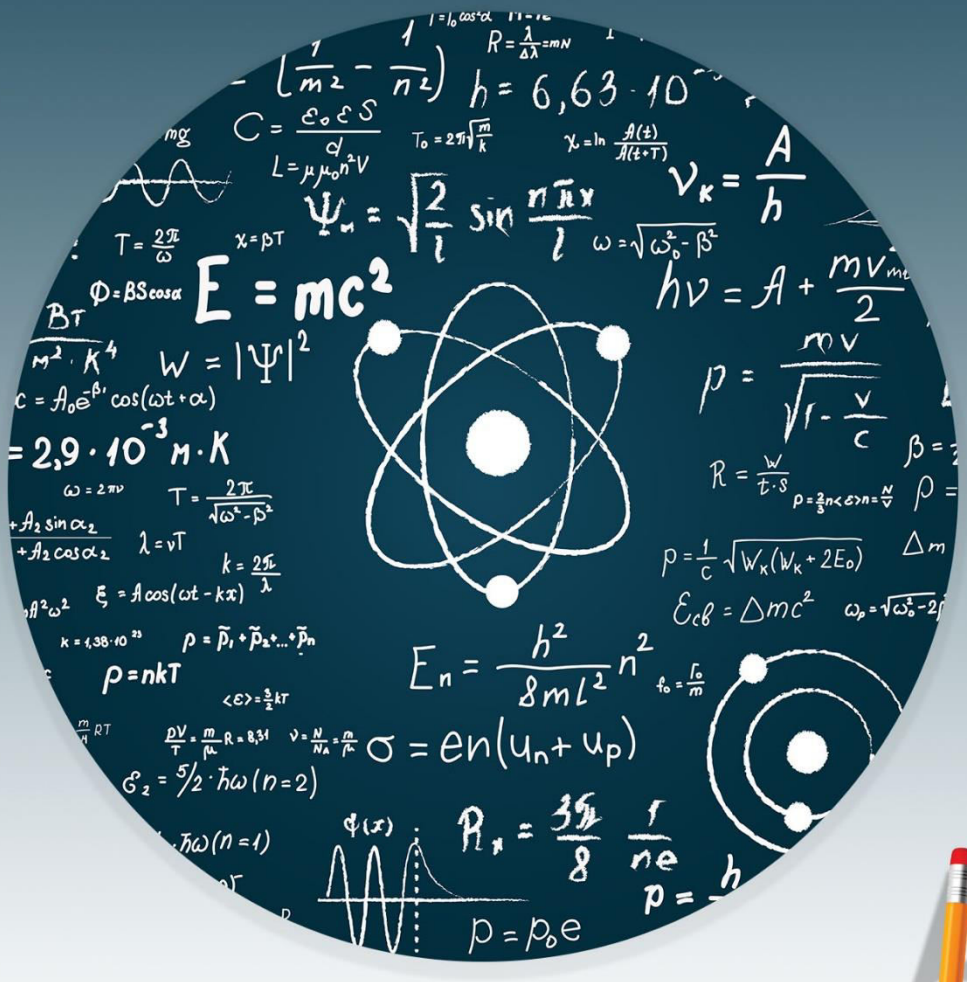
PHYSICS



WORKSHEET-12

STEP

A PROJECT BY PUNJAB GROUP

Worksheet-12

Topics:- Displacement, Velocity, Acceleration, Velocity-time Graph, Equations of Motion, Laws of Motion, Momentum and Conservation of Momentum, Impulse, Projectile Motion, Elastic & Inelastic Collisions

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Q.1 Pull of earth on a mass of 20 kg at surface of earth is:

A) 196 N C) 20 N

B) 1960 N D) 19.6 N

Q.2 Time rate of change of momentum is equal to:

A) Force C) Velocity

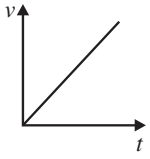
B) Impulse D) Force constant

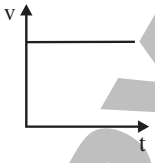
Q.3 Distance covered by a freely falling body in 2 seconds will be:

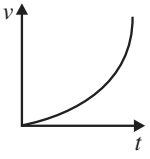
A) 4.9 m C) 39.2 m

B) 19.6 m D) 9.8 m

Q.4 For which of the following graph/graphs, both velocity and acceleration are constant:

A) 

C) 

B) 

D) None of these

Q.5 1st law of motion gives definition of:

A) Mass C) Force

B) Inertia D) Momentum

Q.6 One Newton is the force:

A) Of gravity on $\frac{1}{g} kg$ body

B) Of gravity on a 1 g body

C) That gives a 1 kg body an acceleration of 1 m s^{-2}

D) Both "A" and "C"

Q.7 A 7.0 kg ball experiences a net force of 7.0 N what will be its acceleration?

A) 10 m s^{-2} C) 1 m s^{-2}

B) 5.0 m s^{-2} D) 35.0 m s^{-2}

Q.8 **A force 2F acting on a particle of mass 10 kg produces an acceleration of 60 m s^{-2}. A force 5F acting on a particle of mass M produces an acceleration of 50 m s^{-2}. What is the mass M?**

A) 3.3 kg C) 21 kg

B) 4.8 kg D) 30 kg

Q.9 **The Newton's 2nd law:**

A) Defines force C) Balances force

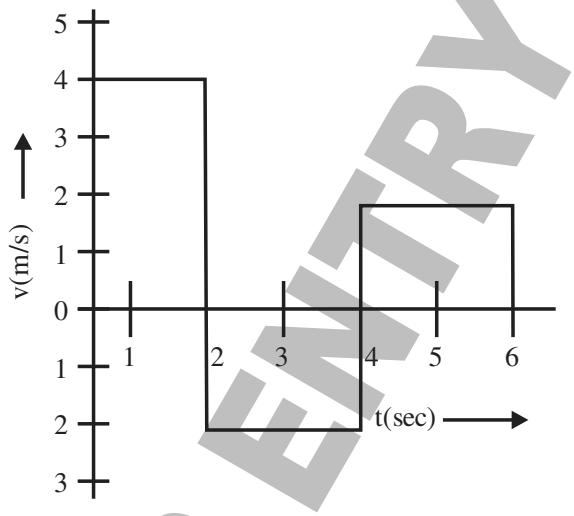
B) Measures force D) All of these

Q.10 **A ball of mass m_1 and another ball of m_2 are dropped from equal heights. If m_1 is twice as compared to m_2, then time taken by the balls t_1 and t_2 are related as:**

A) $t_1 = \frac{t_2}{2}$ C) $t_1 = 4t_2$

B) $t_1 = t_2$ D) $t_1 = \frac{t_2}{4}$

Q.11 **The velocity-time graph of a body moving in a straight line is shown in the figure. The displacement and distance travelled by the body in 6 sec, are respectively.**



A) 8 m , 16 m C) 16 m , 8 m

B) 16 m , 16 m D) 8 m, 8 m

Q.12 **A steel ball covers half the distance with velocity v_i and the other half with velocity v_f in the same straight line. The average velocity of ball is:**

A) $\frac{v_i + v_f}{2}$ C) $\frac{v_i v_f}{v_i + v_f}$

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B) $v_i + v_f$ D) $\frac{2v_i v_f}{v_i + v_f}$

Q.13 A 60 m long train is moving in a direction with speed 20 m s^{-1}. Another train moving with 30 m s^{-1} in the opposite direction and 40 m long crosses the first train in:

A) 5 s C) 2 s

B) 6 s D) 4 s

Q.14 A car covers 2/3 distance with 60 m s^{-1} and 1/3 distance with 20 m s^{-1}. Average speed is:

A) 36 m s^{-1} C) 66 m s^{-1}

B) 46 m s^{-1} D) 56 m s^{-1}

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Q.15 A person standing on a horizontal floor feels two forces: The downward pull of gravity and the upward supporting force from the floor. These two forces:

A) Have equal magnitude and form an action/reaction pair

B) Have equal magnitude but do not form an action/reaction pair

C) Have unequal magnitudes

D) Are equal forces

Q.16 An object with a constant speed:

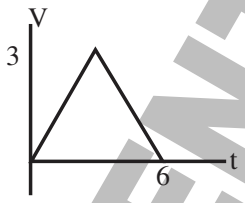
A) Is not accelerated

B) Might be accelerated

C) Is always accelerated

D) Also has a constant velocity

Q.17 In the figure, distance covered is:



A) 9 units C) 3 units

B) 6 units D) 18 units

Q.18 The ratio of distance to magnitude of displacement when a body covers a semicircle is:

A) $\frac{\pi}{2}$ C) $\frac{1}{\pi}$

B) πR D) $\frac{\pi}{4}$

Q.19 Distance travelled by a body falling freely starting from rest in the 1st, 2nd and 3rd seconds are in the ratio:

A) 1:4:9 C) 1:2:3

B) 1:3:5 D) 1:2:5

Q.20 Throwing a package onto shore from a boat that was previously at rest causes the boat to move outward from shore, is explained by:

A) Newton's 1st law of motion

B) Newton's 2nd law of motion

C) Newton's 3rd law of motion

D) Conservation of momentum

Q.21 A body is released from a height of 5 m. If friction is ignored then its velocity just before striking the ground will be ($g = 10\ m\ s^{-2}$):

A) 5 m s^{-1} C) 15 m s^{-1}

B) 10 m s^{-1} D) 20 m s^{-1}

Q.22 If momentum is increased by 20% then K.E. increases by:

A) 44% C) 66%

B) 55% D) 77%

Q.23 A boy throws a ball with velocity 10 m s^{-1} in vertically upward direction. If $g = 10\ m\ s^{-2}$, the ball rises to a height

A) 2 m C) 10 m

B) 5 m D) 25 m

Q.24 Two bodies of different masses m_1 and m_2 are dropped from two different heights h_1 and h_2. The ratio of times taken by the two bodies through these distances is:

A) $h_1 : h_2$ C) $\sqrt{h_1} : \sqrt{h_2}$

B) $\frac{m_1}{m_2} : \frac{h_2}{h_1}$ D) $h_1^2 : h_2^2$

Q.25 The distance traveled by a body dropped from the top of a tower is proportional to:

A) Mass of the body

B) Height of the tower

C) Weight of the body

D) Square of the time elapses

Q.26 An object is released from a height h above the ground reaches the ground in 8 s. The time taken by the object to cover the first half distance is:

A) $2\sqrt{2}$ s C) $4\sqrt{2}$ s

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B) $\frac{4}{\sqrt{52}}$ s D) $8\sqrt{2}$ s

Q.27 If a body starts from a point and returns back to the same point then its:

A) Average speed is zero but not average velocity

B) Average speed and velocity depend on the path

C) Both average speed and velocity are zero

D) Average velocity is zero but not average speed

Q.28 Which pair contains one scalar & one vector:

A) Acceleration, force C) Force, K.E

B) Momentum, velocity D) Work, P.E

Q.29 All statements are correct about third law of motion except:

A) Forces have equal magnitude

B) Both forces have opposite direction

C) Both forces are applied on different bodies

D) Both are applied on same body maintaining equilibrium

Q.30 If R is the maximum horizontal distance of projectile then the greatest height attained by projectile in this condition is:

A) R C) 2R

B) $\frac{R}{2}$ D) $\frac{R}{4}$

Q.31 During projectile motion if H = R then angle of projection with horizontal is

A) Tan^{-1} (4) C) $Tan^{-1}\left(\frac{1}{4}\right)$

B) $Tan^{-1}\left(\sqrt{4}\right)$ D) $Tan^{-1}\left(\frac{1}{\sqrt{4}}\right)$

Q.32 Range of projectile is R when angle of projection is 60^o, then the value of other angle of projection for same range is:

A) 40^o C) 50^o

B) 30^o D) 20^o

Q.33 A person can throw a stone to maximum range of 100 m. The greatest height with same conditions to which he can make the stone to rise is:

A) 50 m C) 100 m

B) 150 m D) 25 m

Q.34 During projectile motion the quantities that remain

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constant are:

A) Acceleration, v_x C) Force, velocity

B) Acceleration, K.E D) Acceleration, Momentum

Q.35 The path of projectile is:

A) Hyperbola C) Parabola

B) Straight line D) Ellipse

Q.36 Motion of projectile is _____ dimensional.

A) One C) Two

B) Three D) Four

Q.37 Four projectiles are launched at angles 20°, 30°, 40° and 50° respectively. Which of these projectiles will have maximum range?

A) Projectile launched at 20°

B) Projectile launched at 50°

C) Projectile launched at 30°

D) Both projectiles launched at 40° and 50°

Q.38 Which component of the velocity of projectile remains constant throughout the motion?

A) v_x C) a_x

B) v_y D) a_y

Q.39 Which of the following factors in a projectile motion remains same?

A) v_x C) a_x

B) a_y D) All of these

Q.40 At which angle when a projectile is launched R=H?

A) 45° C) 76°

B) 30° D) 60°

Q.41 At which angle when a projectile is launched $H = \frac{R}{4}$?

A) 45° C) 76°

B) 30° D) 60°

Q.42 The angle between velocity of projectile and acceleration at the highest point becomes:

A) 90° C) 0°

B) 180° D) 76°

Q.43 A person moving in a car at a constant velocity throws an apple vertically upwards. If we ignore air friction and suppose car to move with same velocity then according to an observer standing outside.

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A) Apple will follow a parabolic path and will fall again in car

B) Apple will follow a parabolic path but will fall behind car

C) Apple will follow a linear path and will fall again in car

D) Apple will follow a parabolic path but will fall before car

Q.44 Two balls are thrown at angles of θ and (90°-θ) with the horizontal with same speed. Ratio of their time of flights is:

A) $\tan^2\theta : 1$ C) $\tan\theta : 1$

B) $1 : \tan\theta$ D) 1:1

Q.45 A bomber drops its bomb when it is vertically above the target, it misses the target due to (falls ahead):

A) Air resistance

B) Horizontal component of velocity

C) Vertical component of velocity

D) Gravity

Q.46 The maximum height of projectile has the largest value for which of the following angles of projection?

A) 0° C) 30°

B) 60° D) 75°

Q.47 A body drops a coin from the window of a moving train. The path of coin according to a stationary observer inside the train will be:

A) Vertical straight line C) Parabolic

B) Elliptical D) Circular

Q.48 A ball whose K.E is E, is projected at an angle of 45° with vertical then, its K.E at maximum height is

A) E C) $\frac{E}{2}$

B) $\frac{E}{\sqrt{2}}$ D) 2E

Q.49 In a competition, fielders are required to throw the cricket hard ball as far as possible. Under ideal conditions, the optimum throwing angle is 45°. What should this angle, with respect to ground, be in (i) Strong winds against the direction of throw; and (ii) Strong winds in the direction of throw?

A) (i) more than 45°, (ii) less than 45°

B) (i) less than 45°, (ii) more than 45°

C) 45° in both cases

D) Depends on throwing speed

Q.50 Which of the following is decreasing acceleration graph?

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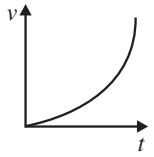
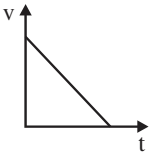
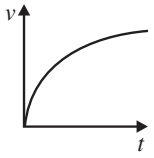
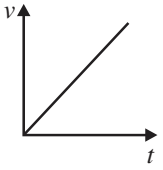
A) 

C) 

B) 

D) 

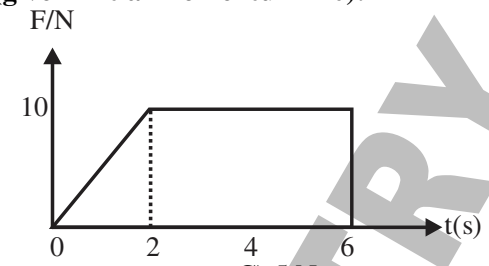
Q.51 A collision in which K.E of system remains constant is called:

A) Elastic Collision
B) Inelastic Collision
C) Partially elastic Collision
D) Any of these

Q.52 In the head on elastic collision of a heavy vehicle moving with a velocity of 20 m s^{-1} and a small stone at rest, the stone will fly away with a velocity equal to

A) 5 m s^{-1}
B) 10 m s^{-1}
C) 20 m s^{-1}
D) 40 m s^{-1}

Q.53 A body of mass 3 kg is acted upon by a force which varies as shown in the graph below. The momentum acquired during 6 s is given by (given initial momentum = 0):



A) Zero
B) 30 N s
C) 5 N s
D) 50 N s

ANSWER KEY (Worksheet-12)											
1	A	11	A	21	B	31	A	41	A	51	A
2	A	12	D	22	A	32	B	42	A	52	D
3	B	13	C	23	B	33	D	43	A	53	D
4	C	14	A	24	C	34	A	44	C		
5	C	15	B	25	D	35	C	45	B		
6	D	16	B	26	C	36	C	46	D		
7	C	17	A	27	D	37	D	47	A		
8	D	18	A	28	C	38	A	48	C		
9	B	19	B	29	D	39	D	49	C		
10	B	20	C	30	D	40	C	50	B		

SOLUTIONS

Unit – 2 (W-12)

Q.1 Answer is "A"

Solution:- $w = mg$

Q.2 Answer is "A"

Solution:- $F = \frac{\Delta p}{\Delta t}$

Q.3 Answer is "B"

Solution:- $S = \frac{1}{2}gt^2$

Q.4 Answer is "C"

Solution:-

- For option A, acceleration is constant but velocity is increasing uniformly.
- For option B, both velocity and acceleration are increasing.
- For option C, velocity is constant, so acceleration is zero which is also a constant.

Q.5 Answer is "C"

Solution:- First law of motion defines force while 2nd law of motion measures force.

Q.6 Answer is "D"

Solution:-

- One newton force in terms of g (gravitational acceleration)

$F = mg = 1\ \text{N}$

$m = \frac{1}{g}\ kg$

- One newton force by 2nd law of motion

$F = ma$ if $m = 1\ \text{kg}$ and $a = 1\ m\ s^{-2}$ then $F = 1\ \text{N}$

Q.7 Answer is "C"

Solution:- F = ma

Q.8 Answer is "D"

Solution:- $\frac{F_1}{F_2} = \frac{M_1 a_1}{M_2 a_2}$

Q.9 Answer is "B"

Solution:- First law of motion defines force while 2nd law of motion measures force.

Q.10 Answer is "B"

Solution:- All objects (massive or light) reach on earth with same acceleration "g" when dropped from same heights. Their free fall time is given as:

$t = \sqrt{\frac{2S}{g}}$

So $t_1 = t_2$

Q.11 Answer is "A"

Solution:- Both distance and displacement given as:

Distance= $(4\times2)+(2\times(4-2))+(2\times(6-4))$

Displacement = $(4\times2)+(-2\times(4-2))+(2\times(6-4))$

Q.12 Answer is "D"

Solution:-

$$v_{avg} = \frac{\text{total distance}}{\text{total time}}$$

$$\Rightarrow \quad v_{avg} = \frac{d_1 + d_2}{t_1 + t_2}$$

$$\Rightarrow \quad v_{avg} = \frac{\frac{d}{2}+\frac{d}{2}}{\frac{\frac{d}{2}}{v_i}+\frac{\frac{d}{2}}{v_f}}$$

Simplify it $\Rightarrow \; v_{avg} = \frac{2v_i v_f}{v_i + v_f}$

Q.13 Answer is "C"

Solution:- $t = \frac{\text{Total distance}}{\text{relative speed}}$

$$\Rightarrow \quad t = \frac{60+40}{30+20}$$

Q.14 Answer is "A"

Solution:- $v_{avg} = \frac{d_1 + d_2}{\frac{d_1}{v_1}+\frac{d_2}{v_2}}$

Q.15 Answer is "B"

Solution:- Since both of these forces act on one body, so these cannot make action-reaction pair as according to Newton's 3rd law of motion action reaction never act on same body.

Q.16 Answer is "B"

Solution:- An object moving with constant speed may or may not be accelerated.

Case-I

When object is moving with constant speed in same direction its acceleration is zero.

Case-II

When object is moving with constant speed on a circular path, its direction changes which results in centripetal acceleration which is not zero.

Q.17 Answer is "A"

Solution:- Simply find area under curve

Q.18 Answer is "A"

Solution:- $\frac{S}{d} = \frac{\pi R}{2R}$

Q.19 Answer is "B"

Solution:- Distance covered in n^{th} second is:

$$S = \frac{g}{2}(2n-1)$$

Q.20 Answer is "C"

Solution:- This is well according to Newton's 3rd law, the action force acts on package towards shore while the reaction force acts away from shore on boat.

Q.21 Answer is "B"

Solution:- $v = \sqrt{2gh}$

Q.22 Answer is "A"

Solution:- Use relation $P = \sqrt{2mE}$

Q.23 Answer is "B"

Solution:- Use 3rd equation of motion

Q.24 Answer is "C"

Solution:- $S = \frac{1}{2}gt^2$

Q.25 Answer is "D"

Solution:- $y = \frac{1}{2}gt^2$

Q.26 Answer is "C"

Solution:-

i. $S = \frac{1}{2}gt^2$

$$S = \frac{1}{2}\times 10 \times 8^2$$

$$S = 320 \text{ m}$$

ii. $\frac{S}{2} = 160 \text{ m}; t_x = ?$

$$\left(\frac{S}{2}\right)=\frac{1}{2}gt_x^2$$

Solve it

$$t_x=4\sqrt{2}\ \text{sec}$$

Q.27 Answer is "D"

Solution:- In a closed path distance ≠ zero but displacement = 0

Q.28 Answer is "C"

Solution:-

A) Acceleration and force both are vectors.

B) Momentum and velocity both are vectors.

C) Force is vector while K.E is scalar.

D) Work and P.E both are scalars.

Q.29 Answer is "D"

Solution:- In action reaction forces;

- Both forces have equal magnitudes but opposite directions.
- Both forces are applied on different bodies.
- As both forces acts on different bodies, so these cannot maintain equilibrium.

Q.30 Answer is "D"

Solution:- When $\theta=45°$, $R=max$ then

$$H=\frac{R}{4}$$

Q.31 Answer is "A"

Solution:- For a projectile;

If R=nH then

$$\theta=\tan^{-1}\left(\frac{4}{n}\right)=\tan^{-1}\left(\frac{4}{1}\right)=76°$$

For given question

$$R=1H\Rightarrow\theta=\tan^{-1}\left(\frac{4}{1}\right)$$

Q.32 Answer is "B"

Solution:- If sum of two angles is 90°, the ranges at those angles are equal if projected with same speed.

Q.33 Answer is "D"

Solution:- The maximum range and height are related as;

$$R=\frac{v_i^2}{g}\sin 2\theta\ ;\qquad h=\frac{v_i^2\sin 2\theta}{2g}$$

As range is maximum at $\theta=45°$, so;

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

$$R_{max}=\frac{v_i^2}{g}\ ;\quad h=\frac{v_i^2}{4g}$$

$$h=\frac{R_{max}}{4}$$

Just remember this formula. This formula says at maximum range height is four times less than maximum range.

Q.34 Answer is "A"

Solution:- As friction is ignored so $v_x=constant$ also $a_x=0=constant$

And $a_y = g = constant$

Q.35 Answer is "C"

Solution:- Usually we consider ideal case in which air friction is ignored, so path of projectile is parabola.

Q.36 Answer is "C"

Solution:- Projectile motion is a two dimensional motion under constant acceleration due to gravity.

Q.37 Answer is "D"

Solution:- The range of projectile is maximum at 45°. But among given option 45° is not present, so range among given options will be maximum at that angle which is closest to 45° (no matter whether

it is closer with value less than 45° or greater than 45°). As 40° and 50° are equally closest to 45°, so range will be maximum at these angles.

Q.38 Answer is "A"

Solution:- As air friction is ignored in projectile motion, so no force acts along horizontal direction, hence horizontal component of velocity remains constant and horizontal component of acceleration remains zero. i.e

$$v_x = \text{constant} \;;\quad a_x = \frac{\Delta v_x}{\Delta t} = 0$$

Q.39 Answer is "D"

Solution:- $v_x = \text{constant}$,

$a_x = 0 = \text{constant}$, $a_y = g = \text{constant}$

Q.40 Answer is "C"

Solution:- For a projectile;

If R=nH then $\theta = \tan^{-1}\left(\frac{4}{n}\right)$

For given question

$$R = 1\text{H} \Rightarrow \theta = \tan^{-1}\left(\frac{4}{n}\right) = \tan^{-1}(4) = 76°$$

Q.41 Answer is "A"

Solution:- If R = nH

then $\theta = tan^{-1}\left(\frac{4}{n}\right)$

Q.42 Answer is "A"

Solution:- At highest point $v_y = 0$ so $v = v_x$ is $\perp_r'$ to a=g

Q.43 Answer is "A"

Solution:- Car will provide it horizontal component and person a vertical so combination makes a parabolic path.

Q.44 Answer is "C"

Solution:-

$$\frac{t_1}{t_2} = \frac{\left(\frac{2v_i sin\theta}{g}\right)}{\left(\frac{2v_i \sin(90-\theta)}{g}\right)} = \frac{\sin\theta}{\sin(90-\theta)}$$

$$\frac{t_1}{t_2} = \frac{\sin\theta}{\cos\theta} = \tan\theta$$

Q.45 Answer is "B"

Solution:-

Because of horizontal component of velocity, the bomb undergoes projectile motion rather than vertically downward motion so it misses the target.

Q.46 Answer is "D"

Solution:- Height of projectile is given as;

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

It is maximum at 90°, among given options 90° is not present, so height will be maximum at that angle which is closer to 90°.

Q.47 Answer is "A"

Solution:- The path will be projectile for an observer standing outside the train, while for an observer within the train the path will be straight line.

Q.48 Answer is "C"

Solution:-

Use relation; $K.E_H = K.E_i \times cos^2\theta$

For $P.E_H = K.E_i \times sin^2\theta$

Q.49 Answer is "C"

Solution:- Range can only be maximum at θ=45°.

Q.50 Answer is "B"

Solution:- The slope of velocity time graph gives acceleration. As the slope of v-t graph decreases to zero in option-B, so acceleration will also be decreasing in this case, while in option "C" the slope is negative but it is constant.

Q.51 Answer is "A"

Solution:- A Collision in which K.E of system remains constant is called elastic collision.

Q.52 Answer is "D"

Solution:- When a massive body collides with a light body then after collision velocity of light body is twice the initial velocity of massive body.

Q.53 Answer is "A"

Solution:-

Area of F-t graph = change in momentum

Area of F-t graph = $\frac{1}{2}(2)(10)+(6-2)(10)=50$ N s

STEP

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