NEET UG (2024)
Physics
Quiz-3

SECTION - A

1. A train is moving towards east and a car is along north, both with same speed. The observed direction of car to the passenger in the train is
(1) East-north direction
(2) West-north direction
(3) South-east direction
(4) None of these

2. A boat is moving with velocity of $3\hat{i}+4\hat{j}$ in river and water is moving with a velocity of $-3\hat{i}-4\hat{j}$ with respect to ground. Relative velocity of boat with respect to water is:
(1) $-6\hat{i}-8\hat{j}$ (2) $6\hat{i}+8\hat{j}$
(3) $8\hat{i}$ (4) $6\hat{i}$

3. When a person walks on a straight road with a speed 10 km/h, rain appears to fall vertically downward. As he stops, the rain appears to fall at an angle 30° with the vertical. The speed of rain with respect to ground is
(1) 20 km/h (2) $10\sqrt{3}$ km/h
(3) 10 km/h (4) $20\sqrt{3}$ km/h

4. A person can swim in still water at 5 m/s. He moves in a river of velocity 3 m/s, first down the stream and next same distance up the stream. The ratio of times taken are
(1) 1 : 1 (2) 1 : 2
(3) 1 : 4 (4) 4 : 1

5. A ball is thrown upwards at an angle of 60° to the horizontal. It falls on the ground at a distance of 90 m. If the ball is thrown with the same initial velocity at an angle 30°, it will fall on the ground at a distance of
(1) 30 m (2) 60 m
(3) 90 m (4) 120 m

6. A person is walking in rain feels the velocity of rain as twice to his velocity. At which angle he should hold the umbrella with vertical if he moves forward, if it is raining vertically downwards
(1) 30° (2) 45°
(3) 60° (4) 90°

7. The angle of projection of a projectile which is projected with certain velocity from ground is $\frac{\pi}{8}$ with horizontal and its horizontal range is R. The angle with the horizontal for another projectile having same range R and speed is:
(1) $\frac{3\pi}{8}$ (2) $\frac{\pi}{4}$
(3) $\frac{\pi}{3}$ (4) $\frac{\pi}{6}$

8. A projectile is thrown at an angle 37° from the vertical. The angle of elevation of the highest point of the projectile from point of projection is:
(1) $\tan^{-1}\left(\frac{3}{2}\right)$ (2) $\tan^{-1}\left(\frac{2}{3}\right)$
(3) $\tan^{-1}\left(\frac{3}{8}\right)$ (4) $\tan^{-1}\left(\frac{8}{3}\right)$

9. A missile is fired for maximum range with an initial velocity of 20 m/s. If g = 10 m/s^2, the range of the missile is:
(1) 20 m (2) 40 m
(3) 50 m (4) 60 m

10. A particle is projected from horizontal plane (x-z) (where y-axis is along vertical) such that its velocity at time t is $\vec{v}=\alpha\hat{i}+(\beta-\gamma t)\hat{j}$. The horizontal range of the particle is:
(1) $\frac{\alpha\beta}{\gamma}$ (2) $\frac{2\alpha\beta}{\gamma}$
(3) $\frac{\alpha\beta}{2\gamma}$ (4) $\frac{3\alpha\beta}{2\gamma}$

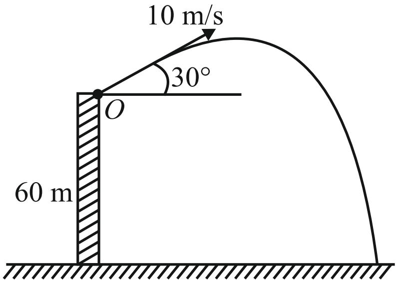
11. A projectile is thrown up with initial speed u making angle θ with the horizontal (θ > 45°). Time just after which it will be moving perpendicular to its initial direction of motion is:
(1) $\frac{u}{g\sin\theta}$ (2) $\frac{u\sin\theta}{g}$
(3) $\frac{u}{g\cos\theta}$ (4) $\frac{u\cos\theta}{g}$

12. If H_1 and H_2 be the greatest heights of a projectile in two paths for a given value of range, then the horizontal range of projectile is given by:
(1) $\frac{H_1+H_2}{2}$ (2) $\frac{H_1+H_2}{4}$
(3) $4\sqrt{H_1H_2}$ (4) $4[H_1+H_2]$

13. Four bodies P, Q, R and S are projected with equal velocities having angles of projection 15°, 30°, 45° and 60° with the horizontal respectively. The body having shortest range is
(1) P (2) Q
(3) R (4) S

14. A projectile is projected with speed u at an angle θ with the horizontal. The average velocity of the projectile between the instants it crosses the same level is:
(1) u cos θ (2) u sin θ
(3) u cot θ (4) u tan θ

15. A ball is projected from a point O as shown in figure. It will strike the ground after (g = 10 m/s^2)



(1) 4 s (2) 3 s
(3) 2 s (4) 5 s

16. A projectile thrown with a speed v at an angle θ has a range R on the surface of earth. For same v and θ, its range on the surface of moon will be

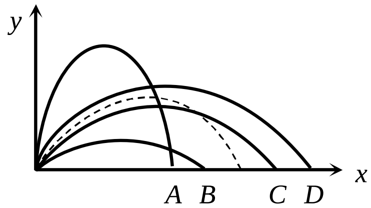
(1) $R/6$ (2) $6R$
(3) $R/36$ (4) $36R$

17. If the range of a gun which fires a shell with muzzle speed V is R, then the angle of elevation of the gun is

(1) $\cos^{-1}\left(\frac{V^2}{Rg}\right)$ (2) $\cos^{-1}\left(\frac{gR}{V^2}\right)$

(3) $\frac{1}{2}\sin^{-1}\left(\frac{V^2}{Rg}\right)$ (4) $\frac{1}{2}\sin^{-1}\left(\frac{gR}{V^2}\right)$

18. The path of a projectile in the absence of air drag is shown in the figure by dotted line. If the air resistance is not ignored then which one of the path shown in the figure is appropriate for the projectile



(1) B (2) A
(3) D (4) C

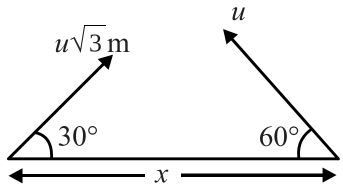
19. At what point of a projectile motion acceleration and velocity are perpendicular to each other

(1) At the point of projection
(2) At the point of drop
(3) At the topmost point
(4) Anywhere in between the point of projection and topmost point

20. The maximum horizontal range of a projectile is 400 m. The maximum value of height attained by it will be

(1) 100 m (2) 200 m
(3) 400 m (4) 800 m

21. Two particles are separated at a horizontal distance x as shown in figure. They are projected at the same time as shown in figure with different initial speeds. The time after which the horizontal distance between the particles become zero is:



(1) $x/2u$ (2) x/u
(3) $2u/x$ (4) u/x

22. A body dropped from top of a tower fall through 40 m during the last two seconds of its fall. The height of tower is: (g = 10m/s²)

(1) 60 m (2) 45 m
(3) 80 m (4) 50 m

23. The position x of a particle varies with time, (t) as $x = at^2 - bt^3$. The acceleration will be zero at time t is equal to :

(1) $a/3b$ (2) zero
(3) $2a/3b$ (4) a/b

24. From a balloon rising vertically upwards at 5 ms^{-1} stone is thrown up at 10 ms^{-1} relative to the balloon. Its velocity w.r.t. ground after 2s is (assume, g =10 ms^2):

(1) Zero (2) 5 ms^{-1}
(3) 10 ms^{-1} (4) 20 ms^{-1}

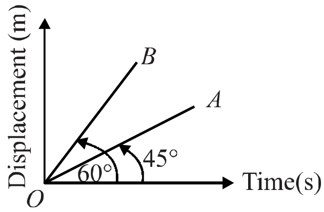
25. Position of particle moving along y-axis (in m) is given as $y = \frac{1}{5}t^5 + \frac{2}{3}t^3 + 12$, where t is in seconds. At What time velocity of particle becomes 24 m/s?

(1) 1 s (2) 2s
(3) 4s (4) 6s

26. A particle moves with constant acceleration along a straight line starting from rest. The percentage increase in its displacement during the 4th second compared to that in the 3rd second is :

(1) 33 % (2) 40 %
(3) 66 % (4) 77 %

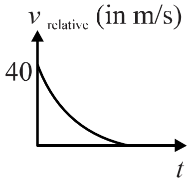
27. The displacement-time graphs for two bodies moving in a straight line are shown. What is the relative velocity of B with respect to A ?

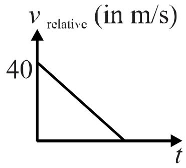


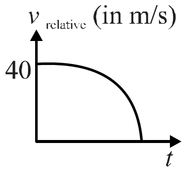
(1) $\left(\sqrt{3}-1\right)$m/s (2) $\left(\sqrt{3}+1\right)$m/s

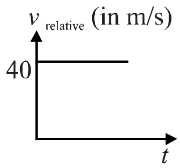
(3) $\left(\sqrt{3}\right)$m/s (4) 1 m/s

28. A ball is dropped from a building of height 45 m. Simultaneously another ball is thrown up with a speed 40 km/s. The relative speed of the balls as a function of time can be shown as:

(1) 

(2) 

(3) 

(4) 

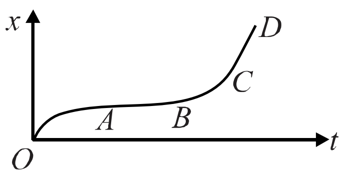
29. A body dropped from the top of a tower covers a distance $7x$ in the last second of its journey, where x is the distance covered in first second. How much time does it take to reach the ground ?

(1) 3 s (2) 4 s
(3) 5 s (4) 6 s

30. A body is released from the top of the tower H metre high. It takes t second to reach the ground. Where is the body after $t/2$ second of release ?

(1) At $3H/4$ metre from the ground
(2) At $H/2$ metre from the ground
(3) At $H/6$ metre from the ground
(4) At $H/4$ metre from the ground

31. The graph between the displacement x and time t for a particle moving in a straight line in shown in figure. During the interval OA, AB, BC and CD the acceleration of the particle is :

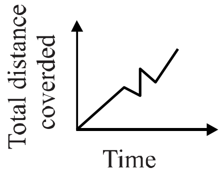


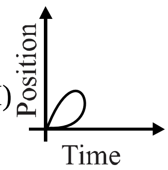
	OA	*AB*	*BC*	*CD*
(1)	+	0	+	+
(2)	–	0	+	0
(3)	+	0	–	+
(4)	–	0	–	0

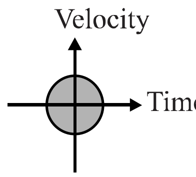
32. Position of the particle moving along y-axis is given as $y = (4 + 2t^3)$, where y is in meter and t is in seconds. What is ratio of its average velocity for $t = 0$ to $t = 2$ second interval with instantaneous velocity at $t = 2$ second?

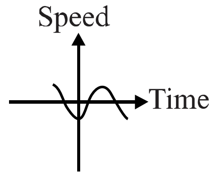
(1) 1 : 3 (2) 1 : 1
(3) 2 : 3 (4) 1 : 2

33. Which of the following graphs cannot possibly represent one-dimensional motion of a particle ?

(I) 

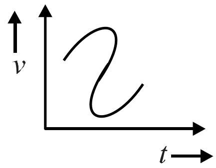
(II) 

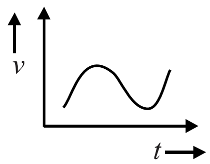
(III) 

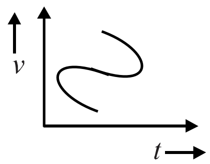
(IV) 

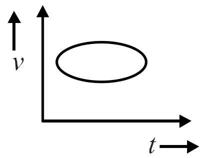
(1) I and II (2) II and III
(3) II and IV (4) All of these

34. Which of the following velocity-time graph shows a realistic situation for a body in motion ?

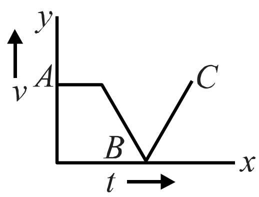
(1) 

(2) 

(3) 

(4) 

35. The velocity-time graph body is shown below. It explain that :



(1) at B force is zero
(2) at B there is a force but towards motion
(3) at B there is a force which opposes motion
(4) None of these

SECTION – B

36. A particle moving in straight line along x-axis has velocity related to x as $v = 16\sqrt{x}$, what is its acceleration ?

(1) 16 m/s^2 (2) 128 m/s^2
(3) 256 m/s^2 (4) 6.4 m/s^2

37. The distance x (in metre) travelled by a particle in time t (in second) moving along a straight line is given by $x = 4t - t^2$.How long would the particle travel before coming to rest ?

(1) 2 m (2) 3 m
(3) 4 m (4) 5 m

38. The velocity of train increases uniformly from 20 km/h to 60 km/h in 4 hours. The distance travelled by the train during this period is :

(1) 160 km (2) 180 km
(3) 100 km (4) 120 km

39. A bullet is dropped from the same height when another bullet is fired horizontally. They will hit the ground

(1) One after the other
(2) Simultaneously
(3) Depends on the observer
(4) None of the above

40. A bomb is dropped from an aeroplane moving horizontally at constant speed. When air resistance is taken into consideration, the bomb

(1) Falls to earth exactly below the aeroplane
(2) Fall to earth behind the aeroplane
(3) Falls to earth ahead of the aeroplane
(4) Flies with the aeroplane

41. An aeroplane moving horizontally with a speed of 720 km/h drops a food pocket, while flying at a height of 396.9 m. the time taken by a food pocket to reach the ground and its horizontal range is (Take g = 9.8 m/sec^2)

(1) 3 sec and 2000 m
(2) 5 sec and 500 m
(3) 8 sec and 1500 m
(4) 9 sec and 1800 m

42. Galileo writes that for angles of projection of a projectile at angles (45+θ) and (45–θ), the horizontal ranges described by the projectile are in the ratio of (if $\theta \le 45$)

(1) 2 : 1 (2) 1 : 2
(3) 1 : 1 (4) 2 : 3

43. The greatest height to which a man can throw a stone is h. The greatest distance to which he can throw it, will be

(1) $h/2$ (2) h
(3) $2h$ (4) $3h$

44. A bullet is fired from a cannon with velocity 500 m/s. If the angle of projection is 15° and g = 10 m/s^2. Then the range is

(1) 25×10^3 m (2) 12.5×10^3 m
(3) 50×10^2 m (4) 25×10^2 m

45. The equation of motion of a projectile are given by $x = 36\ t$ *metre* and $2y = 96\ t - 9.8\ t^2$ *metre.* The angle of projection is

(1) $\sin^{-1}\left(\frac{4}{5}\right)$ (2) $\sin^{-1}\left(\frac{3}{5}\right)$
(3) $\sin^{-1}\left(\frac{4}{3}\right)$ (4) $\sin^{-1}\left(\frac{3}{4}\right)$

46. Two bodies are thrown up at angles of 45° and 60°, respectively, with the horizontal. If both bodies attain same vertical height, then the ratio of velocities with which these are thrown is

(1) $\sqrt{\frac{2}{3}}$ (2) $\frac{2}{\sqrt{3}}$
(3) $\sqrt{\frac{3}{2}}$ (4) $\frac{\sqrt{3}}{2}$

47. A man standing on the roof of a house of height h throws one particle vertically downwards and another particle horizontally with the same velocity u. The ratio of their velocities when they reach the earth's surface will be

(1) $\sqrt{2gh+u^2} : u$
(2) 1 : 2
(3) 1 : 1
(4) $\sqrt{2gh+u^2} : \sqrt{2gh}$

48. A projectile projected at an angle 30° from the horizontal has a range R. If the angle of projection at the same initial velocity be 60°, then the range will be

(1) R (2) $2R$
(3) $R/2$ (4) R^2

49. A stone is projected from the ground with velocity 50 m/s at an angle of 30°. It crosses a wall after 3 sec. How far beyond the wall the stone will strike the ground $(g = 10\ \text{m/sec}^2)$

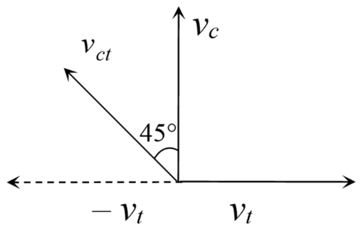
(1) 90.2 m
(2) 89.6 m
(3) 86.6 m
(4) 70.2 m

50. A particle is projected with a velocity v such that its range on the horizontal plane is twice the greatest height attained by it. The range of the projectile is (where g is acceleration due to gravity)

(1) $\frac{4v^2}{5g}$ (2) $\frac{4g}{5v^2}$
(3) $\frac{v^2}{g}$ (4) $\frac{4v^2}{\sqrt{5}g}$

Solution

1. (2)



$\overrightarrow{v_{ct}} = \overrightarrow{v_c} - \overrightarrow{v_t}$

$\overrightarrow{v_{ct}} = \overrightarrow{v_c} + (-\overrightarrow{v_t})$

Velocity of car *w.r.t.* train (v_{ct}) is towards West – North

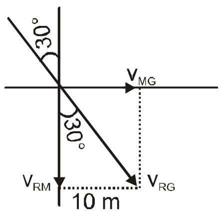
2. (2)

The relative velocity of boat *w.r.t.* water

$= v_{\text{boat}} - v_{\text{water}} = (3\hat{i} + 4\hat{j}) - (-3\hat{i} - 4\hat{j})$

$= 6\hat{i} + 8\hat{j}$

3. (1)



v_{mG} = velocity of man w.r.t. ground

v_{RG} = velocity of rain w.r.t. ground

v_{RM} = velocity of rain w.r.t. man

$\sin 30° = \dfrac{10}{v_{RG}} \Rightarrow V_{RG} = 20$ km/h

4. (3)

5. (3)

Range will be equal for complementary angles.

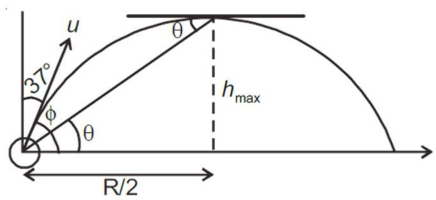
6. (1)

7. (1)

For $R_1 = R_2$, $\theta_1 + \theta_2 = \dfrac{\pi}{2}$

$\theta_2 = \dfrac{\pi}{2} - \theta_1 = \dfrac{\pi}{2} - \dfrac{\pi}{8} = \dfrac{3\pi}{8}$

8. (2)



$\tan\theta = \dfrac{h_{\max}}{R/2}$ $\tan\theta = \dfrac{\tan\phi}{2}$

$\tan\theta = \dfrac{\tan 53^\circ}{2}$ $\tan\theta = \dfrac{4/3}{2} = \dfrac{2}{3}$

$\theta = \tan^{-1}\left(\dfrac{2}{3}\right)$

9. (2)

For maximum range $\theta = 45^\circ$

$v = 20 \text{ ms}^{-1}$

$R = \dfrac{u^2}{g} = \dfrac{20 \times 20}{10} \left[\because \theta = 45^\circ\right]$

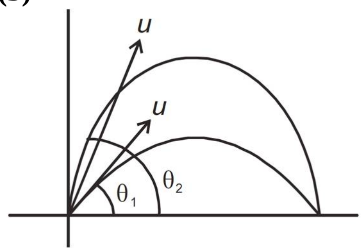
$R = 40$ m

10. (2)

$R = \dfrac{2u_x u_y}{g} = \dfrac{2\alpha\beta}{\gamma}$

11. (1)

12. (3)



$\theta_1 + \theta_2 = 90^\circ$

$H_1 = \dfrac{u^2 \sin^2 \omega_1}{2g}$

$H_2 = \dfrac{u^2 \sin\left(90^\circ - \theta_1\right)}{2g}$

$H_1 H_2 = \dfrac{R^2}{16}$

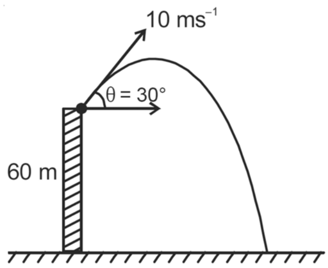
$R = 4\sqrt{H_1 H_2}$

13. (1)

When the angle of projection is very far from 45° then range will be minimum.

14. (1)

15. (1)



$s_y = u_x T + \dfrac{1}{2} a_y T^2$

$-60 = 10\sin 30^\circ \cdot T - \dfrac{1}{2} g T^2$

$-60 = 5T - 5T^2$

$T^2 - T - 12 = 0$

$T = 4$ s

16. **(2)**

Range is given by $R = \dfrac{u^2 \sin 2\theta}{g}$

On moon $g_m = \dfrac{g}{6}$.

Hence $R_m = 6R$

17. **(4)**

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

$$\Rightarrow \theta = \frac{1}{2}\sin^{-1}\left(\frac{gR}{V^2}\right)$$

18. **(1)**

If air resistance is taken into consideration then range and maximum height, both will decrease.

19. **(3)**

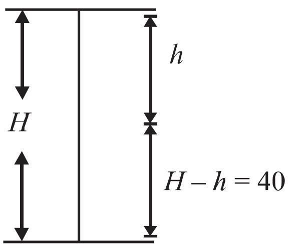
20. **(1)**

$$R_{\max} = \frac{u^2}{g} = 400\,\text{m} \qquad (\text{For } \theta = 45°)$$

$$H_{\max} = \frac{u^2}{2g} = \frac{400}{4} = 100\,\text{m} \qquad (\text{For } \theta = 90°)$$

21. **(1)**

22. **(2)**



$$H = \frac{1}{2}gt^2 \text{ ...(i)}$$

$$h = \frac{1}{2}g(t-2)^2 \text{ ... (ii)}$$

$$\frac{1}{2}gt^2 - \frac{1}{2}g(t-2)^2 = 40$$

$t = 3$ sec.

then

$$H = \frac{1}{2} \times 10 \times 3^2 = 45\,\text{m}$$

23. **(1)**

$$x = at^2 - bt^3$$

$$\frac{dx}{dt} = 2at - 3bt^2$$

$$v = 2at - 3bt^2$$

$$\frac{dv}{dt} = 2a - 6bt$$

acceleration = $(2a - 6bt) = 0$

$2a - 6bt = 0$

$$t = \frac{2a}{6b} \qquad \boxed{t = \frac{a}{3b}}$$

24. **(2)**

$u = 10 + 5 = 15$ m/s

$v = u + at$

$v = 15 - 10 \times 2$

$= -5$ m/s

25. **(2)**

$$y = \frac{1}{5}t^5 + \frac{2}{3}t^3 + 12$$

$$\frac{dy}{dt} = \frac{1}{5} \times 5t^4 + \frac{2}{3} \times 3t^2 + 0$$

$v = t^4 + 2t^2$

$\because$ v = 24 m/s

$24 = t^4 + 2t^2$

$t^4 + 2t^2 - 24 = 0$

Let $t^2 = y$

then $y^2 + 2y - 24 = 0$

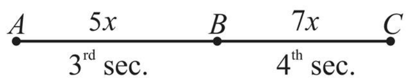
$y = 4$

or

$t^2 = 4$

$t = 2$sec.

26. **(2)**



Percentage increases in its displacement

$$= \frac{7x - 5x}{5x} \times 100\% = 40\%$$

27. **(1)**

$\tan\theta = V$

$V_A = \tan 45° = 1$

$V_B = \tan 60° = \sqrt{3}$

$V_{AB} = V_A - V_B = (1 - \sqrt{3})$

OR

$V_{BA} = \sqrt{3} - 1$

28. **(4)**

Under gravity $\boxed{a_{rel} = 0} \Rightarrow \boxed{V_{rel} = \text{const.}}$

uniform relative motion.

29. **(2)**

$$S = u + \frac{a}{2}(2n - 1)$$

$7x = \frac{1}{2} \times 10(2n-1)$ ....(i)

and $x = \frac{1}{2} \times 10 \times 1^2 = 5$

from equation (i)

$7 \times 5 = 5(2n - 1)$

$7 = 2n - 1$

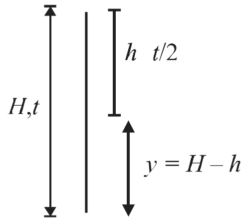
$2n = 8$

$n = 4$

30. **(1)**

$H = \frac{1}{2} 2t^2$ ..... (i)

and $h = \frac{1}{2} g(t/2)^2$



$\boxed{h = \frac{H}{4}}$

then , $y = H - h = H - \frac{H}{4} = \frac{3H}{4} m$

31. **(2)**

$\tan\theta = v$

OA ÷ *v* decreases in positive direction or, particle is retarding i.e., a is –ve

AB ÷ *v* = constant, a = 0

BC ÷ *v* increases with positive direction so, a is positive.

CD ÷ *v* = constant, *a* = 0

32. **(1)**

$t = 0$

$y = 4$

$t = 2$

$y = 20$ m

$\bar{V}_{avg} = \frac{\Delta\bar{y}}{\Delta t} = \frac{\bar{y}_2 - y_1}{\Delta t}$

$= \frac{20-4}{2}$

$\boxed{V_{avg} = 8 \text{m/s}}$

$V_{inst} = \frac{dy}{dt} = 6t^2$

at $t = 2$

$\boxed{V_{inst.} = 24 \text{m/s}}$

$V_{avg.} : V_{inst}$

= 8 : 24

= 1 : 3

33. **(4)**

Speed and distance never be negative.

In practice, the body cannot have multiple postion and velocity at the same time.

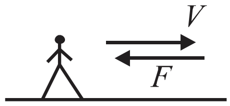
34. **(2)**

In practice, the body cannot have multiple velocity vector at the same time.

35. **(3)**

v decrease in positive dir.

Hence $\bar{F}$ or $\bar{a} = -ve$



36. **(2)**

Given, $V = 16\sqrt{x}$

Acceleration $= V\frac{dV}{dx}$

$= 16\sqrt{x}\frac{d}{dx}16\sqrt{x} = 16 \times 16\sqrt{x}\frac{d}{dx}x^{1/2}$

$= 16 \times 16\sqrt{x} \times \frac{1}{2}x^{-1/2} = 8 \times 16$

$= 128$ m/s^2

37. **(3)**

$x = 4t - t^2$

$\frac{dx}{dt} = 4 - 2t$

$v = 4 - 2t$

for turning time $v = 0$

$0 = 4 - 2t$

$\boxed{t = 2\text{sec}}$

Then

$x = 4 \times 2 - 2^2 = 4$m

38. **(1)**

$v = u + at$	$v^2 = u^2 + 2as$
$60 = 20 + a \times 4$	$60^2 = 20^2 + 2 \times 10 \times s$
$a = 10$ km/h^2	$s = 160$ km

39. **(2)**

Because the vertical components of velocities of both the bullets are same and equal to zero and $t = \sqrt{\frac{2h}{g}}$.

40. **(2)**

Due to air resistance, it's horizontal velocity will decrease so it will fall behind the aeroplane.

41. **(4)**

$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 396.9}{9.8}} \simeq 9$sec and

$u = 720$ km/hr $= 200$ m/s

$\therefore R = u \times t = 200 \times 9 = 1800$ m

42. **(3)**

For angle $(45° - \theta)$,

$R = \frac{u^2 \sin(90° - 2\theta)}{g} = \frac{u^2 \cos 2\theta}{g}$

For angle $(45° + \theta)$,

$R = \frac{u^2 \sin(90° + 2\theta)}{g} = \frac{u^2 \cos 2\theta}{g}$

43. **(3)**

For greatest height $\theta = 90°$

$$H_{max} = \frac{u^2 \sin^2(90°)}{2g} = \frac{u^2}{2g} = h \text{ (given)}$$

$$R_{max} = \frac{u^2 \sin^2 2(45°)}{g} = \frac{u^2}{g} = 2h$$

44. **(2)**

$$R = \frac{u^2 \sin 2\theta}{g} = \frac{(500)^2 \times \sin 30°}{10} = 12.5 \times 10^3 \text{ m}$$

45. **(1)**

$$x = 36t \therefore v_x = \frac{dx}{dt} = 36 \text{ m/s}$$

$$y = 48t - 4.9t^2 \therefore v_y = 48 - 9.8t$$

at $t = 0$ $v_x = 36$ and $v_y = 48$ m/s

So, angle of projection

$$\theta = \tan^{-1}\left(\frac{v_y}{v_x}\right) = \tan^{-1}\left(\frac{4}{3}\right)$$

Or $\theta = \sin^{-1}(4/5)$

46. **(3)**

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

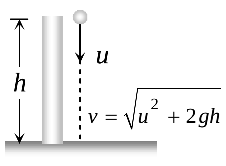
According to problem

$$\frac{u_1^2 \sin^2 45°}{2g} = \frac{u_2^2 \sin^2 60°}{2g}$$

$$\Rightarrow \frac{u_1^2}{u_2^2} = \frac{\sin^2 60°}{\sin^2 45°} \Rightarrow \frac{u_1}{u_2} = \frac{\sqrt{3}/2}{1/\sqrt{2}} = \sqrt{\frac{3}{2}}.$$

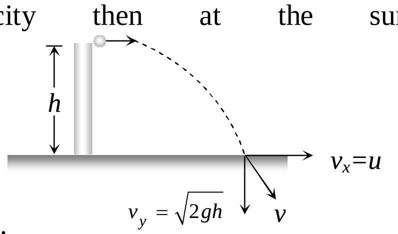
47. **(3)**

When particle thrown in vertical downward direction with velocity u then final velocity at the ground level



$$v^2 = u^2 + 2gh \therefore v = \sqrt{u^2 + 2gh}$$

Another particle is thrown horizontally with same velocity then at the surface of



earth.

Horizontal component of velocity $v_x = u$

$\therefore$ Resultant velocity, $v = \sqrt{u^2 + 2gh}$

For both the particle final velocities when they reach the earth's surface are equal.

48. **(1)**

For complementary angles of projection horizontal range is same.

49. **(3)**

Total time of flight $= \frac{2u \sin\theta}{g} = \frac{2 \times 50 \times 1}{2 \times 10} = 5\text{s}$

Time to cross the wall = 3 sec (given)

Time in air after crossing the wall

= (5 – 3) = 2 sec

$\therefore$ Distance travelled beyond the wall $= (u \cos\theta)t$

$$= 50 \times \frac{\sqrt{3}}{2} \times 2 = 86.6 \text{ m}$$

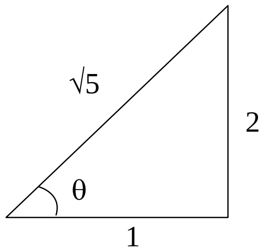
50. **(1)**

$R = 2H$ given

We know $R = 4H \cot\theta \Rightarrow \cot\theta = \frac{1}{2}$

From triangle we can say that $\sin\theta = \frac{2}{\sqrt{5}}$,

$$\cos\theta = \frac{1}{\sqrt{5}}$$



$\therefore$ Range of projectile $R = \frac{2v^2 \sin\theta \cos\theta}{g}$

$$= \frac{2v^2}{g} \times \frac{2}{\sqrt{5}} \times \frac{1}{\sqrt{5}} = \frac{4v^2}{5g}.$$