Conservative Forces and Non-conservative Forces

Question 1

While watering a garden, if you lift the watering can to a higher position, how does the gravitational potential energy of the water change?

A) Decreases

B) Increases

C) Remains the same

D) Becomes zero

Question 2

If a cyclist coasts down a hill without pedalling, how does the work done by gravity affect the cyclist's kinetic energy?

A) It decreases

B) It increases

C) It remains constant

D) It initially decreases, then increases

Question 3

When a bird is flying upward at a constant velocity, what can be said about the work done by the gravitational force on the bird?

A) Positive, as it aids in the bird's ascent

B) Negative, as it opposes the bird's ascent

C) Zero, because the bird maintains a constant velocity

D) Cannot be determined without the bird's mass

Question 4

If you shoot an arrow vertically upwards, at its highest point, what is the relationship between its kinetic energy (KE) and potential energy (PE)?

A) KE is maximum; PE is zero

B) KE is zero; PE is maximum

C) Both KE and PE are equal

D) Both KE and PE are zero

Question 5

During a game of basketball, when the ball is at its peak after being thrown, what is the work done by gravity on the ball?

A) Maximum

B) Minimum

C) Zero

D) Negative

Question 6

A squirrel jumps from one tree branch to another of the same height. How does this action affect the squirrel's gravitational potential energy?

A) Decreases

B) Increases

C) Remains the same

D) First increases, then decreases

Question 7

In which of the following scenarios is positive work done by the gravitational force?

A) A person climbing up a ladder

B) An apple falling from a tree

C) Pushing a boulder up a hill

D) A helicopter hovering at a constant altitude

Question 8

If two children, one lighter and one heavier, slide down a playground slide from the same height, how does their final kinetic energy compare, assuming no friction?

A) The lighter child has more kinetic energy

B) The heavier child has more kinetic energy

C) Both have the same kinetic energy

D) Impossible to determine without knowing their speeds

Question 9

When a pendulum swings from its highest point to its lowest, how does the potential energy at the highest point compare to the kinetic energy at the lowest point?

A) Potential energy is greater than kinetic energy

B) Kinetic energy is greater than potential energy

C) Potential energy and kinetic energy are equal

D) Both are zero

Question 10

If a book is pushed across a table and comes to a stop because of friction, what does this scenario illustrate about the force of friction?

A) It is a conservative force because it conserves energy

B) It is a non-conservative force because it converts kinetic energy into thermal energy

C) It is a conservative force because it does no work

D) It is non-conservative because it increases the book's potential energy

Answers UnCubed

Question 1: Increases (B)

Explanation: Lifting the watering can to a higher position increases its gravitational potential energy because the potential energy in a gravitational field is directly proportional to the height above the reference point. In a way you are increasing the PE of every molecule of water (…but to a varying extent)

Question 2: Increases (B)

Explanation: As the cyclist coasts down the hill, gravity does positive work on the cyclist, converting potential energy into kinetic energy, thereby increasing the cyclist's speed and kinetic energy.

Question 3: Negative, as it opposes the bird's ascent (B)

Explanation: For the bird flying upward at a constant velocity, the work done by gravity is negative because gravity is acting in the opposite direction to the bird's displacement, thus opposing the ascent.

Question 4: KE is zero; PE is maximum (B)

Explanation: At the arrow's highest point, its velocity and, consequently, its kinetic energy are zero because it momentarily stops before starting to fall. At this point, its potential energy is at a maximum due to its height.

Question 5: Zero (C)

Explanation: At its peak, the basketball's velocity is momentarily zero, meaning gravity is not doing any work on the ball at that instant since work is defined as the force applied over a distance, and there is no vertical movement at the peak.

Question 6: Remains the same (C)

Explanation: Since the squirrel jumps between branches of the same height, its gravitational potential energy remains unchanged because there's no change in its height relative to the ground.

Question 7: An apple falling from a tree (B)

Explanation: Positive work is done by gravity in this scenario because the force of gravity acts in the same direction as the apple's displacement when it falls, increasing the apple's kinetic energy.

Question 8: The heavier child has more kinetic energy (B)

Explanation: If friction is neglected, the heavier child will have more KE since the starting PE would be higher for the heavier child, that eventually converts to KE at the bottom. Remember PE = mgh. So higher the mass, more the PE

Question 9: Potential energy and kinetic energy are equal (C)

Explanation: At the lowest point, all of the pendulum's potential energy has been converted into kinetic energy. If we assume no energy loss due to air resistance or friction, the potential energy at the highest point equals the kinetic energy at the lowest point.

Question 10: It is a non-conservative force because it converts kinetic energy into thermal energy (B)

Explanation: Friction is a non-conservative force because it converts mechanical energy (in this case, kinetic energy) into other forms of energy, like thermal energy, which cannot be fully converted back into mechanical energy by the force of friction alone. This results in a net loss of mechanical energy from the system or the energy is not conserved. Hence friction is a non-conservative force.

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