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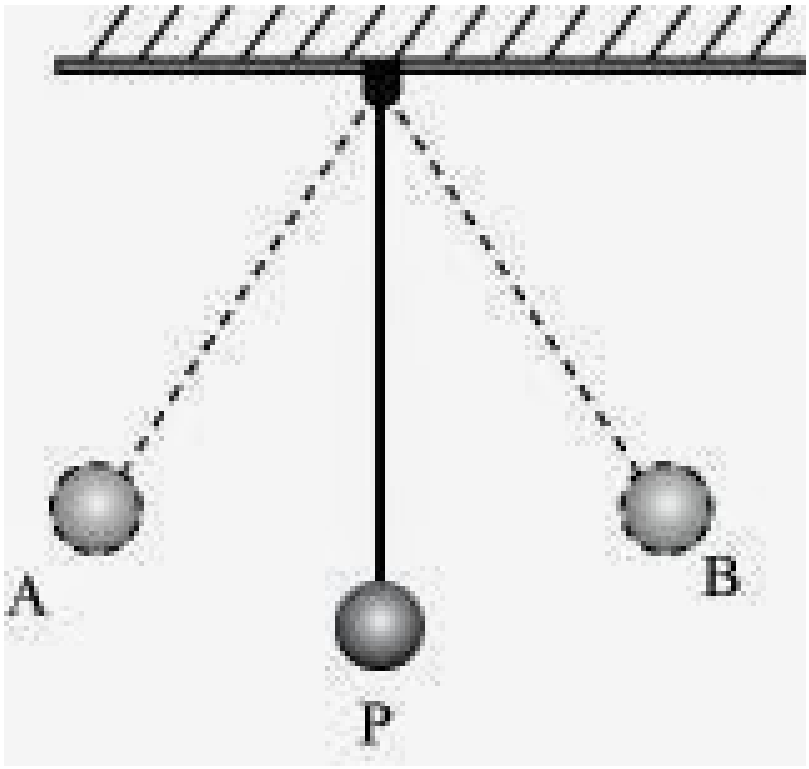
13. A person holds a bundle of hay over his head for 30 minutes and gets tired. Has he done some work or not? Justify your answer.
Answer:
Work is done whenever the given two conditions are satisfied:

- A force acts on the body.
- There is a displacement of the body by the application of force in or opposite to the direction of force.

When a person holds a bundle of hay over his head, then there is no displacement in the bundle of hay. Although, force of gravity is acting on the bundle, the person is not applying any force on it. Hence, in the absence of force, work done by the person on the bundle is zero.

14. An electric heater is rated 1500 W. How much energy does it use in 10 hours?
Answer:
Energy consumed by an electric heater can be obtained with the help ofthe expression,
P = W / T
Where,
Power rating of the heater, P= 1500 W = 1.5 kW
Timefor which the heater has operated, T = 10 h
Work done = Energy consumed by the heater
Therefore, energy consumed = Power x Time
= 1.5 x 10 = 15 kWh
Hence, the energy consumed by the heater in 10 h is 15 kWh.

15. Illustrate the law of conservation of energy by discussing the energy changes which occur when we draw a pendulum bob to one side and allow it to oscillate. Why does the bob eventually come to rest? What happens to its energy eventually? Is it a violation of the law of conservation of energy?
Answer: The law of conservation of energy states that energy can be neither created nor destroyed. It can only be converted from one form to another.
Consider the case of an oscillating pendulum.



When a pendulum moves from its mean position P to either of its extreme positions A or B, it rises through a height h above the mean level P. At this point, the kinetic energy of the bob changes completely into potential energy. The kinetic energy becomes zero, and the bob possesses only potential energy. As it moves towards point P, its potential energy decreases progressively. Accordingly, the kinetic energy increases. As the bob reaches point P, its potential energy becomes zero and the bob possesses only kinetic energy. This process is repeated as long as the pendulum oscillates. The bob does not oscillate forever. It comes to rest because air resistance resists its motion. The pendulum loses its kinetic energy to overcome this friction and stops after some time.
The law of conservation of energy is not violated because the energy lost by the pendulum to overcome friction is gained by its surroundings. Hence, the total energy of the pendulum and the surrounding system remain conserved.

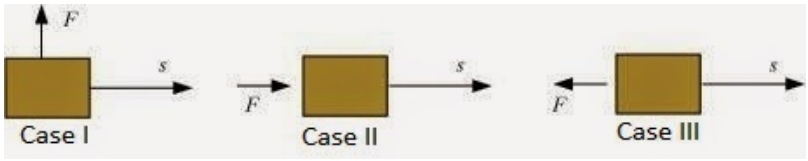
16. An object of mass, mis moving with a constant velocity, v. How much work should be done on the object in order to bring the object to rest?
Answer: Kinetic energy of an object of mass, moving with a velocity, v is given by the expression,
$E_k = 1/2\ mv^2$
To bring the object to rest, $1/2\ mv^2$ amount of work is required to be done on the object.

17. Calculate the work required to be done to stop a car of 1500 kg moving at a velocity of 60 km/h?
Answer: Kinetic energy, $Ek = 1/2\ mv^2$
Where,
Mass of car, m= 1500 kg
Velocity of car, v= 60 km/h= 60 x 5 / 18 ms^{-1}

$$\therefore E_k = \frac{1}{2} \text{x } 1500 \text{ x } (60\ x \frac{5}{18})^2 = 20.8 \text{ x } 10^4 \text{ J}$$

18. In each of the following a force, F is acting on an object of mass, m. The direction of displacement is from west to east shown by the longer arrow. Observe the diagrams carefully and state whether

the work done by the force is negative, positive or zero.



Answer:
Case I
In this case, the direction of force acting on the block is perpendicular to the displacement. Therefore, work done by force on the block will be zero.
Case II
In this case, the direction of force acting on the block is in the direction of displacement. Therefore, work done by force on the block will be positive.
Case III
In this case, the direction of force acting on the block is opposite to the direction of displacement. Therefore, work done by force on the block will be negative.

19. Soni says that the acceleration in an object could be zero even when several forces are acting on it. Do you agree with her? Why?
Answer: Acceleration in an object could be zero even when several forces are acting on it. This happens when all the forces cancel out each otheri.e., the net force acting on the object is zero. For a uniformly moving object, the net force acting on the object is zero. Hence, the acceleration of the object is zero. Hence, Soni is right.

20. Find the energy in kW h consumed in 10 hours by four devices of power 500 W each.
Answer: Energy consumed by an electric device can be obtained with the help of the expression for power,
P = W / T
Where,
Power rating of the device, P= 500 W = 0.50 kW
Time for which the device runs, T= 10 h
Work done = Energy consumed by the device
Therefore, energy consumed = Power x Time
= 0.50 x 10 = 5 kWh
Hence, the energy consumed by four equal rating devices in 10 h will be 4 x 5 kWh = 20 kWh = 20 Units.

21. A freely falling object eventually stops on reaching the ground. What happens to its kinetic energy?
Answer: When an object falls freely towards the ground, its potential energy decreases and kinetic energy increases. As the object touches the ground, all its potential energy gets converted into kinetic energy. As the object hits the hard ground, all its kinetic energy gets converted into heat energy and sound energy. It can also deform the ground depending upon the nature of the ground and the amount of kinetic energy possessed by the object.

********** END **********