here. Thus a teacher moving around in the class is doing work but a child standing & reading a book is not doing any work.

[C] Numericals :-

(1) A ~~Poo~~ force of 30 N acts on a body and moves through a distance of 5m in the direction of force. Calculate the work done by a force.

Ans ~~Force~~ Force applied ~~for~~

Force acting on a body = 30 N

Distance moved in the direction of force = 5 m

The work done by a force = F × d
= 30N × 5m
= 150 Joules.

∴ 150 Joules is the work done by the force.

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(2) A man lifts a mass of 20 kg to a height of 2.5 m. Assuming that the force of gravity of 1kg mass is 10 N, the work done by the man.

Sol:→ Given, Force $F = mg$

$= 20 kg \times 10 N kg^{-1}$

$= 200 N$

$d = 2.5 m$

Work done $W = F \times d$

$= 200 N \times 2.5 m$

$= 500$ Joules

200
x 2.5
1000
+400 x
500.0

(3) A body when acted upon by a force of 10 kgf moves to a distance 0.5 m in the direction of force. Find the work done by the force.
Take 1 kgf = 10 N

Sol:→ $F = mg = 10 kgf \times 10 N kgf^{-1}$

$= 100 N$

$d = 0.5 M = \frac{5}{10} m$

The work done by the force $= 100 N \times \frac{5}{10} m$ (F × d)

∴ 50 Joules is work done by the force. $= 50$ Joules

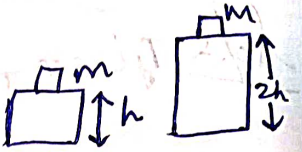
(4) Two bodies of same masses are placed at height h and 2h. Compare their gravitational potential energy.

Sol:→

Body→1 Body→2

$m_1 = m$ $m_2 = m$

$h_1 = h$ $h_2 = 2h$



$(G.P.E)_1 = mgh$ $(G.P.E)_2 = m_2 g \times 2h$

$= mgh$ $= 2(mgh)$

$$\frac{(G.P.E)_1}{(G.P.E)_2} = \frac{mgh}{2(mgh)} = \frac{1}{2}$$

∴ 1 : 2 is the comparison of the g.p.e.

(5) Find the gravitational potential energy of 2.5 kg mass kept at a height of 15 m above the ground. The force of gravity on mass 1 kg is 10 N.

Sol:→ $F = mg = 2.5\,kg \times 10\,N\,kg^{-1} = 25\,N$

d = 15 m

W = F × d

= 25 N × 15 m

= 375 Joules.

∴ 375 Joules is the gpe.

⑥ The gravitational potential energy stored in a box of weight 150 kgf is 1.5×10^4 J. Find the height of the box. Take 1 kgf = 10 N

[G.P.E = mgh]

G.P.E = 1.5×10^4 J.

M = Mass of box = 150 kgf

G = Acceleration due to gravity = 1 kgf = 10 N

= 10 N kg^{-1}

h = h.

G.P.E = mgh

1.5×10^4 J = 150 kg × 10 N kg^{-1} × h

1.5×10^4 J = 1500 × h

$h = \frac{1.5 \times 10^4}{1.5 \times 10^3} = 10$ m

∴ 10 m = height of the box.

(7) The potential energy of a body of mass 0.5 kg increases by 100 J when it is taken to the top of a tower from the ground. If force of gravity on 1 kg is 10 N, what is the height of the tower?

Ans $m = 0.5\,kg = \frac{5}{10}\,kg$

$g = 1kg$ is $10N = \frac{10N}{1kg} = 10Nkg^{-1}$

$h = h$

P.E = 100 Joules.

P.E = mgh

$100J = \frac{5}{10}kg \times \frac{10N}{1kg} \times h$

$100\,J = \frac{50^{5}}{10} \times h$

$100J = 5 \times h$

$h = \frac{100^{20}}{5} = 20\,m$

∴ 20 m is the height of the tower

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(8) A body of mass 60kg is moving with a speed $50 ms^{-1}$. Find its kinetic energy.

Sol: Mass = 60kg

Speed = $50 ms^{-1}$

Kinetic energy = $\frac{1}{2} mv^2$

$= \frac{1}{2} \times 60 \times 50^2$

$= \frac{1}{2} \times 30 \times 2500$

$= 75000 = 7.5 \times 10^4 J$

$\therefore 7.5 \times 10^4$ Joules is its kinetic energy.

(9) A truck of mass 1000kg, increases its speed from $36 km h^{-1}$ to $72 km h^{-1}$. Find the increase in its kinetic energy.

Sol: 🚚 → Truck

$m = 1000 kg$

$u = 36 km/hr$

$= \frac{36 \times 5}{18} m/s = 10 m/s$

here, v = final

here, u = initial

$V = 72 km/hr$

$= \frac{72 \times 5}{18} m/s = 20 m/s$

Δ K.E = Increase in the KE = ~~20 mJ~~

$$\frac{1}{2}mv^2 - \frac{1}{2}mu^2$$

$$= \frac{1}{2}m(v^2 - u^2)$$

$$= \frac{1}{2} \times 1000 (20^2 - 10^2)$$

$$= \frac{1}{2} \times 1000 \times (400 - 100)$$

$$= \frac{1}{2} \times 1000^{500} \times 300$$

$$= 150000$$

$$= 1.5 \times 10^5 \text{ Joules.}$$

$\therefore$ 1.5×10^5 Joules is the increase in its kinetic energy.

(11) A pump raises water by spending 4×10^5 J of energy in 10 s. Find the power of pump.

Ans Sol:→ Work done by the body $= 4 \times 10^5$

Time taken $=$ 10 s

$$\text{Power} = \frac{W}{t}$$

$$= \frac{4 \times 10^5}{10}$$

$$= 4 \times 10^4 = 40000$$

$$= 4 \times 10^4 \text{ W}.$$

(10) A car is moving with a speed of 15 km h^{-1} and another identical car is moving with a speed of 30 km h^{-1}. Compare their kinetic energy.

Ans

Mass of the car [A] $= m$

Speed of the car [A] $= 15 \text{ km h}^{-1}$

Mass of the car [B] $= m$

Speed of the car [B] $= 30 \text{ km h}^{-1}$

K.E of car A $= \frac{1}{2} mv^2 = \frac{1}{2} \times m \times 15$

$= \frac{1}{2} \times m \times 225 = \frac{225}{2} m$

K.E of car B $= \frac{1}{2} \times mv^2$

$= \frac{1}{2} \times m \times 30^2$

$= \frac{1}{2} \times m \times 900$

$= 450\,m$

$1\,km = 1000\,m$

$1\,hr = 3600\,sec$

$= \frac{5}{18}\,m/s$

$1\,m/s = \frac{18}{5}\,km/hr$

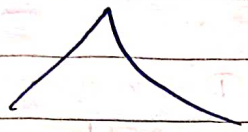
$\frac{\text{K.E of Car A}}{\text{K.E of Car B}} = \frac{225\,m}{2 \times 450\,m} = \frac{1}{4} = 1:4$

$\therefore \frac{1}{4}$ is the comparision of the kinetic energy.

(12) It takes 20 s for a girl A to climbs up the staires while girl B takes 15 s for the same job. Compare (i) the work done and (ii) the Power spent by them.

Sol. Next Page → →

Sol:-



$$W_1 = W \qquad W_2 = W$$

$$P_1 = \frac{W}{t_1} = \frac{W}{20} \qquad P_2 = \frac{W}{t_2} = \frac{W}{15}$$

$$t_1 = 20 \text{ secs} \qquad t_2 = 15 \text{ secs}$$

(i) $$\frac{W_1}{W_2} = \frac{W}{W} = \frac{1}{1} = 1:1$$

(ii) $$\frac{P_1}{P_2} = \frac{W_1/t_1}{W_2/t_2}$$

$$= \frac{W}{20} \Big/ \frac{W}{15} = 3:4$$

(1) Define Work.

Ans → The Work done by a force on a body is equal to the Product of the force applied and the distance moved by the body in the direction of force.

(2) When does a force perform work?

Ans → When a force brings displacement in the body in the direction of force, then, the force performs work.

(3) In which of the following cases is work being done.

(a) A boy pushing a heavy rock. No work is being done.

(b) A boy climbing up the stairs. Work is being done.

(c) A coolie standing with a box on his head. No work is being done.

(d) A girl moving on the road. Work is being done.

(5) A coolie is moving on a road with a luggage on his head. Does he perform work against the force of gravity? Give reason for your answer.

Ans→ He perform no work against the force of gravity as distance moved by the coolie is normal to his weight. So the work done by his against the force of gravity is zero.

(6) The moon is revolving around the earth in a circular path. How much work is done by the moon?

Ans→ No work is done by the moon. The force of attraction on moon by the earth is always normal

to the direction of motion of moon, so no work is done by the gravitational force of earth on the moon.

(7) Write the expression for work done by a force.

Ans⇒ The expression for work done by a force = ~~Force~~ ×
⇒ Force × Displacement
⇒ F × S
⇒ FS

(8) State the S.I. unit of work and define it.

Ans⇒ ⇒ S.I. unit of work is -
★ newton × metre (Nm) or
★ Joule (J).
⇒ One joule of work is said to be done if one newton force when acting on a body moves it by 1 metre in the direction of force.

(9) State two factors on which the work done on a body depends.

Ans:- Two factors on which the work done on a body depends are -

(1) A force must act on the body.

(2) The force must produce change in position i.e., motion of the body or change in size or shape of the body.

(10) Define the term energy.

Ans:- Energy is the capacity of doing work.

(11) State the S.I. unit of energy.

Ans:- S.I. unit of energy is joule (J)

(12) Define 1 joule of energy.

Ans:- A body is said to

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Possess an energy of one joule if it can do one joule work ~~is done on it~~, or if one joule work is done on it.

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HOME ASSIGNMENT

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(1) How is work related to energy?

Ans → There is a relationship between work energy. The work done on a body is changing its state is said to be the energy possessed by the body.

(14) What are the two kinds of mechan-
-ical energy?

Ans→ * Potential Energy * Kinetic Energy

(1) What is potential energy? State its unit.

Ans> The energy possessed by a body due to its state of rest or position is called potential energy. Joule is its unit. (P.E).
(GPE = mgh).

(3) Give one example of a body that has potential energy in each of the following.

(a) Due to its position at height.

Ans → A stone placed at a height has potential energy stored

in it. The stone has this energy because of its position at a height. The stone is dropped on a nail fixed on a piece of wood. It drives the nail into the wood due to its Potent-ial energy.

(b) Due to its elongated stretched state.

Ans> A stretched rubber band has potential energy. It does work in restoring itself to its original state. A pebble placed on the stretched rubber catapault, is thrown away when it is released to restore its original state. In stretching a rubber band, work is done. This work is stored in the rubber band in form of Potential energy. This potential energy does work in moving the pebble.

[B] Short / Long Questions

(18) Two bodies A and B of masses 10 kg and 20 kg respectively are at the same height above the ground. Which of the two has greater potential energy?

Ans → ~~20 kg~~ The body with 20 kg mass has greater potential energy because the mass of the body is one of the factors on which g.P.e. depends. Greater the mass of the body, ~~greater~~ greater is the potential energy of the body.
[$U = mgh$]

(19) A bucket full of water is on the first floor of your house and another identical bucket with same quantity of water is kept on the second floor. Which of the two has greater ~~en~~ energy?

Ans → The bucket full of water which is kept on the second floor has greater energy because the its heights above the ground

is one of the factors on which the P.E of a body depend on. More the height of the body, greater is its potential energy. ($U = Mgh$)

(20) Write the expression for the gravitational Potential energy explaining the meaning of the symbols used.

Ans→ The expression for g.p.e. is =

$P.E\ (or\ U) = mgh$

P.E } means Potential energy
U }

m = Mass of the body

g = Acceleration due to gravity.

h = height which is the distance moved against ~~any force~~ the ~~gravitational~~ force of gravity.

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Explaination

Let a body of mass m kg be moved from the ground to a height of h m. The minimum upward force reqd. to move the gravit body acting vertically downwards. If g is the force of gravity on a mass of 1 kg, the force of gravity on mass m kg will be mg N.

(5) A body of mass m is moved from ground to a height h. If force of gravity on mass on 1 kg is g newton,

(a) Find the force needed to lift the body. $F = mg$.

(b) Find the work done in lifting the body = work done in lifting the body = Force (mg) × displacement (h) = $mg \times h$.

(c) Find the potential energy ~~stored~~ stored in the body. = P.E $= mgh$.

(22) Define the term of kinetic energy. Give one example of a body which possesses kinetic energy.

Ans) The energy of a body in motion is called its kinetic energy. ~~A~~ ~~rod~~ rolling ball is one example of a body which possesses kinetic energy.

(23) State two factors on which the kinetic energy of a moving body depends.

Ans) Two factors on which the kinetic energy of a moving body depends are-

(i) Mass (m) of the body.

(ii) ~~Speed~~ Moving with a speed (v) OR Speed of the body.

$\therefore K.E = \frac{1}{2}mv^2$

(24) Two toys cars A and B of masses 200g and 500g respectively are moving with the ~~speed~~ same speed. Which of the two has greater kinetic energy?

~~Ans~~ Toy car B of mass 500g has greater kinetic energy. As the mass of the body is a factor which kinetic energy of a moving body depend on. Greater the mass of the body, higher is its kinetic energy.

(25) A cyclist doubles his speed. ~~His~~ How ~~the~~ will his kinetic energy change: increase, decrease or remain the same?

Ans His kinetic energy will increase to four times the initial kinetic energy.

(23) A ball of mass m is moving with a speed v. What is its kinetic energy?

Ans) The kinetic energy $\Rightarrow K.E = \frac{1}{2} mv^2$.
The unit of kinetic energy is Joule (J).

(1) Name the form of energy stored in a wound up spring of a watch.

Ans: Potential energy is stored in a wound up spring of a watch.

(29) Can a body possess energy even when it is not in motion? Explain your answer with an example.

Ans → Yes, a body possess energy even when it is not in motion (rest or position). The body possess Potential energy.

The energy stored in the body (P.E) when work has been done by a force in bringing the body to that state of rest or position (i.e., the work done on the body has been stored in it in form of potential energy.

Ex- A wound up watch spring has P.E. because of the wound.

up state of its coil. As the spring unwinds itself, it does work to move the arms of the watch.

6) Name the type of energy (kinetic or Potential) possessed by the following.

(a) A moving cricket ball

Ans → Kinetic Energy

(b) A stone at rest on the top of a building.

Ans → Potential Energy

(c) A compressed spring

Ans → Potential Energy

(d) A moving bus.

Ans> Kinetic Energy

(e) A bullet fired from a gun.

Ans> Kinetic Energy

(f) Water flowing in a river.

Ans> Kinetic Energy

(g) A wide stretched rubber band.

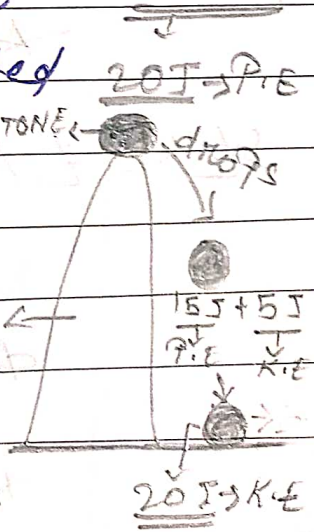
Ans> Potential Energy

(3) Give an example to show the conversion of potential energy to kinetic energy when put in use.

Ans → Eg –

A stone at a height has potential energy due to its lifted or raised position and when the stone falls down from the height, the potential energy gets converted to kinetic energy.

DIAGRAM



STONE FALLING FROM A HILL

(4) State the ~~energy~~ energy changes that occur in a watch spring while unwinds.

Ans) When a watch spring ~~while~~ unwinds → Potential Energy (P.E) get converted to kinetic energy (K.E).

(33) Give reasons for the following:

(a) No work is done if a man is pushing against a wall.

Ans: The reason is that a no change in position or motion even after.

The reason is - The Person does no work as no change in Position or no motion even after the application of force. Thus, he/she is not able to move the wall.

(c) Hammer drives a nail into the wood only when it is lifted up and then struck.

Ans: The reason is that the moving hammer has kinetic energy when the hammer is in state of motion and it does work done on the nail.

Thus, a falling hammer drives a nail into the wood only when it is lifted (motion) and then struck.

(c) A horse & a dog are running with the same speed. Which one of them has more kinetic energy than the other?

Ans: The mass of the horse is more than the dog. Greater the mass of the body, higher is its kinetic energy. Thus the horse has more kinetic energy that the dog.

(d) A teacher moving around in the class is doing work but a child standing and reading a book is not doing any work.

Ans: The teacher is in motion so change in the position (moves) occurs. But when a child is standing and reading a book, no motion is

here. Thus a teacher moving around in the class is doing work but a child standing & reading a book is not doing any work.

(5) State the energy changes in the following -

* An electric bulb -

Ans> Electrical energy to Light energy.

* An electric oven -

Ans> Electrical energy to heat energy.

* A Loudspeaker

Ans> Electrical energy to sound energy.

* Microphone - Sound energy to electrical energy.

* Electric motor - Electrical energy to mechanical energy.