# PHYSICS

# BOOKS - VGS PUBLICATION-BRILLIANT

# MOTION IN STRAIGHT LINE

## Very Short Answer Questions

**1.** The states of motion and rest are relative. Explain.

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**2.** How is average velocity different from instantaneous velocity?

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**3.** Give an example where the velocity of an object is zero but its acceleration is not zero.

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**4.** A vehicle travels half the distance L with speed $v_1$ and the other half with speed $v_2$, What is the average speed?

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**5.** A lift coming down is just about to reach the ground floor. Taking the ground floor are origin and positive direction upwards for all quantities, which one of the following is correct?

A. $x < 0, v < 0, a > 0$

B. $x > 0, v < 0, a < 0$

C. $x > 0, v < 0, a > 0$

D. $x > 0, v > 0, a > 0$

**Answer: A**

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**6.** A uniformly moving cricket balls is hit with a bat for a very short time and is turned back. Show that variation of its acceleration with

time taking the acceleration in the backward direction as positive.

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**7.** Give an example of one dimensional motion where a particle moving along the postitive x-direction comes to rest periodically and moves forward.

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**8.** An object falling through a fluid is observed to have an acceleration given by a=g-bv where g is the gravitational acceleration and b is a constant. After a long time it is observed to fall with a constant velocity. What would be the value of this constant velocity?

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**9.** If the trajectory of a body is parabolic in one frame, can it be parabolic in another frame

that moves with a constant velocity with respect to the first frame? If not, what can it be?

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**10.** A spring with one end attached to a mass and the other to a rigid support is stretched and released. When is the magnitude of acceleration a maximum?

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**11.** Define average velocity and average speed. When does the magnitude of average velocity become equal to the average speed?

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## Short Answer Questions

**1.** Can the equation of kinematics be used when the acceleration varies with time? If not, what form would these equations take?

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**2.** A particle moves in a strainght line with uniform acceleration . Its velocity at time t=0 is $v_1$ and at time $t_2 = t$ is $v_2$. The average velocity of the particle in this time interval is $(v_1 + v_2)/2$ Is this correct? Substantiate your answer.

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**3.** Can the velocity of an object be in a direction other than the direction of acceleration of the object? IF so, given an example.

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**4.** A parachutist flying in an aeroplane jumps when it is at a height of 3 km above ground. He opens his parachute when he is about 1 km above ground. Describe his motion.

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**5.** A bird holds a fruit in its beak and flies parallel to the ground. It lets go of the fruit at some height. Describe the trajectory of the fruit as it falls to the ground as seen by the bird.

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**6.** A bird holds a fruit in its beak and flies parallel to the ground. It lets go of the fruit at

some height. Describe the trajectory of the fruit as it falls to the ground as seen by a person on the ground.

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**7.** A man runs across the roof of a tall building and jumps horizontally on to the (lower) roof of an adjacent building. If his speed in $9ms^{-1}$ and the horizontal distance between the buildings is 10 m and the height difference

between the roof is 9m, will he is able to land on the next buildings? (take $g = 10ms^{-2}$)

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**8.** A ball is dropped from the roof of a tall building and simultaneously another ball is thrown horizontally with some velocity from the same roof. Which ball lands first? Explain your answer.

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**9.** A ball is dropped from the building and simultaneously another ball is projected upward with some velocity. Describe the change in relative velocities of the balls as a function of time.

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**10.** A typical raindrop is about 4 mm in the diameter. If a raindrop falls from a cloud which is at 1 km above the ground, estimate its momentum when it hits the ground.

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**11.** Show that the maximum height reached by a projectile launched at an angle of $45^\circ$ is one quarter of its range.

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**12.** Derive the equation of motion $x = v_0 t + \frac{1}{2} a t^2$ using appropriate graph.

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## Problems

**1.** A man walks on a straight road from his home to a market 2.5 km away with a speed of $5kmh^{-1}$. Finding the market closed, he instantly turns and walks back home with a speed of $7.5kmh^{-1}$. What is the (a) magnitude of average velocity and (n) average speed of the man over the time interval 0 to 50 minutes?

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**2.** A stone is dropped from a height 300 m and at the same time another stone is projected vertically upwards with a velocity of $100m/\sec$. Find when and where the two stones meet.

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**3.** A car travels the first third of a distance with a speed of 10 kmph, the second third at 20

kmph and the last third at 60 kmph. What is its mean speed over the entire distance?

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**4.** A bullet moving with a speed of $150ms^{-1}$ strikes a tree and penetrates 3.5 cm before stopping. What is the magnitude of its retardation in the tree and the time taken for it to shop after striking the tree?

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**5.** A motorist drives north for 30 min at $85km/h$ and then stops for 15 min. He continues travelling north and covers 130 km in 2hours. What is his total displacement and average velocity?

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**6.** A ball A is dropped from the top of a building and at the same time an identical ball B is thrown vertically upward from the ground. When the balls collide the speed of A is twice

that of B. At what fraction of the height of the building did the collison occur?

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**7.** Drops of water fall at regular intervals from the roof of a building of height 16 m. The first drop strikes the ground at the same moment as the fifth drop leaves the roof. Find the distances between successive drops.

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**8.** Rain is falling vertically with a speed of $35ms^{-1}$. A woman rides a bicycle with a speed of $12ms^{-1}$ in east to west direction. What is the direction in which she should hold her umbrella?

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**9.** A hunter aims a gun at a monkey hanging from a tree some distance away. The monkey drops from the branch at the moment he fires

the gun hoping to avoid the bullet. Explain why the monkey made a wrong move.

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**10.** A food packet is dropped from an aeroplane, moving with a speed of 360 kmph in a horizontal direction, from a height of 500m. Find (i) its time of decent (ii) the horizontal distance between the point at which the food packet reaches the ground and the point above which it was dropped.

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**11.** A ball is tossed from the window of a building with an initial velocity of $8ms^{-1}$ at an angle of $20^{\circ}$ below the horizontal . It strikes the ground 3 s later. From what height was the ball thrown? How far from the base of the building does the ball strike the ground?

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**12.** Two balls are projected from the same point in directions $30^\circ$ and $60^\circ$ with respect to the horizontal . What is the ratio of their initial velocities if they attain the same height?

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**13.** Two balls are projected from the same point in directions $30^\circ$ and $60^\circ$ with respect to the horizontal . What is the ratio of their initial velocities if they have the same range?

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**14.** A ball is thrown vertically upwards with a velocity of $20ms^{-1}$ from the top of a multistorey building. The height of the point from where the ball is thrown is 25.0 m from the ground.

How high will the ball rise?

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**15.** A ball is thrown vertically upwards with a velocity of $20ms^{-1}$ from the top of a multistorey building. The height of the point from where the ball is thrown is 25.0 m from the ground.

How long will it be before the balls hits the ground?

Take $g = 10ms^{-2}$ [Actual value of $g$ is $9.8ms^{-2}$].

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**16.** A parachutist flying in an aeroplane jumps when it is at a height of 3 km above ground. He opens his parachute when he is about 1 km above ground. Describe his motion.

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