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Solution 26

a) Work done by force applied by the boy is positive because this force is in the direction of motion of the body.

b) Work done by the gravitational force is negative because this force is against the direction of motion of the body.

Solution 27

$W = F \cos\theta \times s$

where, W is work done

F is the force applied

θ is the angle between the direction of force and the direction of motion of the body

s is the distance moved by the body.

Solution 28

Kinetic energy is directly proportional to the mass of the body, m.

Kinetic energy is directly proportional to the mass of the body, m.

$KE \propto m$

Kinetic energy is directly proportional to square of speed of the body, v

$KE \propto v^2$

Solution 29

(a) Positive work: Work done by the force applied by a person on a ball that is thrown upwards.

(b) Negative work: Work done by gravitational force of earth on a ball thrown upwards.

(c) Zero work: Work done by gravitational force of earth on a box that is sliding horizontally on the ground.

Solution 30

Mass = 200 g = 0.2 kg

Height = 5 m

Initial velocity u = 0

Acceleration due to gravity, g = 9.8 m/s^2

Final velocity, v

Using third equation of motion,

$v^2 - u^2 = 2gs$

$v^2 - 0 = 2 \times 9.8 \times 5$

$v^2 = 98$ ----(i)

$$\text{Kinetic energy} = \frac{1}{2} m \times v^2$$

Put the value of v^2 from eqn (i)

$$\text{Kinetic energy} = \frac{1}{2} \times 0.2 \times 98 = 9.8 \text{ J}$$

Solution 31

KE = 20 J
Mass = 100 g = 0.1 kg

$$KE = \frac{1}{2} m \times v^2$$

$$20 = \frac{1}{2} \times 0.1 \times v^2$$

$v^2 = 400$
v = 20 m/s
Momentum = m x v = 0.1 x 20 = 2 kg.m/s

Solution 32

Let masses of the two objects be m
v_1 = 2 m/s
v_2 = 6 m/s

$$KE_1 = \frac{1}{2} m \times v_1^2 = \frac{1}{2} m \times 2^2$$

$$KE_2 = \frac{1}{2} m \times v_2^2 = \frac{1}{2} m \times 6^2$$

$$\text{Ratio} = \frac{KE_1}{KE_2} = \frac{2^2}{6^2} = \frac{4}{36} = \frac{1}{9}$$

Solution 33

Mass of body = 2 kg
Initial velocity u = 0
Time taken = 2 s
Acceleration due to gravity, g = 10 m/s^2
Final velocity v
Using first equation of motion
v = u + gt
= 0 + 10 x 2 = 20 m/s

$$KE = \frac{1}{2} m \times v^2 = \frac{1}{2} \times 2 \times 20^2 = 400\text{ J}$$

Solution 34
Mass of scooter + scooterist = 150 kg
Initial velocity u = 10 m/s
Final velocity v = 5 m/s
Retardation = a
Distance covered= s
Using third equation of motion
$v^2 - u^2 = 2as$
$5^2 - 10^2 = 2as$
as = -75/2 ------(i)
Work done W = F x s

But F = m x a
So, W= m x a x s
Put the value of 'as' from eq(i)
W = 150 x (-75/2) = -5625 J
Neagtive sign implies that force of brakes acts opposite to the direction of motion.
Solution 35

Mass of rock = 10 kg
Height of ladder, h = 5 m
Initial velocity of rock, u = 0
Final velocity v
$g = 10\ m/s^2$
using third equation of motion
$v^2 - u^2 = 2gh$
$v^2 - 0^2 = 2 \times 10 \times 5$
v = 10 m/s

$$KE = \frac{1}{2}mv^2 = \frac{1}{2} \times 10 \times 10^2 = 500\ J$$

Solution 36
Mass of car = 1000 kg
Initial velocity u = 20 m/s
Final velocity v = 10 m/s
Retardation = a
Distance covered = s
Using third equation of motion
$v^2 - u^2 = 2as$
$10^2 - 20^2 = 2as$
as = -150 ------(i)
Work done W = F x s
But F = m x a
So, W= m x a x s
Put the value of 'as' from equation (i)
W = 1000 x -150 = -150000 = -150 kJ Neagtive sign implies that force of brakes acts opposite to the direction of motion.
Solution 37
Height , h= 10 m
Acceleration due to gravity, $g = 10\ m/s^2$
i) Work done, W = m x g x h = 100 x 10 x 10 = 10000 = 10 kJ
ii) Potential energy of the body = work done = 10 kJ
Solution 38
Height, h = 100 m
Acceleration due to gravity, $g = 9.8 m/s^2$
Work done by the boy, W = m x g x h = 50 x 9.8 x 100 = 49000 J = 49 kJ
Potential energy gained by the boy = work done by the boy = 49 kJ
Solution 39
Work done by a force applied on a body is
i) positive when the force acts in the direction of motion of the body.
ii) negative when the force acts in the direction opposite to the direction of motion of the body.
iii) zero when the force acts at right angle to the direction of motion of the body.
Solution 40

Mass of the box, m = 150 kg
PE = 7350 J
Acceleration due to gravity, g = 9.8m/s^2
PE = m x g x h
7350 = 150 x 9.8 x h

$$h = \frac{7350}{150 \times 9.8} = 5\text{ m}$$

Solution 41

Mass of the body, m = 2 kg
Initial velocity, u = 20 m/s
Acceleration due to gravity, g = 10 m/s^2
Height reached = h
Time, t = 2 s
Using second equation of motion

$$h = ut + \frac{1}{2}gt^2$$

$$= 20 \times 2 + \frac{1}{2}(-10) \times 2^2$$

$$= 20\text{m}$$

PE after 2 s = m x g x h = 2 x 10 x 20 = 400 J

Solution 42
Force, F = 1 N
Distance, s = 1 m
Work done W = F x s = 1 x 1 = 1 J
Solution 43
Force, F = 2.5 x 10^{10} N
Velocity, v = 5 m/s
Time, t = 2 minutes = 120 s
Distance, s = v x t = 5 x 120 = 600 m
Work done, W = F x s = 2.5 x 10^{10} x 600 = 15 x 10^{12} J
Solution 44
A stretched rubber band is an example of a body possessing energy while it is not in motion. The rubber band contains potential energy due to the change in its shape or configuration.
Solution 45
a)Gravitational potential energy of a body depends on:
i) mass of the body, m
ii) height to which the body is lifted, h
iii) acceleration due to gravity, g
b)
i. A moving cricket ball has kinetic energy
ii. A stretched rubber band has potential energy
Solution 46
Two examples where a body possesses both kinetic energy as well as potential energy are
i) a man climbing up a hill
ii) a flying aeroplane
Solution 47

Mass of man, m
Height of tree, h = 5 m
Work done, W = 2500 J
Acceleration due to gravity, g = 10 m/s^2
W = m x g x h
2500 = m x 10 x 5

$$m = \frac{2500}{10 \times 5} = 50\text{kg}$$

Solution 48
Work done, W =24.2 J
Distance, s = 20 cm = 0.2 m
Force, F
W = F x s
24.2 = F x 0.2
F = 24.2/0.2 = 121 N
Solution 49
Mass of boy, m = 40 kg
Height, h = 1.5 m
Acceleration due to gravity, g = 10 m/s^2
i) At highest point, velocity, v = 0
Therefore KE = 0
ii) PE = m x g x h = 40 x 10 x 1.5 = 600 J
Solution 50
a) Potential energy
b) Both potential and kinetic energy

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