

STD: IX
Date: 18/09/2025

Marks: 80
Time: 2 hrs

Section-1

(Attempt all questions from this section)

Question 1 Choose the correct answers to the questions from the given options.

(Do not copy the question, write the correct answers only.)

[15]

- i. Find the least count of a screw gauge whose head scale is divided into 100 division and moves 10 mm for 10 rotations of the head
(a) 0.1 mm (b) 1 mm (c) 0.001 cm (d) 1 cm
- ii. Out of the following, which years would be leap years:
(a) 1966 (b) 1978, (c) 2500 (d) none of the these
- iii. The apparent weight of a body in a fluid is :
(a) equal to weight of fluid displaced (b) volume of fluid displaced
(c) difference between its weight in air and weight of fluid displaced
(d) none of the above
- iv. At the maximum height, a body thrown vertically upwards has:
(a) velocity not zero but acceleration zero. (b) acceleration not zero but velocity zero.
(c) both acceleration and velocity are zero. (d) both acceleration and velocity are not zero.
- v. A man is walking from east to west on a rough surface. The force on the man is directed:
(a) from west to east (b) from east to west (c) along the north (d) along the west
- vi. When you kick a stone, you get hurt. Due to which property this happens?
(a) Inertia of stone (b) Velocity of the kick
(c) Momentum of the kick (d) Reaction of the stone.
- vii. Pressure applied in liquids is transmitted with undiminished force:
(a) in downward direction (b) upward direction only
(c) sides of containing vessel (d) in all directions
- viii. The unit N/m^2 is the unit of
(a) force (b) pressure (c) thrust (d) momentum
- ix. Pressure at a point inside a liquid does not depend on:
(a) The nature of the liquid (b) The acceleration due to gravity at that point
(c) The shape of the containing vessel (d) The depth of the point below the surface of the liquid
- x. The ratio between the mass of a substance and the mass of an equal volume of water at 4°C is called :
(a) relative density (b) density (c) weight (d) pressure
- xi. When a body is wholly or partially immersed in a liquid, it experiences a buoyant force which is equal to:
(a) volume of liquid displaced by it (b) weight of liquid displaced by it
(c) both (a) and (b) (d) none of the above

- xii.** If the mass of the body is doubled and its velocity becomes half, then the linear momentum of the body will
 (a) become double (b) remain the same
 (c) become half (d) become four times
- xiii.** What would be the displacement of a particle moving in a circular path of radius r after a displacement of half a circle?
 (a) $2\pi r$ (b) πr (c) $2r$ (d) Zero
- xiv.** The unit of time is:
 (a) light year (b) parsec (c) leap year (d) angstrom
- xv.** Identify the correct statement from the following:
 (a) The average speed of a body can be zero even if its average velocity is not zero.
 (b) Speed and velocity both are scalar quantities.
 (c) The magnitude of velocity of a body in motion is its speed.
 (d) Speed and velocity can be positive or negative depending upon the direction of motion.

Question 2

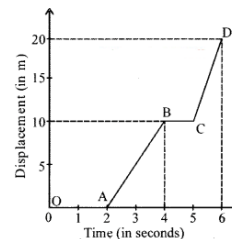
- a. i. Up to how many decimal places can a common vernier caliper measure the length in cm?
 ii. 1 nano sec = -----sec

[2]

- b. Length of second's pendulum is 100 cm. Find the length of another pendulum whose time period is 2.4 s.

[2]

- c. What is the initial velocity and acceleration of the particle whose velocity-time graph is as shown in the figure below?



[2]

- d. The relative density of a body is 0.52 and its volume is 2 m^3 . What is the mass of the body.

[2]

- e. i. The motion of a body for which the acceleration is zero is known as.....
 ii. State the numerical value of the frequency of oscillation of a second's pendulum.

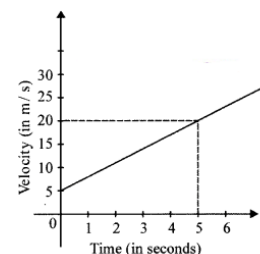
[2]

- f. Will one kilogram of feather weigh the same in a vacuum as it does in air? Explain.

[2]

- g. The displacement-time graph of a body is as shown in the figure. Find its average speed over each of the intervals

- i. OA and BC
 ii. AB
 iii. CD.



[3]

Question 3

- a. Name two non – metric units for measuring length.
- b. How long would a force of 30 N act on a body of mass 10 kg so that the body gains a velocity of 24 ms^{-1}

[2]

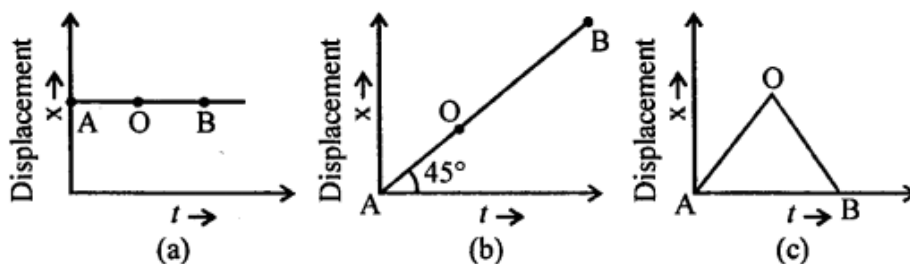
[2]

- c. Explain why some of the leaves may fall from a tree, if we vigorously shake its branch [2]
- d. When dropped from the same height, a body reaches the ground quicker at the poles than at the equator. Why? [2]
- e. According to Newton's third law, every force is accompanied by an equal and opposite force. How can a movement ever take place? [2]

Section – II
(Attempt any four questions from this section)

Question 4

- a. What is meant by zero error of a Vernier calipers? How is it determined? [2]
- b. A wooden block is weighed with iron, such that combination just floats in water at room temperature. State your observations when:
(1) water is heated above room temperature
(2) water is cooled below 4°C . Give reasons to your answers in (1) and (2). [2]
- c. i. A body dipped in a liquid experience upthrust. State the factors on which the upthrust depends on
ii. While floating, is the weight of body greater than, equal to or less than upthrust? [3]
- d. Write down the type of motion of a body along the A – O – B in each of the following distance – time graphs. [3]



Question 5

- a. The area of pistons in hydraulic machines are 6 cm^2 and 576 cm^2 . What force on the smaller piston will support a load of 1152 N on the larger piston? [2]
- b. Why does a ship sink to a greater depth in river water than in sea water? [2]
- c. An inflated balloon is placed inside a big glass jar which is connected to an evacuating pump. What will you observe when the evacuating pump starts working? Give a reason for your answer. [2]
- d. A metal piece weighs 200 gf in air and 150 gf when completely immersed in water.
(i) Calculate the relative density of the metal piece.
(ii) How much will it weigh in a liquid of density 0.8 g cm^{-3} ? [4]

Question 6

- a. Copy the following table and fill in the blank spaces. [2]

Quantity	S.I. Unit	Scalar or Vector
Displacement		
.....	kg m^{-3}	

- b. State briefly, how and why the atmospheric pressure of a place varies with the altitude. Draw an approximate graph to illustrate this variation. [2]

- c. A trawler is fully loaded in sea water to maximum capacity. What will happen to this trawler if moved to river water? Explain your answer. [2]

- d. (i) What do you understand by the term weight?
(ii) State two important characteristics of weight
(iii) State the units of weight in CGS and SI system.
(iv) Name the device used for measuring weight [4]

Question 7

- a. A train moves at a velocity of 25 ms^{-1} . It is brought to rest by applying the brakes which produce a uniform retardation of 0.5 ms^{-2} . Calculate:
(i) The velocity of the train after 10s.
(ii) If the mass of the train is 20000 kg, then calculate the force required to stop the train. [3]

- b. Show that: Rate of change of momentum = Mass x Acceleration. [3]

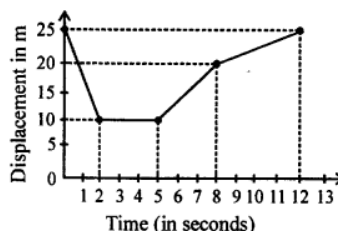
- c. i. Why does a pillion rider fall forward, when the driver of a two-wheeler suddenly applies the brakes?
ii. A body of mass 'm' is floating in a liquid of density 'p'
(1) what is the apparent weight of body?
(2) what is the loss of weight of body? [4]

Question 8

- a. Two-fifths of a cylindrical block of wood, of relative density 0.8, floats in a liquid. Calculate the density of liquid in S.I. units. [3]

- b. From the displacement – time graph shown given below calculate:

1. Velocity between 0 – 2 s.
2. Velocity between 2 s – 5 s.
3. Average velocity between 5 s – 12 s.



- c. (i) State the universal law of gravitation.
(ii) Express it in a mathematical form. (Explain the symbols used.)
(iii) State the value of universal gravitational constant in S.I. unit.
(iii) The value of gravitational constant G is $6.67 \times 10^{-11} \text{ Nm}^2 \text{ kg}^{-2}$. [4]

Answer key

- i. c) 0.001 cm
- ii. d) none of the these
- iii. (c) difference between its weight in air and weight of fluid displaced
- iv. (b) acceleration not zero but velocity zero.
- v. (a) from west to east
- vi. (a) Inertia of stone
- vii. (d) in all directions
- viii. (b) pressure
- ix. (c) The shape of the containing vessel
- x. (a) relative density
- xi. (b) weight of liquid displaced by it
- xii. (b) remain the same
- xiii. (c) 2r
- xiv. (c) leap year
- xv. (c) The magnitude of velocity of a body in motion is its speed.

Question 2

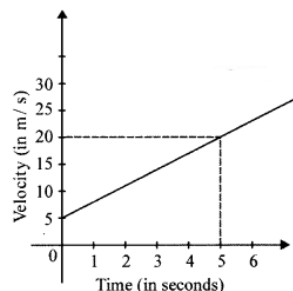
- c. i. Up to how many decimal places can a common vernier caliper measure the length in cm?
 iii. 1 nano sec = -----sec [2]

Ans. i. 2 dp
 ii. 10^{-9} seconds

- b. Length of second's pendulum is 100 cm. Find the length of another pendulum whose time period is 2.4 s. [2]

- ci. What is the initial velocity and acceleration of the particle whose velocity-time graph is as shown in the figure below?

Ans: The initial velocity of the particle is clearly 5 ms^{-1} The acceleration equals the slope of the graph.
 $\text{Slope} = (20-5)/(5-0) = 15/5 = 3$
 $\therefore$ The acceleration of the particle is 3 ms^{-2} .



[2]

- d. The relative density of a body is 0.52 and its volume is 2 m^3 . What is the mass of the body. [2]

Ans: We Know that R.D. = Density of a body / Density of water
 $\therefore$ Density of body = $0.52 \times 1000 \text{ kg m}^{-3}$
 $= 520 \text{ kg m}^{-3}$
 Volume of body = 2 m^3
 Mass = $d \times v = 520 \times 2 = 1040 \text{ kg}$

- e. i. The motion of a body for which the acceleration is zero is known as.....
- ii. State the numerical value of the frequency of oscillation of a second's pendulum. [2]

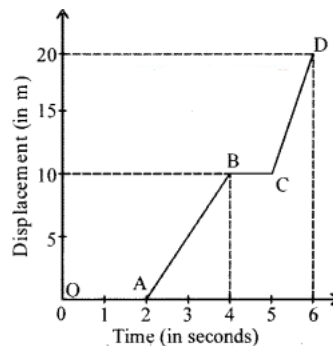
- Ans.** i. uniform velocity
ii. 0.5 Hz

f. Will one kilogram of feather weigh the same in a vacuum as it does in air? Explain. [2]

Ans: No, in vacuum, there would be no upthrust or buoyant force acting on the feather. In air, however, there would be small upthrust. The weight of one kilogram of feather, in air, will therefore, be a little less than its weight in vacuum.

g. The displacement-time graph of a body is as shown in the figure. Find its average speed over each of the intervals

- iv. OA and BC
v. AB
vi. CD.



- Ans:** i. 0
iii. 5m/s
iv. 10 m/s

[3]

Question 3

- a.** Name two non – metric units for measuring length. [2]
b. How long would a force of 30 N act on a body of mass 10 kg so that the body gains a velocity of 24 ms^{-1} [2]

Ans: Given : $F = 30 \text{ N}$, $m = 10 \text{ kg}$, $u = 0$, $v = 24 \text{ ms}^{-1}$, $t = ?$

We know,

$$F = \frac{m(v - u)}{t}$$

$$30 \text{ N} = \frac{10(24 - 0)}{t}$$

$$\therefore t = \frac{10 \times 24}{30} = 8 \text{ s.}$$

c. Explain why some of the leaves may fall from a tree, if we vigorously shake its branch [2]

Ans: When the branch of a tree is shaken, it is suddenly set in motion. However, the leaves attached to it tend to continue to be in their state of rest on account of inertia of motion. 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 fall off the branch.

d. When dropped from the same height, a body reaches the ground quicker at the poles than at the equator. Why? [2]

Ans. The acceleration due to gravity is greater at the poles than at the equator. When the initial velocities and the distance travelled are the same, time taken for a body is smaller if the acceleration due to gravity is more. Thus, when dropped from the same height, a body reaches the ground quicker at the poles than at the equator.

e. According to Newton's third law, every force is accompanied by an equal and opposite force. How can a movement ever take place? [2]

Ans. Action and reaction do not act on the same body, but act on different bodies and, hence

motion is possible.

Section – II

(Attempt any four questions from this section)

Question 4

- a. What is meant by zero error of a Vernier calipers? How is it determined? [2]
- b. A wooden block is weighed with iron, such that combination just floats in water at room temperature. State your observations when:
(1) water is heated above room temperature
(2) water is cooled below 4°C . Give reasons to your answers in (1) and (2). [2]

Ans:

- (1) We know density of water decreases with rise in temperature and hence upthrust decreases.
(2) Density of water is maximum at 4°C . When water cooled below 4°C , then its density and hence upthrust acting on it decreases. So, wooden block weighed with iron, sinks more than earlier.

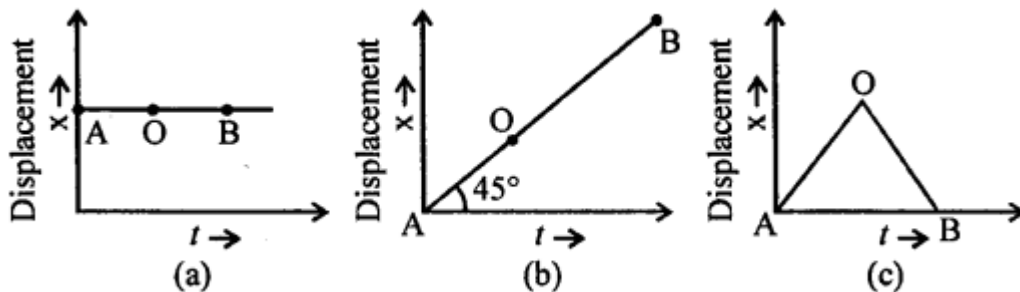
- c. i. A body dipped in a liquid experience upthrust. State the factors on which the upthrust depends on
ii. While floating, is the weight of body greater than, equal to or less than upthrust? [3]

Ans. (i) Factors on which upthrust depends are:

1. Volume of body immersed in fluid.
Upthrust is maximum when body completely immersed in the fluid.
2. Density of the fluid.
Upthrust $\propto$ density of fluid
Larger the density of the fluid, large will be the upthrust acting on the body.

(ii) When the body floats then weight of the body is equal to the upthrust acting on the body.

- d. Write down the type of motion of a body along the A – O – B in each of the following distance – time graphs. [3]



Answer:

1. Body is stationary.
2. Body is in uniform motion i.e. it covers equal distance in equal intervals of time.
3. From A to O, body is in uniform motion having positive slope and from O to B, body is in uniform motion having negative slope.

Question 5

- a. The area of pistons in hydraulic machines are 6 cm^2 and 576 cm^2 . What force on the smaller piston will support a load of 1152 N on the larger piston? [2]

Answer:

Given : $A_1 = 6 \text{ cm}^2$, $A_2 = 576 \text{ cm}^2$, $F_1 = ?$, $F_2 = 1152 \text{ N}$

$$\therefore \frac{F_1}{A_1} = \frac{F_2}{A_2}$$

$$F_1 = \frac{F_2}{A_2} \times A_1$$

b. Why does a ship sink to a greater depth in river water than in sea water? [2]

Ans: The density of sea water, because of etc., is greater than that of river water. Therefore, a lesser immersed in sea water to balance its weight and hence, the ships sinks to greater depths in river water.

$$= \frac{1152}{576} \times 6 \text{ N}$$

$$= 12 \text{ N}$$

depth in river water than in sea

the presence of impurities like salt

volume of the ship will be

ci. An inflated balloon is placed inside a big glass jar which is connected to an evacuating pump. What will you observe when the evacuating pump starts working? Give a reason for your answer. [2]

ans. When evacuating pump starts working, pressure inside the glass jar reduces. As the pressure inside the balloon is more than pressure outside the balloon inside the glass jar, so balloon with burst.

d. A metal piece weighs 200 gf in air and 150 gf when completely immersed in water.

(i) Calculate the relative density of the metal piece.

(ii) How much will it weigh in a liquid of density 0.8 g cm^{-3} ? [4]

Ans: Given: Weight of metal in air (w_1) = 200 gf

Weight of metal in water (w_2) = 150 gf

(i) Relative density of metal piece $= \frac{w_1}{w_1 - w_2} = \frac{200}{200 - 150} = 4$

ii) Density of liquid = 0.8 g cm^{-3}

Relative density of liquid = 0.8

Let , Weight of metal in liquid = w_3

$$\therefore \text{R.D. of liquid} = \frac{w_1 - w_3}{w_1 - w_2}$$

$$\Rightarrow 0.8 = \frac{200 - w_3}{200 - 150}$$

$$\Rightarrow 0.8 \times 50 = 200 - w_3$$

$$\therefore w_3 = 200 - 40 = 160 \text{ gf.}$$

Question 6

- a. Copy the following table and fill in the blank spaces. [2]

Quantity	S.I. Unit	Scalar or Vector
Displacement		
.....	kg m ⁻³	

Answer:

Quantity	S.I. Unit	Scalar or Vector
Displacement	metre (m)	Vector
Density	kg m ⁻³	Scalar

c

- b. State briefly, how and why the atmospheric pressure of a place varies with the altitude. Draw an approximate graph to illustrate this variation. [2]

Ans:

1. We know atmospheric pressure = height of air column x density of air x acceleration due to gravity; $P = h\rho g$ So, as we go up i.e. at higher altitudes, height of air column and hence atmospheric pressure decreases.
2. Also with the increase in altitude, density of air decreases and hence atmospheric pressure decreases.

- c. A trawler is fully loaded in sea water to maximum capacity. What will happen to this trawler if moved to river water? Explain your answer. [2]

Ans: Density of sea water is more than the density of river water. So river water offers less upthrust to the trawler as compared to sea water. So, when a trawler is fully loaded sea water to maximum capacity, is moved to river water, it will sink.

- d. (i) What do you understand by the term weight?
(ii) State two important characteristics of weight
(iii) State the units of weight in CGS and SI system.
(iv) Name the device used for measuring weight

Ans:

(i) **Weight:** Weight of a body is defined as the force with which the earth attracts it.

(ii) **Characteristics of weight:**

1. It depends upon the position and surroundings of body.
2. It is a vector quantity.
3. It changes from place to place on the surface of earth due to the change in the value of acceleration due to gravity (g).

(iii) In CGS system, unit of weight is dyne. In SI system, unit of weight is newton (N).

(iv) Spring balance is used to measure the weight of the body.

[4]

Question 7

- a. A train moves at a velocity of 25 ms⁻¹. It is brought to rest by applying the brakes which produce a uniform retardation of 0.5 ms⁻². Calculate:
(i) The velocity of the train after 10s.
(ii) If the mass of the train is 20000 kg, then calculate the force required to stop the train. [3]

Answer:

(i) Given : $u = 25 \text{ ms}^{-1}$, $a = -0.5 \text{ ms}^{-2}$, $t = 10 \text{ s}$

$$v = u + at$$

$$= 25 + (-0.5) \times 10 = 25 - 5 = 20 \text{ ms}^{-1}$$

(ii) $m = 20000 \text{ kg}$

$$F = ma = 20000 \times 0.5 = 10000 \text{ N.}$$

b. Show that: Rate of change of momentum = Mass x Acceleration. **[3]**

ans. Let a force 'F' be applied on a body of mass 'm' for time T due to which its velocity changes from 'u' to 'v'. then,
Initial momentum of the body = mu
Final momentum of the body = mv
Change in momentum of the body in t second = mv – mu = m (v – u)

$$\text{Rate of change of momentum} = \frac{\text{Change in momentum}}{\text{Time}} = \frac{m(v-u)}{t}$$

But, $\text{Acceleration, } a = \frac{\text{Change in velocity}}{\text{Time}} = \frac{v-u}{t}$

$\therefore \text{Rate of change of momentum} = ma = \text{Mass} \times \text{Acceleration}.$

C. i. Why does a pillion rider fall forward, when the driver of a two-wheeler suddenly applies the brakes?

ii. A body of mass 'm' is floating in a liquid of density 'p'

(1) what is the apparent weight of body?

(2) what is the loss of weight of body? **[4]**

Ans: i. When the driver of a two-wheeler suddenly applies the brakes, then lower part of pillion rider comes to rest, but his upper part remains in motion due to inertia of motion. As a result, pillion rider falls forward.

ii. Mass of body = m

Density of liquid = p

(1) Apparent weight of body = Weight of body in air – Weight of liquid displaced by body.
When a body floats in the liquid, then weight of the body in a liquid is equal to weight of liquid displaced by the body.

=> Apparent weight of body = 0

(2) Loss in weight of body is equal to the weight of liquid displaced by the body.

Question 8

a. Two-fifths of a cylindrical block of wood, of relative density 0.8, floats in a liquid. Calculate the density of liquid in S.I. units. **[3]**

Ans: Relative density of block of wood = Density of block / Density of water

Density of block = R.D. of block x Density of water

$$= 0.8 \times 1000 \text{ kg/m}^3 = 800 \text{ kg/m}^3.$$

Let the volume of block be 'V'.

$\therefore$ Volume of liquid displaced = Volume of submerged part = $\frac{2}{5} V$

$\therefore$ Let the density of the liquid be 'p'

Mass of displaced liquid, $m = (\frac{2}{5} V)p$

Weight of displaced liquid = $mg = (\frac{2}{5} V)pg$

According to floatation law, this is the weight of the block.

Also, Weight of the block = mg

$$= (\text{Volume} \times \text{Density}) g$$

$$=(V \times 800 \text{ kg/m}^3)g$$

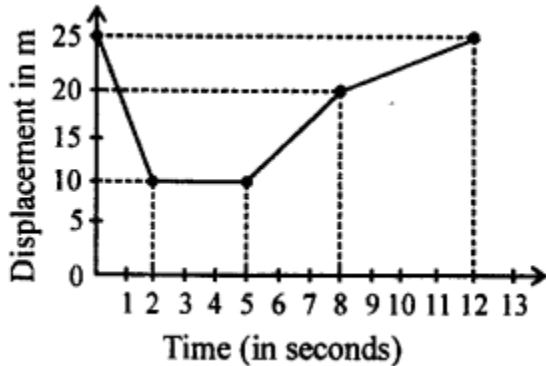
$$\left(\frac{2}{5}V\right)\rho g = (V \times 800 \text{ kg/m}^3) g$$

$$\rho = \frac{800 \times 5}{2} \text{ kg/m}^3 = 2000 \text{ kg m}^{-3}$$

b. From the displacement – time graph shown given below calculate:

4. Velocity between 0 – 2 s.
5. Velocity between 2 s – 5 s.
6. Average velocity between 5 s – 12 s.

[3]



Ans:

(i) Velocity between 0 – 2 s = $\frac{-(25-10)}{2}$

[negative sign because slope is negative]

$$= -\frac{15}{2} = -7.5 \text{ ms}^{-1}$$

(ii) zero

(iii) Average velocity between 5 s – 12 s

$$= \frac{\text{Total displacement from 5 s to 12 s}}{\text{Time}}$$

$$= \frac{25-10}{12-5} = \frac{15}{7} = 2.1 \text{ ms}^{-1}$$

- c. (i) State the universal law of gravitation.
 (ii) Express it in a mathematical form. (Explain the symbols used.)
 (iii) State the value of universal gravitational constant in S.I. unit.

[4]

Ans. (i) According to Newton's universal law of gravitation, the force of attraction acting between the two particles is (1) directly proportional to the product of their masses and (2) inversely proportional to the square of the distance between them.

(ii) Let there be two particles of masses m_1 and m_2 at a separation of r . The magnitude of force of attraction F acting between them is:

$$F = Gm_1m_2/r^2$$

(iii) The value of gravitational constant G is $6.67 \times 10^{-11} \text{ Nm}^2 \text{ kg}^{-2}$.
