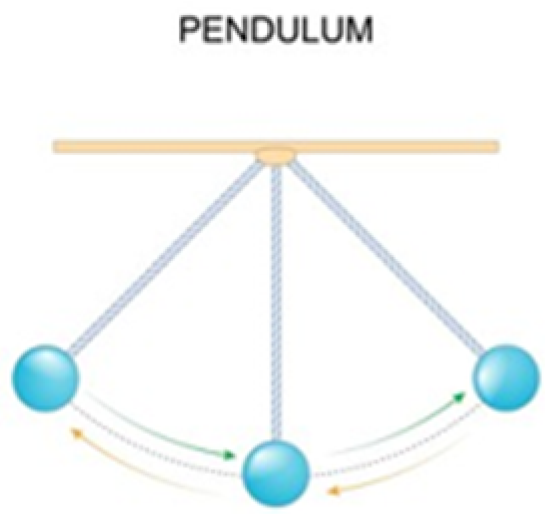
B Elastic potential energy is converted into kinetic energy.

C Chemical energy from fuel is converted into kinetic energy and thermal energy.

D Gravitational potential energy is converted into chemical energy.

Item	BA-2_Physics with ESS_18
Identifier	I-SCI-F-S000026_C97823
Standards	SCI.9-12.HS-PS3-2

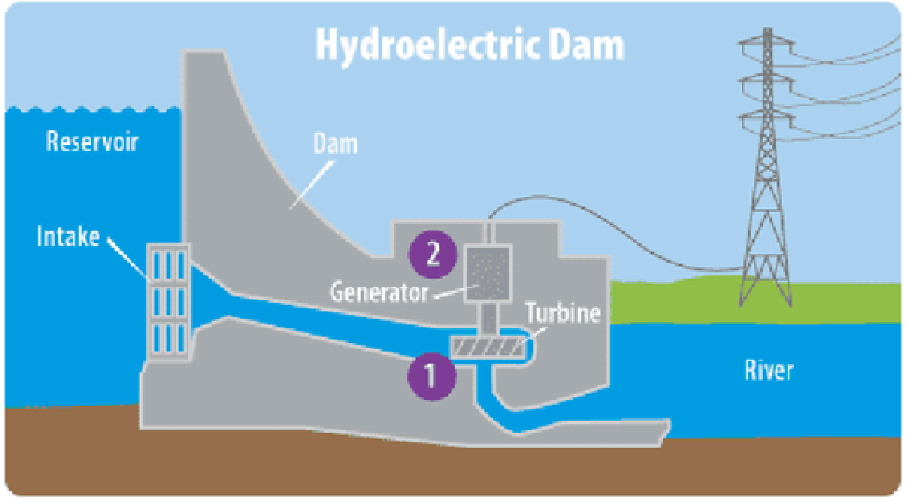
In a pendulum system, energy is constantly being converted between potential energy and kinetic energy. When a pendulum is at its highest point, it possesses the maximum potential energy due to its elevated position above the resting point. As the pendulum swings down, the potential energy is gradually converted into kinetic energy, reaching its peak at the lowest point of the swing. This interconversion of energy between potential and kinetic demonstrates the principle of energy conservation in a macroscopic scale system.



What aspect of the pendulum's motion illustrates the principle of energy conservation?

- A The increasing amplitude of the swing.
- B The conversion of potential energy to kinetic energy and then back to potential and so on.
- C The oscillation period of the pendulum.
- D The change in the pendulum's mass over time.

Item	BA-2_Physics with ESS_19
Identifier	I-SCI-F-S000026_C44113
Standards	SCI.9-12.HS-PS3-3



In designing a hydroelectric dam to convert the potential energy of stored water into electrical energy, what constraint would likely have the most significant impact on the efficiency of the dam?

A The color of the dam

B The temperature of the surrounding air

C The material used for constructing the dam walls

D The height of the water reservoir

Item	BA-2_Physics with ESS_20
Identifier	I-SCI-F-S000026_C86991
Standards	SCI.9-12.HS-PS3-3

During the testing of a solar cell, you observe that the output of electrical energy is significantly lower than expected for the amount of sunlight received.

What would be the most logical first step to refine the device to improve energy conversion?

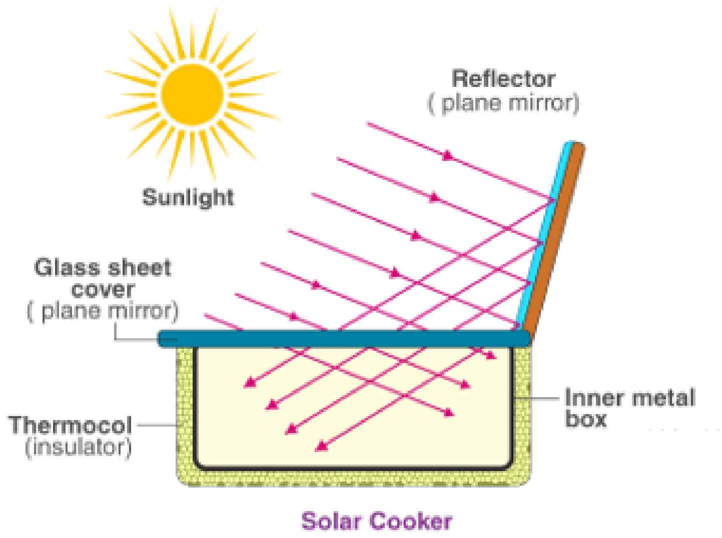
A Alter the angle of the solar panel to optimize sunlight absorption.

B Increase the surface area of the solar panel to capture more sunlight.

C Reduce the amount of sunlight exposure to prevent overheating.

D Replace the wiring in the circuit with wires of higher resistance.

Item	BA-2_Physics with ESS_21
Identifier	I-SCI-F-S000026_C55906
Standards	SCI.9-12.HS-PS3-3



When building a solar cooker to convert sunlight into thermal energy like the one shown above, which component would be **MOST** critical for maximizing the oven's performance?

A The color of the oven

B The weight of the oven

C The size of the oven door

D The type of insulation used