

Ans :

Since initial vertical velocity of both are same, the time taken to reach the ground is same.

23 At which point of the trajectory is the speed of motion minimum ?

1

Ans :

Minimum speed is at the highest point, since the vertical component of velocity is zero.

24 Pick out the two scalar quantities in the following list : force, angular

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momentum, work, current, linear momentum, electric field, average velocity, magnetic moment, relative velocity.

Ans : Work, current.

25 What is the angle of projection at which the h_{\max} and Range are equal ?

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Ans : $\frac{v^2 \sin^2 \theta}{2g} = \frac{v^2 \sin 2\theta}{g} \Rightarrow \theta = \tan^{-1}(4)$.

26 If two bodies have circular path of radius r_1 and r_2 and the time taken are the same, find the ratio of the angular speed.

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Ans : Since time taken T is same and $\omega = \frac{2\pi}{T}$,
 $\omega_1 : \omega_2 = 1 : 1$.

27 What will be the effect on the horizontal range of a projectile when its initial speed is doubled keeping its angle of projection same ?

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Ans :

$R = \frac{u^2 \sin 2\theta}{g}$. If initial speed u is doubled range becomes 4 times the initial range.

28 What is the minimum number of forces acting on an object in a plane that can produce a zero resultant force ?

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Ans : Two.

29 A unit vector is represented by

1

$a\hat{i} + b\hat{j} + c\hat{k}$. If the values of a and b are 0.6 and 0.8 respectively, find the value of c .

Ans : $c = 0$, since $\sqrt{(0.6)^2 + (0.8)^2 + c^2} = 1$

33 Angle that the vector $\vec{A} = 2\hat{i} + 3\hat{j}$ makes with y -axis is

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- (a) $\tan^{-1}(3/2)$
 (b) $\tan^{-1}(2/3)$
 (c) $\sin^{-1}(2/3)$
 (d) $\cos^{-1}(3/2)$

Ans : (b)

As $\vec{A} = 2\hat{i} + 3\hat{j}$, therefore $A_x = 2$ and $A_y = 3$. If θ is the angle which \vec{A} encloses with y -axis, then

$$\tan \theta = \frac{A_x}{A_y} = \frac{2}{3} \text{ or } \theta = \tan^{-1}\left(\frac{2}{3}\right)$$

34 The simple sum of two forces acting at a point is 16 N and their sum is 8 N and its direction is perpendicular to the smaller force, then the forces are:

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- (a) 6 N and 10 N
 (b) 8 N and 8 N
 (c) 4 N and 12 N
 (d) 2 N and 14 N

Ans : (a)

$$\text{Here, } A + B = 16 \quad \dots(i)$$

$$\sqrt{A^2 + B^2 + 2AB \cos \theta} = 8 \quad \dots(ii)$$

$$\text{and } \tan 90^\circ = \frac{B \sin \theta}{A + B \cos \theta}$$

$$\text{or } A + B \cos \theta = \frac{B \sin \theta}{\tan 90^\circ} = 0$$

$$\text{or } B \cos \theta = -A \text{ or } \cos \theta = \frac{-B}{A}$$

$$\text{From (ii), } A^2 + B^2 + 2AB \left(\frac{-B}{A}\right) = 64$$

$$\text{or } B^2 - A^2 = 64 \quad \dots(iii)$$

Solving (i) and (iii), we get

$$A = 6N \text{ and } B = 10N$$

35 If a unit vector is represented by $0.5\hat{i} + 0.8\hat{j} + c\hat{k}$, then the value of 'c' is

1

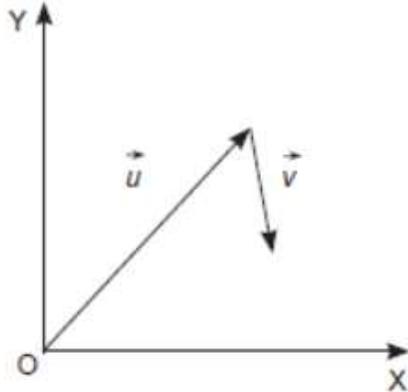
- (a) 1
 (b) $\sqrt{0.11}$
 (c) $\sqrt{0.01}$
 (d) $\sqrt{0.39}$

Ans : (b)

$$\text{Here, } (0.5)^2 + (0.8)^2 + (c)^2 = 1 \text{ or } c = \sqrt{0.11}$$

- 40 Figure shows the orientation of two vectors \vec{u} and \vec{v} in the XY plane.

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If $\vec{u} = a\hat{i} + b\hat{j}$ and $\vec{v} = p\hat{i} + q\hat{j}$, which of the following is correct?

- (a) a and p are positive while b and q are negative.
 (b) a , p and b are positive while q is negative.
 (c) a , q and b are positive while p is negative.
 (d) a , b , p and q are all positive.

Ans :(b)

- 41 Consider the quantities, pressure, power, energy, impulse, gravitational potential, electrical charge, temperature, area. Out of these, the only vector quantities are
- (a) Impulse, pressure and area.
 (b) Impulse and area.
 (c) Area and gravitational potential.
 (d) Impulse and pressure.

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Ans :

(b)

Impulse ($\vec{F}t$) is a vector quantity. Area of a surface is a vector which is along the normal to the surface in the outward direction.

- 42 In a two dimensional motion, instantaneous speed v_0 is a positive constant. Then which of the following are necessarily true?
- (a) The average velocity is not zero at any time.
 (b) Average acceleration must always vanish.
 (c) Displacements in equal time intervals are equal.
 (d) Equal path lengths are traversed in equal intervals.

1

Ans :(d)

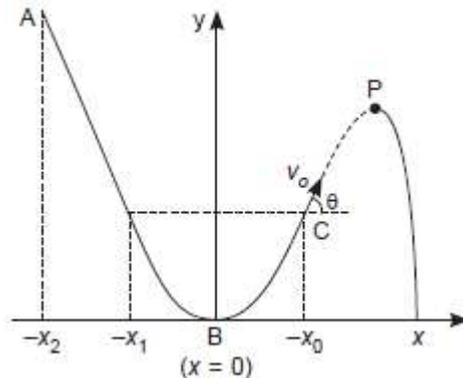
Ans : (a, b)

$$(a) \text{ As } \frac{h_1}{h_2} = \frac{v_0^2 \sin^2 \theta_1 / 2g}{v_0^2 \sin^2 \theta_2 / 2g} > 1 \quad \theta_1 > \theta_2$$

$$(b) \quad \frac{T_1}{T_2} = \frac{2v_0 \sin \theta_1 / g}{2v_0 \sin \theta_2 / g} \\ = \frac{\sin \theta_1}{\sin \theta_2} > 1, \text{ i.e. } T_1 > T_2 \text{ (as } \theta_1 > \theta_2 \text{)}$$

47 A particle slides down a frictionless parabolic ($y = x^2$) track (A \rightarrow B \rightarrow C) starting from rest at point A (Fig.). Point B is at the vertex of parabola and point C is at a height less than that of point A. After C, the particle moves freely in air as a projectile. If the particle reaches highest point at P, then

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- (a) KE at P = KE at B.
 (b) height at P = height at A.
 (c) total energy at P = total energy at A.
 (d) time of travel from A to B = time of travel from B to P.

Ans :

(c)

Since the parabolic track is frictionless, there is no loss of energy from A to B, B to C. Thus, total energy at P = total energy at A.

48 Following are four different relations about displacement, velocity and acceleration for the motion of a particle in general. Choose the incorrect one (s)

1

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$$(a) \quad \vec{v}_{av} = \frac{1}{2} [\vec{v}(t_1) + \vec{v}(t_2)]$$

$$(b) \quad \vec{v}_{av} = \frac{\vec{r}(t_2) - \vec{r}(t_1)}{t_2 - t_1}$$

$$(c) \quad \vec{r} = \frac{1}{2} [\vec{v}(t_2) + \vec{v}(t_1)] (t_2 - t_1)$$

$$(d) \quad \vec{a}_{av} = \frac{\vec{v}(t_2) - \vec{v}(t_1)}{t_2 - t_1}$$

(c)

Resolving displacement $30\sqrt{2}$ m south-west in two rectangular components:

we have $30\sqrt{2} \cos 45^\circ = 30\sqrt{2} \times \frac{1}{\sqrt{2}} = 30$ m towards south

and $30\sqrt{2} \times \sin 45^\circ = 30 \times \sqrt{2} \times 1/\sqrt{2} = 30$ m towards west.

The resultant of 30 m north will neutralise the displacement of 30 m south.

Hence, the effective displacement is the resultant of 30 m west and 20 m east = 10 m west.

- 52 During projectile motion the quantities that remain unchanged are 1
- (a) force and vertical velocity
 - (b) acceleration and horizontal velocity
 - (c) kinetic energy and acceleration
 - (d) acceleration and momentum.

Ans : (b)

- 53 A constant force is acting perpendicular to the velocity of a particle. For this situation which one is correct? 1
- (a) Velocity is constant.
 - (b) Acceleration is constant.
 - (c) Momentum will be constant.
 - (d) Particle will follow elliptical path.

Ans : (b)

When a constant force will be acting perpendicular to the velocity, the body will describe a circular path and its acceleration (called centripetal acceleration) will be constant.

- 54 The x -component of the resultant of several vectors 1
- (a) is equal to the sum of the x -components of the vectors.
 - (b) may be equal to the sum of the magnitudes of the vectors.
 - (c) may be smaller than the sum of the magnitude of the vectors.
 - (d) may be greater than the sum of the magnitude of the vectors.

Ans :(a, b, c)

The x -component of the resultant vector can never be greater than the sum of the magnitude of the vectors.

- 58 For two vectors \vec{A} and \vec{B} and $|\vec{A} + \vec{B}| = |\vec{A} - \vec{B}|$ when: 1
- (a) $|\vec{A}| = |\vec{B}| \neq 0$.
- (b) $\vec{A} \perp \vec{B}$.
- (c) $|\vec{A}| = |\vec{B}| \neq 0$ and \vec{A} and \vec{B} are parallel or antiparallel.
- (d) When either $|\vec{A}|$ or $|\vec{B}|$ is zero.

Ans : (b, d)

(b) As $|\vec{A} + \vec{B}| = |\vec{A} - \vec{B}|$
 $A^2 + B^2 + 2AB \cos \theta = A^2 + B^2 - 2AB \cos \theta$
 Where $\cos \theta = 0$, i.e. $\theta = 90^\circ$

which means $\vec{A} \perp \vec{B}$

(d) The equation $A^2 + B^2 + 2AB \cos \theta = A^2 + B^2 - 2AB \cos \theta$ is also true when either $|\vec{A}| = 0$ or $|\vec{B}| = 0$.

- 59 The necessary condition for a physical quantity to be a vector is that it must obey _____. 1

Ans : Law of vector addition

- 60 A vector which have zero magnitude and arbitrary direction is known as _____. 1

Ans : Null vector

- 61 Vectors which are mutually perpendicular are known as _____. 1

Ans : Orthogonal vectors

- 62 Magnitude of the vector product of two vectors is equal to area of the _____ formed by vectors as adjacent sides. 1

Ans : Parallelogram

- 63 Equation for time of flight of a projectile fired at an angle θ with the horizontal is _____. 1

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

- 64 Horizontal range of a projectile is same for angle of projection θ and _____. 1

- 73 If $\vec{C} = \vec{A} \times \vec{B}$, the direction of \vec{C} is 1
- (a) same as vector \vec{A}
- (b) same as vector \vec{B}
- (c) perpendicular to both \vec{A} and \vec{B} rotating forward from \vec{A} to \vec{B}
- (d) perpendicular to both \vec{A} and \vec{B} rotating forward from \vec{B} to \vec{A}

Ans :(c)

- 74 A body is thrown with a velocity of 10 ms^{-1} at an angle of 60° with the horizontal. Its velocity at the highest point is 1
- (a) zero
- (b) 5 m s^{-1}
- (c) 10 m s^{-1}
- (d) 8.66 m s^{-1}

Ans :

(b) At the highest point of the angular projection, the velocity of projectile has only horizontal component velocity = $u \cos \theta = 10 \cos 60^\circ = 5 \text{ ms}^{-1}$.

- 75 A projectile is hurled into air from a point on the horizontal ground at an angle with the vertical. 1
- If the air exerts a constant resistive force,
- (a) the path of projectile will be parabolic path.
- (b) the time of ascent will be equal to time of decent.
- (c) the total energy of the projectile is not conserved.
- (d) at the highest point, the velocity of projectile is horizontal.

Ans :(a, c, d)

- 76 For what angle of projection, will a projectile have the highest range? 1
- (a) 30°
- (b) 45°
- (c) 60°
- (d) 90°

Ans : (b) $R = \frac{v^2 \sin 2\theta}{g}$

$\sin 2\theta$ is maximum if $\theta = 45^\circ$.

- 77 What is the angular acceleration of a particle moving in a circle of radius 'r' with a angular speed 'ω'? 1

- (a) $r\omega$
- (b) $r\omega^2$
- (c) ω^2/r
- (d) zero

Ans :(d) Since ω is constant, angular acceleration will be zero.

78 For the following question, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. 1

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true but R is NOT the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false and R is also false.

Assertion: A body falling freely with the constant acceleration.

Reason: The body falls freely when the acceleration of the body is equal to acceleration due to gravity.

Ans :

- (a) Both A and R are true and R is the correct explanation of A.

When the body falls freely, the gravitation force is applied on the body in the vertically downward direction with the acceleration due to gravity.

79 For the following question, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. 1

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- (b) Both A and R are true but R is NOT the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false and R is also false.

Assertion: Uniform circular motion is accelerated motion.

Reason: In uniform circular motion velocity of the motion is not constant.

Ans :

- (a) Both A and R are true and R is the correct explanation of A.

The particle moving in the uniform circular motion has constant velocity (magnitude), but the direction changes.

80 For the following question, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. 1

- (a) Both A and R are true and R is the correct explanation of A.
 (b) Both A and R are true but R is NOT the correct explanation of A.
 (c) A is true but R is false.

(d) A is false and R is also false.

Assertion: Maximum horizontal range of the projectile motion obtained at 45° of angle of projection.

Reason: The projectile motion influenced by the acceleration due to gravity.

Ans :

- (b) Both A and R are true but R is NOT the correct explanation of A.

The horizontal range of projectile motion is given by,

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

if $\theta = 45^\circ$

then $R_{\max} = \frac{u^2}{g}$

The projectile motion is influenced by the gravity, but it is not the correct explanation for assertion.

81 For the following question, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. 1

- (a) Both A and R are true and R is the correct explanation of A.
 (b) Both A and R are true but R is NOT the correct explanation of A.
 (c) A is true but R is false.
 (d) A is false and R is also false.

Assertion: A scalar quantity is one that is conserved in a process.

Reason: Scalar quantity depends on the direction.

Ans :(d) A is false and R is also false.

Energy is a scalar quantity, but it not conserved for inelastic collision.

Scalar quantity does not depend on the direction.

82 For the following question, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. 1

- (a) Both A and R are true and R is the correct explanation of A.
 (b) Both A and R are true but R is NOT the correct explanation of A.
 (c) A is true but R is false.
 (d) A is false and R is also false.

Assertion: The rate of change of angular displacement in uniform circular motion is called angular velocity.

Reason: Angular acceleration is equal to the rate of change of angular velocity.

Ans :(b) Both A and R are true but R is NOT the correct explanation of A.

83 For the following question, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

1

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is NOT the correct explanation of A.

(c) A is true but R is false.

(d) A is false and R is also false.

Assertion: To cross a river in the shortest time, the boat should be rowed perpendicular to the river.

Reason: The river velocity causes the person to land at a point up the current.

Ans :(c) A is true but R is false.

84 For the following question, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

1

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is NOT the correct explanation of A.

(c) A is true but R is false.

(d) A is false and R is also false.

Assertion: Circular motion is an example of variable acceleration and not uniform acceleration.

Reason: The centripetal acceleration acts towards the centre of circular path at every point.

Ans : (a) Both A and R are true and R is the correct explanation of A.

85 For the following question, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

1

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is NOT the correct explanation of A.

(c) A is true but R is false.

(d) A is false and R is also false.

Assertion: When projectiles have same velocity of projection, the maximum heights at angle θ and $(90^\circ - \theta)$ are in ratio $\tan^2 \theta : 1$.

Reason: The range is same for angles of projection θ and $(90^\circ - \theta)$ for same velocity of projection.

Ans :(a) Both A and R are true and R is the correct explanation of A.