- Which force is responsible for providing the necessary centripetal force to plants moving around the Sun **- Gravitational force**
- If we suspend the pendulum in a vessel filled with liquid **- The pendulum will stop soon**
- How much force is required to rotate a body of mass 6 kg in a circle of radius 3m with a velocity of 10 m/sec. **- 200 N**
- A particle is moving in a uniform circular motion with a uniform speed 'v' parallel to a circle of radius r. The acceleration of a particle is **- $\frac{v^2}{r}$**
- If the horizontal range of a projectile if four times the maximum height, then the angle of projection is **- 45°**
- What is the magnitude of force which when applied on a body of mass 0.6 kg produces an acceleration of 0.08 m/sec^2. **- 0.048 N**
- A force of 30 N acts on a body of 5 kg for 2 seconds then the acceleration will be **- 6 m/sec^2**
- A second's pendulum is taken in a transport vehicle find the period of oscillation when the vehicle moves with an acceleration of 4 m/sec^2 vertically upwards **- 1.93 second**
- What will be the speed of the body after three seconds if the body is mioving along a straing line at a speed of 20 m/sec and under goes an acceleration of 4 m/sec^2 **- 32 m/sec**
- A stone is dropped from a cliff its speed after it has fallen 100 m is **- 44.72 m/sec**
- Friction between two objects is due to **- Irregularities on the surface**
- A thumb-tripped nail goes easily into wood because **- Move force acts on less area**
- When a gun is fired, it exerts a forward force on the bullet. The bullet also exerts on equal and opposite reaction force on the gun. This phenomenon is explained by **- Third law of motion**
- When a moving bus suddenly applies brakes, the passengers fall in the forward direction. It is because **- Newton's law of inertia**
- A boy sitting in a train moving with constant speed throws a ball straight in the air, then the ball will fall **- into the Hand**
- When an object is moving with uniform velocity with respect to time then velocity-time graph represents **- Straight line**
- An object is moving with non- uniform velocity and uniform acceleration then **- Velocity time graph will be linear**
- If the velocity- time graph is parallel to the time axis, then **- The object is moving with constant velocity**
- The time - graph for uniformly accelerated body **- Straight line.**
- An iron ball and a wooden ball of equal radius are dropped from height h in vacuum. The time taken by both to reach the earth is - **Approximately same.**
- Velocity of body is said to be uniform when **- Both the value and direction of velocity are constant.**

PREVIOUS YEAR QUESTIONS

1. A car accelerates uniformly from 5 ms^{-1} to 10ms^{-1} in five seconds. Find the acceleration of the car

(a) 1 ms^2 (b) 1 ms^{-2}
(c) 1 ms^1 (d) 1 ms^{-1}

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Ans. (b) : Given :
Initial velocity = 5 m/sec.
Final velocity = 10 m/sec.
Time = 5sec.

ΔV = Final velocity – Initial velocity
= 10 – 5
= 5 m/sec.

Acceleration of car (a) = $\frac{\Delta V}{t}$

$= \frac{5 m/sec}{5 sec}$

= 1 m/sec^2 or, 1ms^{-2}

2. Which one of the following physical quantities is a scalar quantity?

(a) Electric current (b) Electric field
(c) Torque (d) Impulse

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Ans. (a) : Scalars are the physical quantities that only have the magnitude and other characteristics. A scalar is unvaried by any changes in the coordinate system.
Examples: volume, energy, mass, density, time, electric current are scalar quantity.
A vector Quantity is one which is characterized by both magnitude and direction. Examples are: Torque, Impulse, Electric field.

3. A particle starts moving from rest under uniform acceleration. It travels a distance 'x' in the first two seconds and a distance 'y' in the next two seconds. If y = nx, then n =

(a) 1 (b) 3
(c) 2 (d) 4

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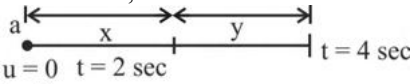
Ans. (b) : Given that,



u = 0 t = 2 sec
t = 0

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

$x = \frac{1}{2} a \times 4$

x = 2a .... (i)

and $S = ut + \frac{1}{2} \times at^2$

$x + y = \frac{1}{2} \times a \times 4 \times 4$

$x + y = 8a$ .... (ii)

From equation (i) and (ii), we get

$x + y = 8a$

$2a + y = 8a$

$y = 6a$

Given, $y = nx$

$y = 3 \times 2a$

$\Rightarrow$ $n = 3$

4. A planet moves around the sun in elliptical orbit. When earth is closest from the sun, it is at a distance *r* having a speed ν. When it is at a distance *4r* from the sun its speed is

(a) ν/4 (b) 4ν (c) 2ν (d) ν/2

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Ans. (a) :

Kepler's second law $\frac{dA}{dt} = \frac{1}{2} r \times v$ ...(i)

If distance is 4r then,

$\frac{dA}{dt} = \frac{1}{2} 4r \times v_2$ ...(ii)

From equation (i) and (ii)

According to question,

$\frac{1}{2} \times r \times v = \frac{1}{2} \times 4r \times v_2$

$v_2 = \frac{v}{4}$

5. A car moving with a speed of 50 km/hr can be stopped by brake after travelling at least 6 m. If the same car is moving at a speed of 100 km/hr, the minimum stopping distance is

(a) 18 m (b) 12 m (c) 24 m (d) 6 m

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Ans. (c) : Speed of the car when stopping distance is 6 m is given as, $u_1 = 50 \frac{km}{hr}$ and $u_2 = 100 \frac{km}{hr}$

Now,

$v^2 = u^2 - 2aS$

$0 = u^2 - 2aS$

$S = \frac{u^2}{2a}$

$S \propto u^2$

(a is constant and negative as considering retarding)

$\therefore$ $\frac{S_2}{S_1} = \frac{(u_2)^2}{(u_1)^2}$

$\frac{S_2}{S_1} = \frac{(100)^2}{(50)^2}$

$\frac{S_2}{S_1} = 4$

$S_2 = 4S_1$

$S_2 = 4 \times 6$

$S_2 = 24m$

6. A spacecraft of mass 2000 kg moving with a velocity of 600m/s suddenly explodes into two pieces. One piece of mass 500 kg is left stationary. The velocity of the other part must be (in m/s)

(a) 1000 (b) 600

(c) 800 (d) 1500

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Ans. (c) : Given that,

mass (m) = 2000kg

velocity (v) = 600m/s

$m_1 = 500kg$, $v_1 = 0$

Explodes in two piece, then mass = $m_1 + m_2$

$2000 = 500 + m_2$

$m_2 = 1500kg$

Formula P = mv

Momentum before explosion = 2000×600

Momentum after explosion = $P_1 + P_2$

$= (m_1 v_1 + m_2 v_2)$

$= 1500 \times v_2$

sine, there is no external fore, the momentum is conserved

So, Momentum before explosion = Momentum after explosion

$2000 \times 600 = 1500\ v_2$

$v_2 = 800$ m/s

7. A body is thrown with a velocity 20 m/s at an angle of 30º with the horizontal. The time taken to reach the maximum height is (Take g = 10m/s^2)

(a) 2 s (b) 5 s

(c) 4 s (d) 1 s

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Ans. (d) : Given,

Initial velocity (u) = 20 m/s

The angle of inclination (θ) = 30º

The time taken to reach the maximum height is equal to half of the time of flight.

Time of flight (T) = ?

$T = \frac{2 \cdot u \cdot \sin\theta}{g}$

$= \frac{2 \times 20 \times \sin 30^\circ}{10}$

$= \frac{2 \times 20 \times \frac{1}{2}}{10} = 2 \sec$

The time taken to reach the maximum height is,

$\frac{T}{2} = 1 \sec$

Hence, option (d) is correct.

8. A body is projected horizontally with a velocity u from a point which is at a height h above the ground level. The range (R) is (Take acceleration due to gravity = g units)

(a) $R = h\sqrt{\frac{2u}{g}}$ (b) $R = u\sqrt{\frac{2g}{h}}$

(c) $R = g\sqrt{\frac{2h}{u}}$ (d) $R = u\sqrt{\frac{2h}{g}}$

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Ans. (d): Horizontal distance covered is = velocity × time

$$R = ut$$

Vertical displacement

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

Given, $v = 0$, for vertical displacement

$$\Rightarrow \quad h = 0 + \frac{1}{2}gt^2$$

$$\Rightarrow \quad \boxed{t = \sqrt{\frac{2h}{g}}}$$

Now,

$$R = ut$$

$$\boxed{R = u\sqrt{\frac{2h}{g}}}$$

9. An automobile that is towing a trailer is accelerating on a level road. The force that the automobile exerts on the trailer is

(a) Equal to the force the trailer exerts on the automobile
(b) Greater than the force the trailer exerts on the automobile
(c) Equal to the force the trailer exerts on the road
(d) Equal to the force the road exerts on the trailer

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Ans. (a) : An automobile that is towing a trailer is accelerating on a level road. According to Newton's third law The force that the automobile exerts on the trailer is equal to the force the trailer exerts on the automobile.

10. A body falling from rest has a velocity 'v'. After it falls through a distance 'h', the distance it has to fall down further, for its velocity to become double is _____ time 'h'.

(a) 0.5 (b) 1.5
(c) 2 (d) 3

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Ans. (d) : We know that, $v^2 = u^2 + 2gh$

Given, $v_1 = v$

$v_2 = 2v$

Then,

$$v_1^2 = u^2 + 2gh$$

$$h = \boxed{h = \frac{v^2}{2g}} \quad \{\because u = 0 \text{ as body initially at rest}\}$$

$$v_2^2 = u^2 + 2gh_2$$

$$(2v)^2 = u^2 + 2gh_2$$

$$4v^2 = 2gh_2$$

$$\boxed{h_2 = \frac{4v^2}{2g}}$$

Required distance, $h_1 = h_2 - h$

$= 4h - h = 3h \Rightarrow \boxed{h_1 = 3h}$

11. An object of mass 3 kg is at rest. Now a 6 N force is applied on the object for 3 second. Find the velocity of the object acquired by it in m/s.

(a) 12 (b) 6
(c) 9 (d) 8

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Ans. (b) : Given, An object of mass (m) = 3 kg

Force (F) = 6 N

time (t) = 3 second

v =?

From Newton's second law.

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

$$\Rightarrow 6 = 3\left(\frac{v-0}{3}\right) \Rightarrow \boxed{v = 6m/s}$$

12. If 'c' is the velocity of light in free space, the time taken by light to travel a distance x in medium of refractive index μ is given by

(a) μxc (b) $\frac{\mu x}{c}$
(c) $\frac{\mu c}{x}$ (d) $\frac{x}{\mu c}$

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Ans. (b) :

Refractive index of a medium is given by $\mu = \frac{c}{v}$

Where v is velocity of light in given medium

Distance = speed × time

$$\Rightarrow \text{Time (t)} = \frac{\text{distance}\ (x)}{\text{speed}(v)}$$

$$\Rightarrow \boxed{t = \frac{\mu x}{c}}$$

13. A boy throws two balls in air in such a manner that when the first ball is at maximum height he throws the second ball. If the balls are thrown with the time difference of one second, the maximum height attained by each ball is ($g = 10m/s^2$)

(a) 2.5 m (b) 5 m
(c) 10 m (d) 3.5 m

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Ans. (b) : Given $t = 1$ second

$g = 10\ m/s^2$

Then, from Newton's first equation of motion

$v = g\,t = 1\times10 \Rightarrow (v = 10m/s)$

From Newton's third equation of motion

$$h = \frac{v^2}{2g} = \frac{10\times10}{2\times10} = 5m \Rightarrow \boxed{h = 5m}$$

14. Average Acceleration =

(a) $\frac{\text{toatal displacement}}{\text{total time}}$ (b) $\frac{\text{change in velocity}}{\text{time taken}}$
(c) $\frac{\text{distance}}{\text{time}}$ (d) $\frac{\text{change in mass}}{\text{time}}$

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Ans. (b) : The change in velocity divided by the elapsed time is the average acceleration. i.e.

$$\text{Average Acceleration} = \frac{\text{Change in velocity}}{\text{time taken}}$$

15. A body is allowed to slide down a frictionless track from rest position at its top under gravity. The track ends in a circular loop of diameter D. Then, the minimum height of the inclined track (in terms of D) so that it may complete successfully the loop is

(a) 3D/4 (b) 9D/4
(c) 5D/4 (d) 7D/4

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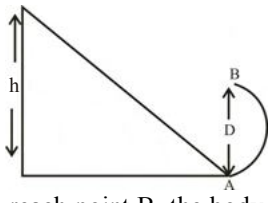
Ans. (c) :



For the body to reach point B, the body must have least velocity of $\sqrt{5gr}$ (from vertical circular motion) at A.

So, for a body falling from height h

Velocity (v) = $\sqrt{2gh}$

From both the velocities

$$\sqrt{5gr} = \sqrt{2gh}$$

$$\sqrt{5g\frac{D}{2}} = \sqrt{2gh}$$

On squaring both sides, we get

$$5g\frac{D}{2} = 2gh$$

$$\boxed{h = \frac{5D}{4}}$$

Hence, the loop is $\frac{5D}{4}$

16. A rope of length 10 m and linear density 0.5 kg/m is lying length wise on a smooth horizontal floor. It is pulled by a force of 25 N. The tension in the rope at a point 6 m away from the point of application is:

(a) 10 N (b) 20 N
(c) 15 N (d) 5 N

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Ans. (a) : Given : Length of rope (L) = 10 m

Linear Density (λ) = 0.5 kg/m

Force (F) = 25N

L_1 = 6 m, L_2 = 4 m

Total mass of rope = $\lambda \times L$

$= 0.5 \times 10$

$= 5$ kg

Acceleration of rope $[F = ma]$

$$a = \frac{F}{m} = \frac{25}{5} = 5 m/s^2$$

$T = m' \times a$

$m' = 0.5 \text{ kg/m} \times 4m = 2$ kg

$T = 2 \times 5 = 10$ N

17. A constant force (F) is applied on a stationary particle of mass 'm' They velocity attained by the particle after a certain displacement will be proportional to

(a) $\frac{1}{\sqrt{m}}$ (b) m (c) 1/m (d) $\sqrt{m}$

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Ans. (a) : Given : Force = F , Mass = m

Initial velocity (u) = 0 m/s

Acceleration of particle, $a = \frac{F}{M}$

The equation of motion of the particle after moving a certain displacement is given by-

$v^2 - u^2 = 2as$

Put the values.

$$v^2 = (0)^2 = 2\left(\frac{F}{M}\right)s$$

$$v = \sqrt{2\left(\frac{F}{M}\right)s}$$

From the above equation, it is clear

$$\boxed{v = \frac{1}{\sqrt{m}}}$$

18. A horizontal force F produces an acceleration of $6m/s^2$ on a block resting on a smooth horizontal surface. The same force produces an acceleration of 3 m/s^2 on a second block resting on a smooth horizontal surface. If the two blocks are tied together and the same force acts, the acceleration produced will be

(a) 1 m/s^2 (b) 2 m/s^2
(c) 4.5 m/s^2 (d) $9m/s^2$

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Ans. (b) : Given:

Acceleration of first block (a_1) = $6m/s^2$

Acceleration of second block (a_2) = $3m/s^2$

Given that force acted on the block is same.

So,

$$F_1 = F_2 = F$$

Force, F = ma

$$m = \frac{F}{a}$$

The mass of first block -

$$m_1 = \frac{F}{a_1} \text{ ---------(i)}$$

The mass of second block -

$$m_2 = \frac{F}{a_2} \text{ ------(ii)}$$

Add equation (i) & (ii), we get

$$m = m_1 + m_2$$

$$\frac{F}{a} = \frac{F}{a_1} + \frac{F}{a_2}$$

$$\frac{1}{a} = \frac{1}{a_1} + \frac{1}{a_2} = \frac{a_2 + a_1}{a_1 a_2}$$

$$a_{total} = = \frac{a_1 a_2}{a_1 + a_2}$$

Put the given values of a_1 & a_2 , we get

$a_{total} = \frac{6\times3}{6+3} = \frac{18}{9} = 2m/s^2$

Hence, the acceleration produced will be $2m/s^2$

19. To keep a particle moving with constant velocity on a frictionless surface, an external force:

(a) should act continuously
(b) should act opposite to the direction of motion
(c) is not necessary
(d) should be of variable magnitude

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Ans. (c) : To keep a particle moving with constant velocity on a frictionless surface, an external force is not necessary.
This is based on Newton's first law of motion - A body remains at rest, or in motion at a constant speed in a straight line, unless acted upon by a force.

20. When light travels from one medium to another, which of the following does not change?

(a) Wavelength (b) Intensity
(c) Velocity (d) Frequency

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Ans. (d) : Whenever light goes from one medium to another (from air to glass), the frequency of light and phase of light does not change. However, the velocity of light and wavelength of light change.

21. By applying the brakes without causing a skid, the driver of a car is able to stop his car within a distance of 5m, if it is going at 36 kmph. If the car were going at 72 kmph, using the same brakes, he can stop the car over a distance of:

(a) 10 m (b) 20 m
(c) 40 m (d) 2.5 m

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Ans. (b) :

Given: Initial velocity $(u_1) = 36$ km/h $= 36\times\frac{5}{18} = 10$ m/s
Distance (s) = 5m
Final velocity $(v_1) = 0$
Using second equation of motion -
$v^2 - u^2 = 2as$
$(0)^2 - (10)^2 = 2\times a\times 5$
$-100 = 10a$
$a = -10 m/s^2$
Now again from question–

Initial velocity $(u_2) = 72$ km/h $= 72\times\frac{5}{18} = 20 m/s$
Final velocity $(v_2) = 0$ m/s
& Acceleration (a) $= -10\ m/s^2$
Distance (s) = ?
Again, using second equation of motion –
$v_2 - u_2 = 2as$
$(0)^2 - (20)^2 = 2\times(-10)\times s$
$-400 = -20\times s$
$s = 20m$

22. A rigid body is made to rotate about an axis of rotation. Its moment of inertia about the axis of rotation depends on

(a) Its angular momentum only
(b) Its angular velocity only
(c) The distribution of its mass about the axis about which it rotates, and also the orientation and position of this axis of rotation
(d) The torque applied only

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Ans. (c) : Moment of inertia of a rigid body about a fixed axis is defined as the sum of the product of the masses of the particles constituting the body and its square of a distance from the axis of rotation.

$I = mr^2$

Moment of inertia of a body made up of number of particles $= m_1r_1^2 + m_2r_2^2 + m_3r_3^2 + ...$
So it can be said that moment of inertia depends on the mass and its distribution about the axis which it rotates.
So, option (c) is correct.

23. A ball, having speed V_0 moves in a straight line under the influence of a constant acceleration a. Then its final speed after travelling a distance x for time t will be

(a) $\left(\frac{x}{t}\right) - v_0$ (b) $V_0^2 + 2ax$
(c) $V_0 + \frac{1}{2}\ at^2$ (d) $\left(\frac{2x}{t}\right) - v_0$

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Ans. (b) :
Given that,
Initial velocity (u) = V_0
Acceleration (a) = a
Distance (s) = x
The motion of the equation is only valid when -
- Acceleration is constant
- The motion is in straight line.

From third motion equation,
$v^2 = u^2 + 2as$ -------- (1)
Where, v = Final velocity
Put the values in equation (1)
So, $V^2 = V_0^2 + 2ax$

24. An object of mass m follows a circular path of radius r with a constant speed v in uniform circular motion. Then, the work done by the centripetal force for the object to move once in a full circle is

(a) $(MV^2/r).2r$ (b) Zero
(c) $(Mv^2/r).2\pi r$ (d) $(MV^2/r).2\pi r$

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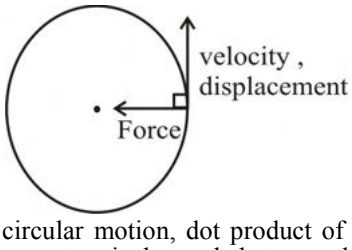
Ans. (b) : Work done on an object is the force applied and the displacement covered in the direction of the force applied.
i.e. $W = f.d\cos\theta$



In uniform circular motion, dot product of two mutual perpendicular vectors is the angle between them is 90°.
Then, $\cos 90° = 0$

$W = f.d.\cos 90°$
$W = 0$
Hence, the work done in a uniform circular motion is always zero.

25. A ball is thrown vertically upwards with initial velocity V_0 and returns to its starting point in 6 seconds then the initial velocity with which the ball was thrown will be
(a) 58.8 m/s (b) 19.6 m/s
(c) 39.2 m/s (d) 29.4 m/s

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Ans. (d) : Given that,
Time (t) = 6 second
Initial velocity (u) = V_0
Acceleration (a) = $-g = -9.8$ m/sec^2
The ball returns to its initial point, so displacement (s) = 0
According to motion equation

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

$$0 = 6V_0 + \frac{1}{2}(-9.8)\times(6)^2$$

$$6V_0 = \frac{1}{2}\times 9.8\times 36$$

$$V_0 = 29.4 \text{ m/sec.}$$

26. An object is made to move with uniform speed such that the magnitude of its velocity remains constant with its direction of motion continuously changing with time. Then, the unbalanced force acting on the object will be in the direction.
(a) Inclined at an angle of 60° with the direction of its acceleration
(b) Opposite to that of its velocity
(c) Parallel to that of its velocity
(d) Parallel to the direction of its acceleration

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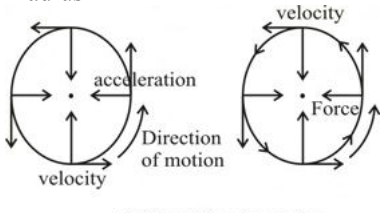
Ans. (d): From the question it is example of uniform circular motion.
• The circular motion in which the speed of the particle remains constant is called uniform circular motion. In uniform circular motion, force supplies the centripetal acceleration.

$$a_c = \frac{v^2}{r}$$

where, v = velocity
r = radius



Uniform Circular motion

• In uniform circular motion, force is parallel to the direction of its acceleration i.e. towards the center.

27. A bullet travels 90 m in 0.2 seconds. Find its speed in km/hr.
(a) 162 (b) 1620
(c) 125 (d) 1250

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Ans : (b) Speed of bullet = $\frac{\text{distance}}{\text{time}}$

$$= \frac{90}{0.2}\times\frac{18}{5}$$
$$= 1620 \text{km/hr}$$

28. Two cars, X and Y, travel from A to B at average speeds of 50 km/hr and 75 km/hr respectively. If X takes 2 hours more than Y for the journey, then the distance between A and B in km is——.
(a) 800 (b) 400
(c) 300 (d) 600

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Ans : (c) Let, y take t hours to reach from A to B, therefore, time taken by x to reach from A to B = (t +2) hours.
from, $r_1t_1 = r_2t_2$
$50\times(t+2) = 75\times t$
$50t + 100 = 75t$
$25t = 100$
$t = 4$ hours
So, desired distance = 75×4
= 300km

29. By cycling 7/9 times his usual speed, Anwar reaches his school 4 minutes late. How many minutes does Anwar take to reach school at his usual cycling speed?
(a) 14 (b) 20 (c) 18 (d) 16

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Ans : (a) Let, the normal speed of answer be x and with this speed its time to reach school.
From, $s_1t_1 = s_2t_2$

$$x\times t = \frac{7}{9}x\times(t+4)$$

$\Rightarrow$ $9t = 7t + 28$
$\Rightarrow$ $2t = 28$
$\Rightarrow$ $t = 14$ min
Hence, answer takes 14 min to reach school at normal speed.

30. A truck travels 450 km in two and a half hours. Find its speed in m/s.
(a) 60 (b) 90
(c) 50 (d) 75

RRB ALP & Tech. 23.01.2019 Shift-II

Ans : (c) Given,

$$t = 2\frac{1}{2} \text{ hour}$$
$$= \frac{5}{2} \text{ hour}$$
$$s = 450\text{km.}$$

$$\text{speed} = \frac{s}{t}$$
$$= \frac{450}{\frac{5}{2}} = 180\text{km/h}$$
$$= 180\times\frac{5}{18}$$
$$= 50\text{m/s}$$

31. A rocket travels 108 m in 0.3 seconds. Find its speed in km/hr.

(a) 1296 km/h (b) 6300 km/h
(c) 1692 km/h (d) 3600 km/h

RRB ALP & Tech. 08.02.2019 Shift-I

Ans : (a) : $t = 0.3$ sec
distance = 108 m

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$
$$= \frac{108}{0.3}$$
$$= 360 \text{ m/sec}$$
$$= 360 \times \frac{18}{5} \text{ km/hour}$$
$$= 72 \times 18$$
$$= 1296 \text{ km/hour}$$

32. A body starts moving form rest. Its displacement is propational to ____ when its acceleration is constant.

(a) Velocity (b) Work
(c) Time squared (d) Time

RRB ALP & Tech. 23.01.2019 Shift-III

Ans : (c) Let, constant acceleration is a initial velocity $u = 0$,

$$s = ut + \tfrac{1}{2}at^2$$
$$s = 0 \times t + \tfrac{1}{2}at^2$$
$$s = \tfrac{1}{2}at^2$$
$$\boxed{s \propto t^2}$$

Therefore, displacement of object is directly proportional to the square of time.

33. A motorcycle covers a distance of 1000 m at a speed of 36 km/hr. Find the time (in seconds) taken by the motorcycle to cover this distance.

(a) 300 (b) 200
(c) 100 (d) 400

RRB ALP & Tech. 23.01.2019 Shift-III

Ans : (c)
$$\text{Time} = \frac{\text{distance}}{\text{speed}}$$
$$= \frac{1000}{36 \times \frac{5}{18}}$$
$$= 100 \text{ second}$$

34. An object starts from rest at x = 0 m and rotates with a constant acceleration of 1.6 m/s^2 about the x-axis. What is its average velocity during its journey from x= 12.8 m to x= 20.0 m?

(a) 2.4m/s (b) 3.6m/s
(c) 7.2m/s (d) 8.8m/s

RRB ALP & Tech. 23.01.2019 Shift-III

Ans:(c) T_1, T_2 and V_1, V_2 shows time and displacement respectively.

Initial velocity (u) = 0, acceleration (a) = 1.6 m/s^2

$$S = ut + \frac{1}{2}at_1^2$$
$$12.8 = 0 + \frac{1}{2} \times 1.6 \times t_1^2$$
$$1.6\, t_1^2 = 25.6$$
$$t_1^2 = 16$$
$$t_1 = 4$$
$$v_1 = u + at_1$$
$$v_1 = 0 + 1.6 \times 4$$
$$v_1 = 6.4 \text{ m/s}$$
$$20 = ut + \frac{1}{2}at_2^2$$
$$t_2 = 5$$
$$t_2 = 5 \text{ sec}$$
$$v_2 = u + at_2$$
$$v_2 = 0 + 1.6 \times 5$$
$$v_2 = 8 \text{ m/s}$$
$$\text{Average velocity} = \frac{v_1 + v_2}{2} = \frac{8 + 6.4}{2} = 7.2 \text{ m/s}$$

35. An airoplane flies at a speed of 50 m/s. How much distance will it cover in 5 hours?

(a) 895 (b) 880
(c) 850 (d) 900

RRB ALP & Tech. 23.01.2019 Shift-III

Ans : (d) distance = speed × time
$$= 50 \times \frac{18}{5} \times 5 = 900 \text{ km.}$$

36. A ball is thrown vertically upward with a speed of 30 m/s. The magnitude of its displacement after 4 s will be _____.

(a) 30m (b) 50m
(c) 15m (d) 40m

RRB ALP & Tech. 22.01.2019 Shift-I

Ans : (d) Given:
u = 30 m/sec
t = 4 sec
g = 10 m/sec^2
h = ?
by 2nd equation of motion -

$$h = ut - \frac{1}{2}gt^2 \text{ (in ward directive)}$$
$$h = 30 \times 4 - \frac{1}{2} \times 10 \times 4 \times 4$$
$$h = 120 - 80$$
$$h = 40 \text{ m}$$

37. ..... is defined as the total path length travelled by an object divided by the total time interval during which the motion has taken place.

(a) Instantaneous acceleration
(b) Average speed
(c) Uniform acceleration
(d) Instantaneous velocity

RRB ALP & Tech. 22.01.2019 Shift-I

Ans : (b) Average speed is defined as the total path length covered by an object which is divided by time interval during which the motion occurred.

38. An object is moving with a speed 100 m/s. Find the distance travelled by this object in one minute.

(a) 100 km (b) 0.6 km
(c) 6 km (d) 10 km

RRB ALP & Tech. 22.01.2019 Shift-II

Ans : (c) : Distance = speed × time
= 100 × 60
= 6000 m {∵ 1 km = 1000 m}
= 6 km

39. An object starts from rest at x = 0 m and t = 0 sec. It moves with constant acceleration of 3 m/s^2 along x axis. What is its average velocity between time 4 s and 8 s?

(a) 6 m/s (b) 18 m/s
(c) 12 m/s (d) 3 m/s

RRB ALP & Tech. 22.01.2019 Shift-II

Ans : (b) : t = 8–4 = 4 sec
u = 0
a = 3 m/s^2
v = u + at
v = 0 + 3×4
V = 12 m/s
From 2nd equation of motion -

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

$$S = 12\times4 + \frac{1}{2}\times4\times4\times3$$

S = 72 m

$$\text{Average velocity} = \frac{\text{total distance}}{\text{total time}} = \frac{72}{4} = 18 \text{ m/s}$$

40. An object starts moving from rest, with constant acceleration. Its velocity is:

(a) Directly proportional to time
(b) Inversely proportional to time
(c) Inversely proportional to time square
(d) Directly proportional to time square

RRB ALP & Tech. 22.01.2019 Shift-II

Ans : (a) : $\text{Acceleration} = \frac{\text{Velocity}}{\text{time}}$
Velocity = acceleration × time
Velocity $\propto$ time
Velocity of object is directly proportional to time.

41. When you double the speed of a car, it takes ..... times more distance to stop it.

(a) four (b) one
(c) two (d) three

RRB ALP & Tech. 21.01.2019 Shift-I

Ans : (a) : $v^2 = u^2 - 2as$
$0 = u^2 - 2as$

$$s = \frac{u^2}{2a}$$

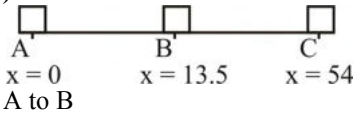
If initial velocity is 2 time then distance will be 4 times,

42. An object starts from rest at x = 0 m and moves with constant acceleration of 3 m/s^2 along x axis. During its journey from x = 13.5 m to x = 54 m, its average velocity is :

(a) 13.5 m/s (b) 10.0 m/s
(c) 8.5 m/s (d) 12.0 m/s

RRB ALP & Tech. 21.01.2019 Shift-I

Ans : (a) : u = 0 a = 3 m/s^2



Motion A to B

$$v_B^2 = 0 + 2\times3\times13.5$$

$$v_B^2 = 6\times13.5$$

$$v_B^2 = 81.0$$

$$v_B = 9 \text{ m/s}$$

motion A → C

$$u_A = 0$$

$$v_c = ?$$

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

$$v_c^2 = 0 + 2\times3\times54$$

$$v_c^2 = 6\times54$$

$$v_c^2 = 324$$

$$v_c = 18 \text{ m/s}$$

$$v_{avg} = \frac{9+18}{2}$$

$$= \frac{27}{2} = 13.5 \text{m/s}$$

43. Find the velocity (in m/s) that a car will achieve after 20 seconds if it starts and accelerates at 3.2 m/s^2.

(a) 72 (b) 36
(c) 108 (d) 64

RRB ALP & Tech. 21.01.2019 Shift-I

Ans : (d) : t = 20 second
a = 3.2 m/sec^2
u = 0
v = u + at
= 0 + 3.2 × 20
= 64 m/second

44. A car accelerating for two seconds would cover ..... times the distance of a car accelerating for only one second (cars starts from rest with the same acceleration in both the cases).

(a) Four (b) Three
(c) Two (d) One

RRB ALP & Tech. 21.01.2019 Shift-I

Ans : (a) : A car accelerating for two seconds would cover 4 time distance of a car accelerating for only one second.

45. An object covers the first distance of 200 m in 20s and takes 30s for the next 200m. What is the average speed of the object?

(a) 8m/s (b) 12m/s
(c) 4m/s (d) 6m/s

RRB ALP & Tech. 22.01.2019 Shift-III

Ans : (a) Total distance = 200+200= 400m
total time = 20+30 = 50sec

$$\text{Average speed} = \frac{\text{total distacne}}{\text{total time}}$$

$$= \frac{400}{50}$$

= 8 m/sec
Average speed of object = 8 m/sec

46. An object starts from rest at X = 0m and t = 0 s and rotates with a constant accelerration of 4m/s^2 about the x-axis. What is its average velocity between the time 2s and 6s ?

(a) 12m/s (b) 16m/s
(c) 8m/s (d) 18m/s

RRB ALP & Tech. 22.01.2019 Shift-III

Ans : (b) $a = \frac{dv}{dt}$

$$\int_{o}^{v} dv = \int_{2}^{6} a\,dt$$

$$(v - 0) = a\int_{2}^{6} dt$$

$$V = a(t)_{2}^{6}$$

$= 4[6–2] = 16\text{m/s}$ (given : $a = 4\ \text{m/sec}^2$)

Average velocity will be 16 m/sec

47. A ball is dropped freely from the top of building from an intial rest and attains a maximum velocity of 40m/s. What will be the height of the building ? (use g = 10m/s for the acceleration due to gravity)

(a) 70m (b) 80m
(c) 50m (d) 60m

RRB ALP & Tech. 22.01.2019 Shift-III

Ans : (b) $v = u + gt$

$v = 0+gt$

$v = gt$

$$t = \frac{v}{g}$$

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

$$h = 0 + \frac{1}{2}g \times \left(\frac{v}{g}\right)^2$$

$$h = \frac{1}{2}g \times \frac{v^2}{g \times g}$$

$$h = \frac{1}{2} \times \frac{v^2}{g}$$

$$h = \frac{1}{2} \times \frac{40^2}{10}$$

$$h = \frac{1}{2} \times \frac{40 \times 40}{10}$$

$h = 80$ m

48. A car starts from rest with a constant acceleration of 3m/s^2. Find the distance covered by this car in 10s.

(a) 250m (b) 100m
(c) 200m (d) 150m

RRB ALP & Tech. 22.01.2019 Shift-III

Ans : (d) $a = 3\text{m/s}^2$

$t = 10\text{s}$

$S = ?$

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

$$S = 0 \times 10 + \frac{1}{2} \times 3 \times 10^2$$

$$S = \frac{1}{2} \times 300$$

$S = 150$m

Total distance covered by the car is 150 m.

49. The circumference of a planet is 36,000 km. If the planet makes no other movement and takes 20 hours for one complete rotation, what is the speed of a point on its equator?

(a) 500 m/s (b) 400 m/s
(c) 300 m/s (d) 200 m/s

RRB ALP & Tech. 21.01.2019 Shift-II

Ans : (a) : If $\Delta\theta$ is the augular displacement at a time Δt then the angular speed is given by –

$$\omega = \frac{\Delta\theta}{\Delta t}$$

Angular speed $(\omega) = \frac{2\pi r}{\text{time}}$

Given that-

Circumference of the planet $(2\pi r) = 36{,}000$ km

time = 20 hours

angular speed $(\omega) = \frac{36000}{20} = 1800\ \text{km/h}$

Now, converting km/h to m/sec

$\therefore$ Angular speed $(w) = 1800 \times \frac{5}{18} = 500\,\text{m/s}$

Hence, the speed of a point on its equator will be 500 m/s.

50. A bullet is fired vertically upwards with a velocity of 196 m/sec. What is the maximum height reached by the bullet? (Assuming $g = 9.8\ \text{m/sec}^2$)

(a) 1960 m (b) 196 m
(c) 980 m (d) 490 m

RRB Bilaspur JE (red) , 14.12.2014

Ans. (a) : Given that,

$v = 196$ m/sec

$h = ?$

$(u) = 0$

$v^2 = u^2 + 2gh$

$(196)^2 = 0 + 2 \times 9.8 \times h$

$h = (1960)$m

The maximum height reached the bullet is 1960m.

51. One early morning, with no traffic on roads, Rahul while cycling down from Red Fort to his residence noted the distance covered and the total time taken to reach home. What can he calculate from this data ?

(a) Velocity
(b) Speed
(c) Acceleration
(d) Displacement

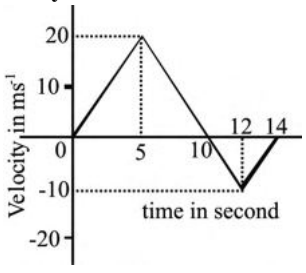
RRB SSE Secundrabad (Shift-I), 02.09.2015

Ans. (b) :

$$\text{Average speed} = \frac{\text{total distance}}{\text{total time}}$$

Average speed can be calculated from the given data.

52. In above graph ratio of average speed to average velocity is :



(a) 1 : 1 (b) 2 : 3
(c) 3 : 2 (d) 2 : 1

RRB Chennai Section Engineer, 12.02.2012

Ans. (c) :

$$\text{Average speed} = \frac{\text{total distance}}{\text{total time}}$$

$$= \frac{\frac{1}{2}\times 10\times 20 + \frac{1}{2}\times 10\times 4}{14} = \frac{120}{14}$$

$$\text{Average speed} = \frac{\text{Displacement}}{\text{time}}$$

$$= \frac{\frac{1}{2}\times 10\times 20 + \frac{1}{2}\times(-10)\times 4}{14}$$

$$= \frac{100-20}{14} = \frac{80}{14}$$

$$\therefore \quad \frac{\text{Average speed}}{\text{Average velocity}} = \frac{120}{14} : \frac{80}{14} = \frac{3}{2}$$

53. A force F produces an acceleration of $3ms^{-2}$ in a body and $6ms^{-2}$ in another body. If both the bodies are tied together and same force is applied due to acceleration in the bodies will be :

(a) $3ms^{-2}$ (b) $9\ ms^{-2}$
(c) $4.5\ ms^{-2}$ (d) $2ms^{-2}$

RRB Kolkata Supervisor (P.Way), 20.02.2000

Ans. (d) : Common acceleration of two object -

$$a = \frac{a_1 a_2}{a_1 + a_2} = \frac{3\times 6}{3+6} = 2ms^{-2}$$

54. A car travels three equal parts of its journey with average speed of 60 kmh^{-1}, 80 kmh^{-1} and 120kmh^{-1}. Average speed of car during its journey will be.

(a) 60kmh^{-1} (b) 80 kmh^{-1}
(c) 100 kmh^{-1} (d) 87 kmh^{-1}

RRB Kolkata Apprentice Supervisors, 14.10.2001

Ans. (b) :

x x x

$$t_1 = \frac{x}{60} \qquad t_2 = \frac{x}{80} \qquad t_3 = \frac{x}{120}$$

$$\text{average speed} = \frac{\text{total distance}}{\text{total time}}$$

$$= \frac{3x}{\frac{x}{60}+\frac{x}{80}+\frac{x}{120}}$$

$$= 3x \times \frac{240}{9x} = 80 kmh^{-1}$$

55. When ball is drop from the roof of a building. It takes 3 second for the ball to reach the ground. the acceleration of the ball towards the earth is 10 m/sec then height of the building is

(a) 40 m (b) 20 m
(c) 30 m (d) None of these

RRB RRB Patna/Allahabad ESM-II , 30.01.2011

Ans. (d) : Hight of building = vertical distance travelled by the ball –

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

$$h = 0 + \frac{1}{2}\times 10\times (3)^2$$

$[\because u = 0]$, g = 10 m/sec^2

$$\boxed{h = 45m}$$

56. Which is the correct formula to find acceleration?

(a) $a = \frac{v-u}{t}$ (b) a = u + vt
(c) $a = \frac{v+u}{t}$ (d) $a = \frac{v+u}{2}$

RRB Ajmer (Tech.), 01.03.1998

Ans. (a) : By first equation of motion

$$v = u + at$$
$$v - u = at$$
$$a = \frac{v-u}{t}$$

57. If an object, on a free fall from a certain height, reaches the ground in 1 second, what is its velocity on the impact with the ground?

(a) 4.9 m/s (b) 9.8 m/s
(c) 14.7 m/s (d) 19.6 m/s

RRB Mumbai Electrical/Diesel Drivers', 03.06.2001

Ans. (b): t = 1 second

initial velocity (u) = 0

velocity of collision with earth = v m/s

$$v = u + gt$$
$$v = 0 + 9.8 \times 1$$
$$v = 9.8 \text{ m/s}$$

58. In a projectile motion, a large angle with the horizontal produces .....

(a) flat trajectory
(b) curve trajectory
(c) straight trajectory
(d) high trajectory

RRB Bhubaneshwar (Tech.), 03.06.2001

Ans. (d) : When an object is project from a vertical plane making an angle with the horizontal its path is parabolic, this motion of the body is called projective motion -

$$h = \frac{u^2 \sin^2 \theta}{2g}$$

$$\theta = 90^0 \qquad h_{max} = \frac{u^2}{2g}$$

Hence, projective motion, a high trajectory is obtained at a large angle $\theta = 90°$ with the horizontal.

59. If a ball is thrown up, which of the following does not change?

(a) Acceleration (b) Speed
(c) Potential energy (d) Distance

RRB Bhubaneshwar App. Elec. Signal Maintainer, 19.08.2001

Ans. (a) : When a ball is thrown upwards, its path, is parabolic, in such a situation its speed, potential energy and distance change but acceleration remains unchanged. The value of this acceleration is always equal to g (acceleration due to gravity).

60. A 5 kg mass at rest on a frictionless table is acted upon by a constant force of 12 N. The distance travelled by it in 2s is–

(a) 1.2 m (b) 2.4 m
(c) 4.8 m (d) 9.6 m

RRB JE Bhopal Paper II (Shift-II), 26.08.2015

Ans. (c) : m = 5 kg
F = 12 N

$F = m.a$

$12 = 5.a$

$a = \frac{12}{5} m/s^2$

by 2nd equation of motion is :-

$S = ut + \frac{1}{2}at^2 \qquad (u = 0)$

$S = \frac{1}{2} \times \frac{12}{5} \times (2)^2$

$S = \frac{24}{5}$

$\boxed{S = 4.8 m}$

The distance travelled by it in 2 sec is 4.8 m.

61. A force of 1.5 Newton is applied on a body of mass 5kg for 2 second. the distance covered by the body is -

(a) 2 m (b) 1.6 m
(c) 1.2 m (d) 0.6 m

RRB Ranchi Diesel/Electric Assistant (Driver), 21.09.2003

Ans. (d): F = Ma

$a = \frac{F}{M} = \frac{1.5}{5} = 0.3 \text{ m/sec}^2$

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

$S = 0 \times 2 + \frac{1}{2} 0.3 \times (2)^2$

$S = 0 + 0.3 \times 2$

$\boxed{S = 0.6m}$

62. A car travels from A to B at a speed of 20 km/h and returns at a speed of 30 km/h. The average speed of the car during this journey will be

(a) 5 km/hour (b) 24 km/hour
(c) 25 km/hour (d) 50 km/hour

RRB Asst. Loco Pilot (Guwahati)-2006

Ans. (b) : Average speed $= \frac{2v_1v_2}{v_1 + v_2} = \frac{2 \times 20 \times 30}{20 + 30}$

$V_{avg} = \frac{1200}{50} = 24$ km/hour.

63. When a ball is dropped from the roof of a building. It takes 3 second for the ball to reach the ground. The acceleration to the ball towards the earth is 10m/sec^2 then the height of the building is

(a) 40 Meter (b) 20 Meter
(c) 30 Meter (d) None of these

RRB Mahendrughat (Patna) Diesel Driver,11.11.2001

Ans. (d) : Given u = 0, t = 3 second g = 10 m/sec^2

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

$h = 0 \times t + \frac{1}{2}gt^2$

$= 0 + \frac{1}{2} \times 10 \times 3^2$

h = 45 meter.

64. A bullet of mass 20 grams moves with a speed of 10 m/sec. It can sink 8 cm into the target before coming the rest. if the target is only 6 cm thick, the speed with which the bullet will exist the target is.

(a) 10 m/sec (b) 7 m/sec
(c) 4 m/sec (d) 5 m/sec

RRB Asst. Loco Pilot (Guwahati)-2006

Ans. (d) : From equation of motion -

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

$0 = (10)^2 + 2 \times a \times (8 \times 10^{-2})$

$a = -\frac{1}{16} \times 10^4 \text{ m/sec}^2$

Now, for the 6 cm thick target -

From $v^2 = u^2 + 2as$,

$v^2 = (10)^2 - 2 \times \frac{10^4}{16} \times \left(6 \times 10^{-2}\right)$

v = 5 m/sec