GREENLAWNS SCHOOL, WORLI

Terminal Examination 2017

PHYSICS

STD: IX Marks: 80

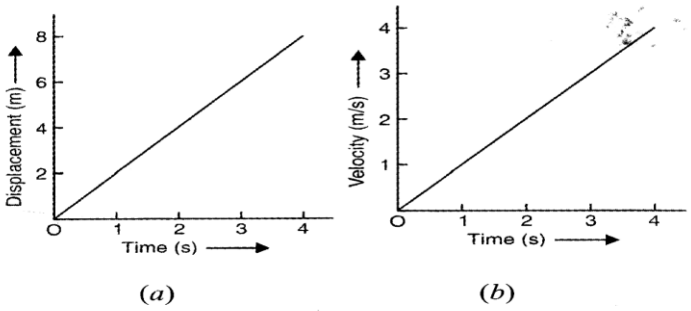
Date: 25/09/2017 Time: 2hrs

Question 1

a. A javelin throw is marked foul if an athlete crosses over the line marked for throw. Explain why the athletes often fail to stop themselves before the line. **[2]**

b. If the displacement of an object is given, what information about the position of the object do you get? **[2]**

c. Corresponding to the Fig. (a) and (b) draw v - t and x - t graph respectively. **[2]**



d. Define followings terms: **[2]**

i. Amplitude ii. Frequency

e. Differentiate between the longitudinal and transverse waves **[2]**

Question 2

a. The weight of two bodies is 2.0 N and 2.0 kgf respectively. What is the mass of each body? **[2]**

b. For a uniformly accelerated motion, what is uniform? What is changing regularly? **[2]**

c. Why are two astronauts not able to hear each other on moon? **[2]**

d. Explain how bats use ultrasound to catch a prey. **[2]**

e. Draw displacement – time graph and displacement – distance graph of a sound wave and label the time period and wave length **[2]**

Question 3

a. A force is applied on (i) a rigid body and (ii) non-rigid body. How does the effect of force differ in the two cases? **[2]**

b. Two blocks made of different metals identical in shape and sizes are acted upon by equal forces which cause them to slide on a horizontal surface**.** The acceleration of the second block is found to be 5 times that of the first. What is the ratio of the mass of the second to the first? **[2]**

c. Why is there a time delay between observing a flash and hearing a thunder? **[2]**

d. A sound wave travels at a speed of 339 m s^{-1}. If its wavelength is 1.5 cm, what is the frequency of the wave? Will it be audible? **[2]**

e. State the properties of ultrasound. **[2]**

Question 4

a. If someone jumps to the shore from a boat, the boat moves in the opposite direction. Explain. **[2]**

b. If time-displacement graph for a particle is a straight line parallel to the time-axis, what will be the velocity of the particle? Can time-displacement graph be perpendicular to the time-axis? **[2]**

c. State two factors on which the speed of a wave travelling in a medium depends. **[2]**

d. State and explain the kinds of reflection with diagram. **[2]**

e. Distinguish between real and virtual image. **[2]**

Question 5

a. How much momentum will a dumbbell of mass 10 kg transfer to the floor, if it falls from a height of 0.8m? Take acceleration due to gravity as 10 ms^{-2}. **[3]**

b. A sound made on the surface of a lake takes 3 sec to reach a boatman. How much time will it take to reach a diver inside the water at the same depth? Velocity of sound in air = 330ms^{-1}. Velocity of sound in water = 1450ms^{-1}. **[3]**

c. Derive the formula: F = ma **[4]**

Question 6

a. What type of waves is produced when a bell rings in air? A string vibrates with a frequency of 500Hz. If the distance between two consecutive troughs of a transverse wave produced in the string is 20 cm, find the velocity and the period of the wave**.** **[3]**

b. Explain Lateral inversion with help of ray diagram. **[2]**

c. What do you understand by the term acceleration due to gravity? How does the acceleration due to gravity change (i) from equator to poles (ii) below the surface of the earth? **[3]**

d. An object is kept at a distance of 4 cm in front mirror of radius of curvature 24 cm. find the position of image, by drawing. Is the image is magnified. **[2]**

Question 7

a. How many images are formed for a point object kept in between two plane mirrors M1& M2 at right angles to each other? Show them by drawing a ray diagram. **[3]**

d. How will you distinguish between a plane mirror, concave mirror and convex mirror? **[3]**

c. Obtain the equations of motion of a body moving with uniform acceleration. **[4]**

Question 8

a. An object 5 cm high is placed at a distance 60 cm in front of a concave mirror of focal length 10 cm. Find the position and size of the image by drawing **[3]**

b. **i.** Define principal focus of convex mirror.

ii. Name the convenient rays required for the construction of image by ray diagrams. **[3]**

c **i.** Explain why a hovercraft (a vessel which floats on a cushion of air) travels much faster than a steamer pushing through water.

ii. Weight of a body changes place to place on the surface of the earth. Explain. **[4]**

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Ans key

Question 1

a. A javelin throw is marked foul if an athlete crosses over the line marked for throw. Explain why the athletes often fail to stop themselves before the line. **[2]**

Ans. It is on account of inertia of motion. The athlete runs a considerable distance so as to build up momentum, which is helpful in throwing the javelin a longer distanc**e.** However, sometimes the large momentum of athlete prevents him from stopping before the marked line therefore the throw is declared foul.

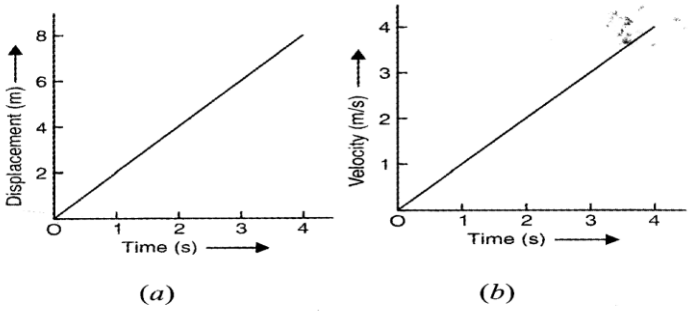
b. If the displacement of an object is given, what information about the position of the object do you get? **[2]**

Ans. Displacement tells us two things

(i) how far the final position is from the initial position, and

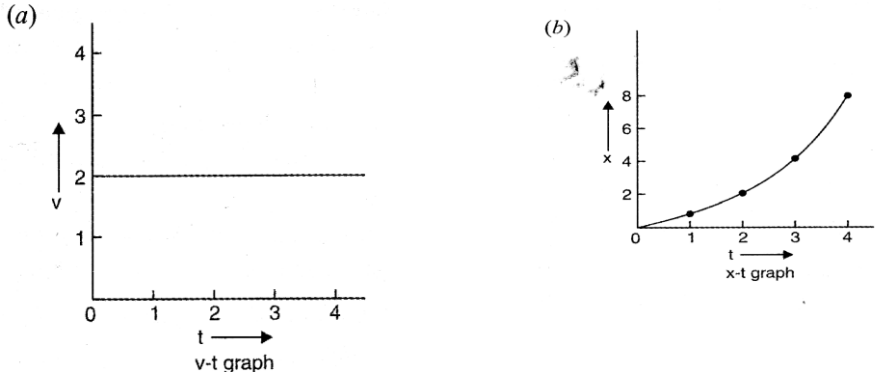
(ii) in which direction the final position is when seen from the initial position.

c. Corresponding to the Fig. (a) and (b) draw v - t and x - t graph respectively. **[2]**



(a) (b)

Ans.



d. Define followings terms: **[2]**

i. Amplitude ii. Frequency

Ans. i. The maximum displacement of the particle of medium on either side of its mean position is called the amplitude of wav**e.**

ii. The number of vibrations made by the particle of the medium in one second is called the frequency of the wav**e.**

e. Differentiate between the longitudinal and transverse waves **[2]**

Ans. longitudinal waves. i. Medium particles vibrate parallel to the direction of propagation
ii. they form alternate compression and rarefactions.
transverse waves. i. Medium particles vibrates perpendicular to the direction of propagation
ii. they form alternate crest and trough.

Question 2

a. the weight of two bodies are 2.0 N and 2.0 kgf respectively. What is the mass of each body? **[2]**

Soln: (i) We have, mg = weight = 2.0 N, therefore

$$m = \frac{2.0\ N}{10\ ms^{-2}} = 0.2\ kg$$

(ii) We have, mg = weight = 2.0 kgf

b. For a uniformly accelerated motion, what is uniform? What is changing regularly? **[2]**

Ans. For a uniformly accelerated motion change in velocity Δv is constant but the velocity is directly proportional to time t, i.**e.**, $v \propto t$.

c.. Why are two astronauts not able to hear each other on moon? **[2]**

Ans. 1. Material medium is necessary for the propagation of sound.
2. On moon there is vacuum i.e. no air, therefore sound cannot propagate on the moon. Thus the astronauts cannot hear each other.

d. Explain how bats use ultrasound to catch a prey. **[2]**

Ans Bats produce high-pitched ultrasonic squeaks. These high-pitched squeaks are reflected by objects such as preys and returned to the bat's ear. This allows a bat to know the distance of his prey.

e. Draw displacement – time graph and displacement – distance graph and label the time period and wave length **[2]**

Ans.diagram

Question 3

a. A force is applied on (i) a rigid body and (ii) non-rigid body. How does the effect of force differ in the two cases? **[2]**

Ans. When force is applied on a non-rigid body it changes the shape or dimensions of the body and when it is applied on a rigid body it tends to produce acceleration in the body.

b. Two blocks made of different metals identical in shape and sizes are acted upon by equal forces which cause them to slide on a horizontal surfac**e.** The acceleration of the second block is found to be 5 times that of the first. What is the ratio of the mass of the second to the first? **[2]**

Soln: Let, Mass of the first block = m_1

Acceleration of the first block = a_1
Mass of the second block = m_2
Acceleration of the second block = a_2
Also, $a_2 = 5\ a_1$

If the force acting on each block be F. Then,

$F = m_1\ a_1$

and $F = m_2\ a_2 = m_2 \times 5a_1$

or $m_1a_1 = m_2a_2 = m_2 \times 5a_1$

or $m_1 = 5m_2$

This gives, $\frac{m_2}{m_1} = \frac{1}{5}$

Thus, the mass of the second block is one-fifth that of the first block.

c. Why is there a time delay between observing a flash and hearing a thunder? **[2]**

Ans. 1. The velocity of light (3×10^8 m/s) is much greater than velocity of sound (340 m/s) in air.
2. So there is time delay between hearing a thunder and observing a flash.

d. A sound wave travels at a speed of 339 m s^{-1}. If its wavelength is 1.5 cm, what is the frequency of the wave? Will it be audible? **[2]**

Ans. Speed of sound, v= 339 m s^{-1}
Wavelength of sound, λ= 1.5 cm = 0.015 m
Speed of sound = Wavelength x Frequency$v = \lambda \times v$
$\therefore v = v / \lambda = 339 / 0.015 = 22600$ Hz

e. State the properties of ultrasound. **[2]**

Ans. i. Very high energy is carried by it
ii. high directivity.

Question 4

a. If someone jumps to the shore from a boat, the boat moves in the opposite direction. Explain. **[2]**

Ans. It is based on Newton's third law of motion. When a man jumps from the boat he pushes the boat backward with his feet. Now; as the boat is in water, it reacts to the man's force and gives a forward push to the man and hence, moves in the opposite direction of the shor**e.**

b. If time-displacement graph for a particle is a straight line parallel to the time-axis, what will be the velocity of the particle? Can time-displacement graph be perpendicular to the time-axis? **[2]**

Ans. If time-displacement graph for a particle is a straight line parallel to the time-axis, then the velocity of the particle will be zero, and is said to be at rest.
The displacement-time graph can never be a straight line parallel to displacement axis because it will represent that displacement of the object in a certain direction is increasing without increase in time, i.**e.**, velocity is infinite which is impossib**le.**

c. State two factors on which the speed of a wave travelling in a medium depends. **[2]**

Ans. 1. The speed of a wave travelling in a medium depends on the elasticity and density of the medium i.**e.** $v = \sqrt{E/d}$.

2. Since the density decreases with increase in temperature and increase in humidity, so speed of sound increases with increase in temperature and with presence of humidity in the medium.

d. State and explain the kinds of reflection with diagram. **[2]**

Ans. There are the following kinds of reflection.

1. Regular reflection: In regular reflection, parallel beam of light is incident on a plane mirror. The reflected beam is also parallel to each other.
2. Irregular reflection: Irregular reflection, parallel beam of light is incident on a rough Surface. The reflected beam is not parallel to each other.

e. Distinguish between real and virtual image.

Ans. Real image

1. A real image is formed due to actual intersection of the reflected rays.
2. It can be obtained on a screen.
3. It is inverted with respect to the object

Virtual image

1. It is formed when the reflected rays meet, if they are produced backwards.
2. It cannot be obtained on a screen.
3. It is erect with respect to the object.

Question 5

a. How much momentum will a dumbbell of mass 10 kg transfer to the floor, if it falls from a height of 0.8m? Take acceleration due to gravity as 10 ms^{-2}. **[3]**

Soln: Given : Initial velocity (u) = 0

Final velocity (v) = ?

Height (S) = 0.8 m,

Acceleration (g) = 10 ms^{-2}

Using, $v^2 - u^2 = 2gS$ we have

$v^2 - (0)^2 \times 10 \times 0.8$

$v^2 = 16$ or $v = 4\ ms^{-1}$

Therefore, Momentum of dumbbell = m x v

10 kg x 4 ms^{-1} = 40 Ns.

Momentum of dumbbell transferred to the ground = 40 Ns.

b. A sound made on the surface of a lake takes 3 sec to reach a boatman. How much time will it take to reach a diver inside the water at the same depth? Velocity of sound in air =330ms^{-1}. Velocity of sound in water = 1450ms^{-1}. **[3]**

Ans. □ d = 330 □ 2 = 990 m

t = 900/1450 = 0.68 sec

c. Derive the formula : F = ma **[4]**

Ans. Let 'F' be the force applied to a body of mass 'm' moving with a velocity 'u'. After time 't' its velocity changes to 'v'.

Initial momentum = m.u; Final momentum = m.v.

Change in momentum = m.u; Final momentum = m.v.

$$\therefore \text{Rate of change of momentum} = \frac{mv - mu}{t} = m\frac{v - u}{t} = m.a$$

[a = acceleration]

According to Newton's second law of motion.

$\therefore F \propto ma \quad \therefore F = K . ma$, where K = constant

but if m = 1, a = 1, F = 1 $\Rightarrow$ K = 1

$\therefore F = ma$

Force = mass x acceleration

Question 6

a. What type of waves are produced when a bell rings in air? A string vibrates with a frequency of 500Hz. If the distance between two consecutive troughs of a transverse wave produced in the string is 20 cm, find the velocity and the period of the wav**e.** **[3]**

Ans. 1. When a bell rings longitudinal waves are produced in air.

2. Frequency (f) = 500 Hz

Wavelength (□) = 20 cm

= 0.2 m

Wave velocity (V) = f□

= 500 □ 0.2

□ V = 100 m/s

3. Time period (T) = 0.002 sec

b. Explain Lateral inversion with help of ray diagram. **[2]**

Ans. The interchange of the left and right sides in the image of an object in a plane mirror is called Lateral inversion.

The image of 'ATOM' word in a plane mirror will be 'MOTA' , this is due to lateral inversion.

c. What do you understand by the term acceleration due to gravity? How does the acceleration due to gravity change (i) from equator to poles (ii) below the surface of the earth? **[3]**

Ans. When an object falls freely, its velocity increases constantly with time and hence is acted upon by a uniform acceleration.

Thus, the acceleration due to gravity is the acceleration of a freely falling object under the action of gravity of earth. It is represented by *g.* Its SI unit is m/s'. Its value changes from place to place.

(i) From equator to poles its value increases

(ii) decreases

d. An object is kept at a distance of 4 cm in front mirror of radius of curvature 24 cm. find the position of image, by drawing. Is the image is magnifie**d.** **[2]**

Question 7

a. How many images are formed for a point object kept in between two plane mirrors M1& M2 at right angles to each other? Show them by drawing a ray diagram. **[3]**

Ans. For two mirrors kept perpendicular to each other, three images are formed for an object kept in between them.

P2 B P

P3

(P4)

D P1

d. How will you distinguish between a plane mirror , concave mirror and convex mirror. **[3]**

Ans. i. in plane mirror the image same size and upright and at same distance as the object.

ii. in concave mirror the image always inverted and real and when the object comes between F and p of the mirror it become magnified and erect.

iii. in convex mirror the image is always erect and diminished.

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c. Obtain the equations of motion of a body moving with uniform acceleration. **[4]**

Ans. Consider an object starting with initial velocity *u* and moving with a uniform acceleration *such* that after time *t* it attains a velocity *v* and during time *t* its displacement is *s.*

To obtain $v = u + at$

We know that

$$\text{Acceleration} = \frac{change\ in\ velocity}{time\ interval}$$

$$a = \frac{v-u}{t} ;$$

$$v = u + at$$

To obtain $s = ut + \frac{1}{2}at^2$

We know that average velocity

$$= \frac{u+v}{2}$$

$\therefore$ s = average velocity x time

$= \left(\frac{u+v}{2} \right)$ x t = $\frac{(u+u+at)}{2}$ x t

s = ut + $\frac{1}{2}$ at^2

To obtain $v^2 = u^2 + 2as$

$v = u + at$

Squaring both sides

$(v)^2 = (u + at)^2$

$v^2 = u^2 + 2uat + a^2t^2$

$= u^2 + 2a\,(ut + \frac{1}{2} at^2)$

$v^2 = u^2 + 2as.$

$[\therefore ut + \frac{1}{2} at^2 = s]$

Question 8

a. An object 5 cm high is placed at a distance 60 cm in front of a concave mirror of focal length 10 cm. Find the position and size of the image by drawing diagram **[3]**

b. **i.** Define principal focus of convex mirror.

ii. Name the convenient rays required for the construction of image by ray diagrams. **[3]**

Ans. i. The focus of convex mirror is a point on the principal axis from which , the light rays incident parallel to the principal axis , appears to come after reflection from the mirror.

ii. a) ray passing through the centre of curvature b)ray parallel to principal axis c) Ray passing through the focus. d) A ray incident at the pole

c **i.** Explain why a hovercraft (a vessel which floats on a cushion of air) travels much faster than a steamer pushing through water.

ii. Weight of a body changes place to place on the surface of the earth. Explain. **[4]**

Ans. i. A hovercraft moves on a cushion of air therefore experiences resistance only from air. Where as a steamer, which pushes it through water has to overcome resistance from water, as well as from air. Also the resistance by water is many times more than that from air

ii. Weight of a body is given by the formula W = mg, where (m) is its mass and (g) is the acceleration due to gravity. Mass of the body (m) remains the same everywhere on the earth, but the value of (g) changes from place to place on the earth's surface. Its value is maximum (9.83 ms^{-2}) at the poles and it is minimum (9.78 ms^{-2}) at the equator. Therefore the weight of the body (mg) changes place to place on the surface

of the earth.

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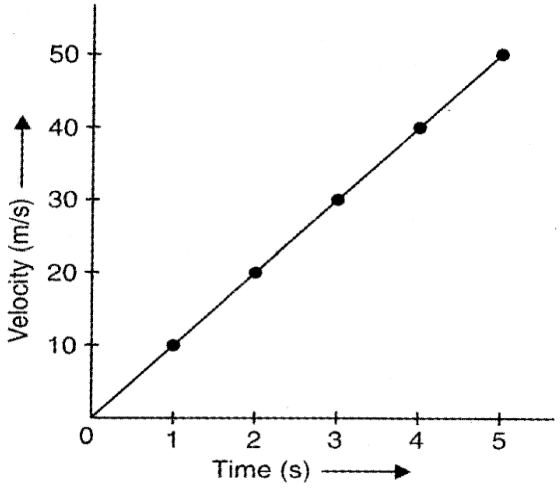
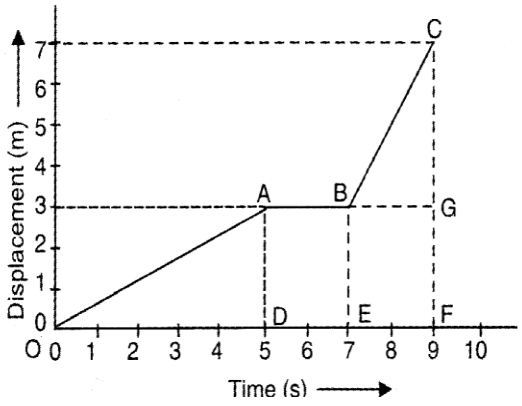
Q.39. If an object is falling freely under gravity. Draw its velocity-time and distance-time graph.(Take g = 10 m/s').

Ans. Using $v = u + gt$, where $u = 0$, $g = 10$ rn/s^2, $t = 0, 1,2,3,4,5...$ respectively.

T(s)	0	1	2	3	4	5
V (m/s)	0	10	20	30	40	50

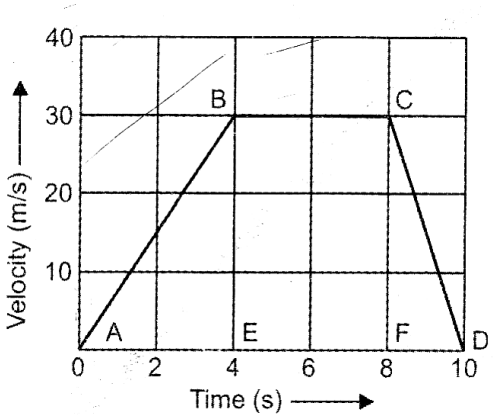




Using s = ut + $\frac{1}{2}$ gt^2, where u = 0 . g = 10 m/s^2,

T = 0. 1, 2, 3, 4, 5….. respectively.

Q.51. From the given velocity-time graph, find



(i) the acceleration in parts AB, BC and C**D.**

(ii) displacement in each pair, and

(iii) total displacement.

Ans. (i) Acceleration in part AB = $\frac{(30-0)\text{m/s}}{(4-0)\text{s}}$ = 7.5 m/s^2

Acceleration in part BC = $\frac{(30-30)\text{m/s}}{(8-4)\text{s}}$ = 0

Acceleration in part CD = $\frac{(0-30)\text{ m/s}}{(10-8)\text{ s}}$ = - 155 m/s^2

(ii) Displacement in part AB = Area of ΔABE

$= \frac{1}{2}$ x BE x AE = $\frac{1}{2}$ x 30 x 4 = 60 m

Displacement in part BC = Area of ❑ BCFE

= BC x CF = 4 x 30 = 120 m

Displacement in part CD Area of ΔCFD

$= \frac{1}{2}$ x CF x FD = $\frac{1}{2}$ x 30 x 2 = 30 m

(iii) Total displacement = 60 m + 120 m + 30 m = 210 m.

Q.1. Define force. How is it represented?

Ans. Force is an agent whose action can produce acceleration in a body. It is represented as the product of mass and acceleration.

Q.4. Define 'mass' and 'weight' and give their S.I. units. [M 1992]

Ans. Definition of mass : "It is defined as the quantity of matter possessed by a body".
"The measure of inertia of a body is called its mass".
S.I. unit of mass is kilogram.
Definition of weight : "The force with which the earth attracts a body, towards its centre is called the weight of that body on the earth".
S.I. unit of weight is Newton or kilogramme force.
Weight (W) = Mass(m) x Acceleration due to gravity (g)
$\therefore W = mg.$

Q.5. State and define the SI unit of force.

Ans. The SI unit of force is Newton. One Newton is that force which when applied on a mass of 1 kilogram produces in it an acceleration of 1 ms^{-2} in the direction of the force.

Q.15. Define the term inertia. On which physical quantity does it depend?

Ans. It is the inherent property of a body due to which it opposes the change in its state of rest or motion. It depends only upon the mass of the body.

Q.20. State the effects of force.

Ans. (i) A force can put a stationary body into motion. e.g. a cart initially at rest starts moving when pulled by a horse.

(ii) A force can bring a moving body to rest. e.g. when brakes are applied to a moving car, the car comes to rest.

(iii) A force can change the direction of motion. **e.**g. If a moving ball is kicked at an angle, it moves in a different direction.

(iv) A force can change the shape or size of body. **e.**g. When a force is applied on a sponge, its shape and size changes.

(v) A force can change physical state of substance **e.**g. ice melts.

Q.21. Explain why some of the leaves may fall from a tree, if we vigorously shake its branch.

Ans. When the branch is suddenly set in motion , the leaves attached to it tend to continue in their rest, on account of inertia of rest. Thus a lot of strain acts on the junction of the leaves and the branches. Due to this strain the weakly held leaves are left behind and hence, fall of the branches.

Q.23. When a carpet is beaten with a stick, dust comes out. Explain.

Ans. In fact, it is the carpet which comes out of the dust. When the carpet is beaten it is set into motion, whereas the dust remains in a state of rest due to inertia of rest. Hence, the carpet comes out of the dust giving a notion as if dust has come out of the carpet.

Q.1. A force of 200 N acts on a body for 5 secon**d.** It gives the body a velocity of 50 ms^{-1}. Find the mass of the body.

Soln: Given : F = 200 N, t = 5s, Initial velocity, u = 0, Final velocity, v = 50 ms^{-1}.

If the acceleration produced in the body = a, then

$v = u + at$

$50 = 0 + a \times 5$

$a = 10\ ms^{-2}$

Now $F = ma$ $\quad m = \frac{F}{a} = \frac{200}{10} = 20$ kg.