**G11 - PHYSICS - WEEKEND TEST – 1**

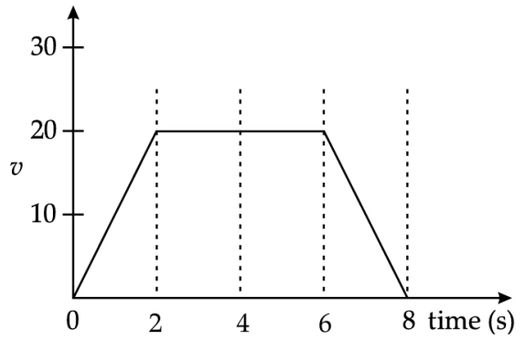
**Section – A**

1. A body starts from rest and travels with an acceleration of 5 m/s². After t seconds its velocity is 10 m/s. Then t is
   a) 10 s b) 15 s c) 20 s d) None of the above
2. Which quantity of a projectile remains unchanged?
   a) Momentum c) Vertical component of velocity
   b) Kinetic energy d) Horizontal component of velocity
3. When a body is dropped from a tower, then there is an increase in its
   a) Weight c) Velocity
   b) Acceleration d) gravitational potential energy

   *Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as.*
   *(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 true*
4. Assertion (A): Area under velocity time graph gives the acceleration.
   Reason (R): The position time graph of an object moving with constant acceleration is a straight line parallel to time axis.
5. Assertion (A): A projected is projected at an angle θ and then at an angle 90° – θ, keeping the velocity same. In both the cases, the range will be same.
   Reason (R): Range of a projectile = R = $\frac{u^2 sin\theta}{g}$
6. Assertion (A): $\lim_{\Delta t \to 0} \frac{\Delta v}{\Delta t}$
   Reason (R): Acceleration is described as the rate of change of velocity with distance.

**Section – B**

7. The velocity time graph for a particle is shown in figure. Draw acceleration time graph from it.




8. A jet plane starts from rest with an acceleration of 3 m/s and makes a run for 35 s before taking off. What is the minimum length of the runaway and what is the velocity of the jet at takeoff?
9. Two forces of 5N and 7N act on a particle with an angle 60˚ between them. Find the resultant force.
10. Prove that the vectors $\vec{A} = \hat{\imath} + 2\hat{\jmath} + 3\hat{k}$ and $\vec{B} = 2\hat{\imath} - \hat{\jmath}$ are perpendicular to each other.

**Section – C**

11. Draw (a) acceleration - time (b) velocity - time (c) position - time graphs representing motion of an object under free fall. Neglect air resistance.
12. A ball thrown from a roof top at an angle of 45° above the horizontal. It hits the ground a few seconds later. At what point during motion, does the ball have (a) greatest speed. (b) smallest speed. (c) greatest acceleration
13. A ball thrown up is caught by the thrower after 4s. How high did it go and with what velocity was it thrown? How far was it below the highest point 3 s after it was thrown?
14. A) A particle has a displacement of 12 m towards east and 5 m towards the north and then 6 m vertically upward. Find the magnitude of the sum of these displacements.

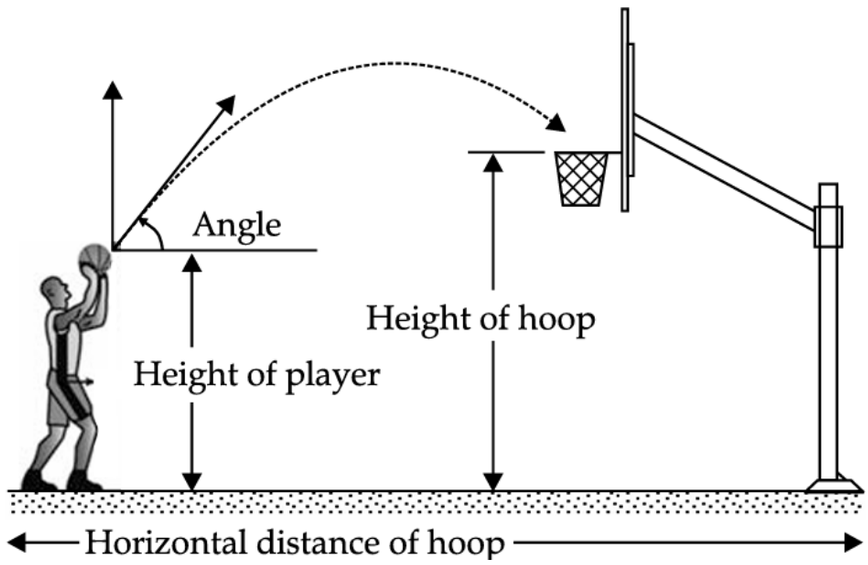
    **(OR)**

    B) A particle has displacement equation
    (i) $x_A = 2t + 7$ (ii) $x_B = 3t^2 + 2t + 6$ (iii) $x_B = 5t^3 + 4t$
    Which of them has uniform acceleration?

**Section – D**

15. Case Based Questions

Using the laws of physics, it is possible to make a successful jump shot in basketball every time. The trajectory of a basketball is always a parabola. It is projectile when it is launched up into the air, and this is due to the effects of gravity as well as the force put on the ball by the player that properly follows the properties of a projectile.




The velocity of the ball changes as it moves through the air, but the velocity of the first half of the path matches with the last half of the path. It may deviate from its path if the ball collides with either the backboard or another player interfering with its path. From the information of the height of the player, the horizontal distance and height of the hoop, the player can easily calculate the speed to be imparted to the ball and the angle for a sure success. If player's height is 1.27 meters standing at a distance of 2 meters from the hoop which is at a height of 3.05 meters, he needs an angle of 55° and velocity of the ball 7 m/s to be imparted to make his shot a success. (If he uses a smaller angle he has to shoot with a greater velocity.) If he stands 6 meters distance from the hoop, he needs an angle 60° and a velocity 9.5 m/s to be successful.

To improve chances of an accurate shot, often a player includes a backspin on the ball as he launches it for a shot. The backspin ensures that the ball enters the hoop, especially if the shot is a "soft shot." Soft shot is when the ball is shot at a low angle and low velocity, the player adds a backspin because if the ball winds up hitting the rim, the spin will help it to enter the hoop. The backspin changes the velocity direction (once it hits the rim) to the opposite direction of the rim rather than bouncing it out.

**Q1.** The trajectory of a basketball is always a

a) Straight line
b) Circle
c) Parabola
d) May be a circle, may be a parabola

**Q2.** When the basketball deviates from its parabolic path?

a) If the ball collides with the backboard
b) If the ball collide with another player interfering with its path
c) If a backspin is applied to the ball
d) Both (A) and (B)

**Q3.** To calculate the speed to be imparted to the ball and the angle for an accurate shot the required information are

a) Height of the player
b) Horizontal distance of the hoop
c) Height of the hoop
d) All of the above

**Q4.** If the horizontal distance of the hoop from a player increases

a) Velocity and angle both should increase
b) Velocity and angle both should decrease
c) Velocity should increase but angle should decrease
d) Velocity should decrease but angle should increase

**Section – E**

16. A player throws a ball upwards with an initial speed of 29.4 m/s.

(a) What is the direction of acceleration during the upward motion of the ball?

(b) What are the velocity and acceleration of the ball at the highest point of its motion?

(c) Choose the x = 0 m and t = 0 s to be the location and time of the ball at its highest point, vertically downward direction to be the positive direction of x-axis, and give the signs of position, velocity and acceleration of the ball during its upward and downward motion.

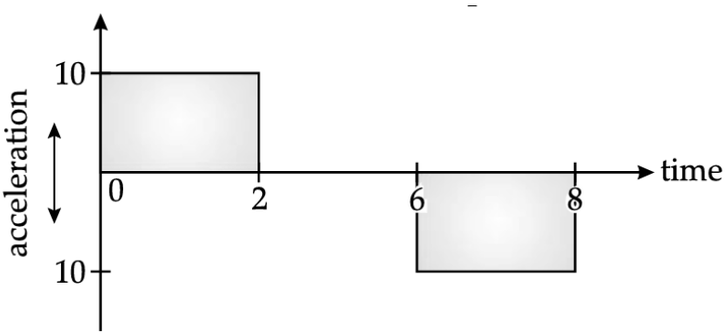
(d) To what height does the ball rise and after how long does the ball return to the player's hands? (Take $g = 9.8\ ms^{-2}$ and neglect air resistance.)

17. A hill is 500 m high. Supplies are to be sent across the hill using a cannon that can hurl packets at a speed of 125 m/s over the hill. The cannon is located at a distance of 800 m from the foot of hill and can be moved on the ground at a speed of 2 m/s; so that its distance from the hill can be adjusted. What is the shortest time in which a packet can reach on the ground across the hill? Take $g=10 m/s^2$.

**ANSWER KEY**

1. D) None of the above
2. D) Horizontal component of velocity
3. C) Velocity
4. (D) A is false and R is true
5. (C) A is true but R is false
6. (C) A is true but R is false

7.




8. s=0+(1/2)*3*35² = 1837.5 m
   Velocity of the jet, v=0+3*35 = 105 m/s
9. Solution. Here $P = 5$ N, $Q = 7$ N, $\theta = 60°$

   The magnitude of the resultant force is

$$R = \sqrt{P^2 + Q^2 + 2PQ\cos\theta}$$

$$= \sqrt{5^2 + 7^2 + 2 \times 5 \times 7 \times \cos 60°}$$

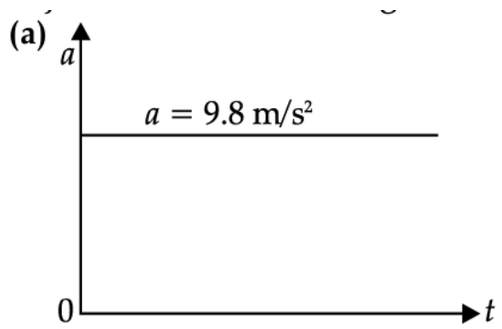
$$= \sqrt{109} = 10.44 \text{ N}.$$

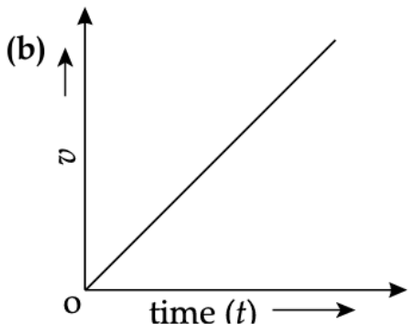
10. **Solution.** $\vec{A} \cdot \vec{B} = (\hat{i} + 2\hat{j} + 3\hat{k}) \cdot (2\hat{i} - \hat{j} + 0\hat{k})$

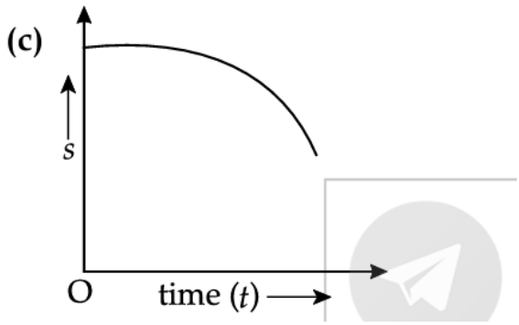
$$= 1 \times 2 + 2 \times (-1) + 3 \times 0 = 0$$

*Hence* $\vec{A} \perp \vec{B}$.

11.






12. (a) It has greatest speed just before it hits the ground. (b) It has smallest speed at the highest point reached. (c) Acceleration is always constant throughout the journey and is vertically downward equal to g.

13. v= u + gt

0=u-9.8*2 u=19.6 m/s

S=ut + (1/2)(-9.8*$2^2$) = 19.6 m

Distance = 0+(1/2)*9.8*$1^2$ = 4.9 m

14.

Fig. 4.22

According to polygon law, $\vec{OC}$ is the resultant displacement. From right $\Delta OAB$,

$$OB = \sqrt{OA^2 + AB^2} = \sqrt{12^2 + 5^2}$$

$$= \sqrt{144 + 25} = 13 \text{ m}$$

From right $\Delta OBC$,

$$OC = \sqrt{OB^2 + BC^2} = \sqrt{13^2 + 6^2}$$

$$= \sqrt{169 + 36} = \sqrt{205} = \mathbf{14.32\ m}.$$

**OR**

**Ans. (i)** $v = \frac{dx_A}{dt} = 2$

and $a = \frac{d^2x_A}{dt^2} = 0$

As per this eqn. the particle has no acceleration at all. **1**

**(ii)** $v = \frac{dx_B}{dt}$

$= 3 \times 2t + 2 + 0$

$= 6t + 2$

$a = \frac{d^2x_B}{dt^2} = 6$

Here, acceleration is uniform. **1**

**(iii)** $v = \frac{dx_C}{dt}$

$= 5 \times 3t^2 + 4$

$= 15t^2 + 4$

$a = \frac{d^2x_C}{dt^2}$

$= 15 \times 2t = 30t$

Here, acceleration depend upon time so it is not uniform. **1**

**15**. Q1. C) Parabola

Q2. D) Both (A) and (B)

Q3. D) All of the above

Q4. (A) Velocity and angle both should increase

**16.** (a) As the ball is moving under the effect of gravity, the direction of acceleration due to gravity remains vertically downwards.

(b) If the ball is at the highest point of its motion, its velocity becomes zero and the acceleration is equal to the acceleration due to gravity = 9.8 ms–2 in vertically downward direction.
(c) The highest point is chosen as the location for x = 0 and t = 0 and vertically downward direction to be the positive direction of x-axis.
For upward motion, sign of position is positive, sign of velocity is negative and the sign of acceleration is positive, i.e., v < 0, a > 0.
For downward motion, sign of position is positive, sign of velocity is positive and the sign of acceleration is also positive, i.e., v > 0, a > 0.
(d) Suppose, t = time taken by the ball to reach the highest point. H = height of the highest point from the ground. During vertically upward motion of the ball, \ Initial velocity,

Final velocity $v = 0, h = H = ?, t = ?$

Applying the relation,

$$v^2 = u^2 - 2gh$$
$$v^2 - u^2 = -2gh$$
$$0^2 - (29.4)^2 = -2 \times 9.8\, H$$

or $$H = \frac{29.4 \times 29.4}{2 \times 9.8} = 44.1 \text{ m}$$

During upward motion,

$$v = u - g\,t$$
$$0 = 29.4 + 9.8 \times t$$

$\therefore$ $$t = \frac{29.4}{9.8} = 3 \text{ s}.$$

i.e., time of ascent $= 3$ s.

It is also known that when the object moves under the effect of gravity alone, the time of ascent is always equal to the time of descent.
Total time after which the ball returns to the player's hand = 2t = 2 × 3 = 6 s.

**17.**

Given: Speed of packets= 125 m/s

Height of hill = 500m

$d = 800$ m

To cross the hill in shortest time the vertical velocity should be such that it just crosses the height of hill.

The minimum vertical velocity required for crossing the hill is given by

$$v_\perp^2 \geq 2gh = 10{,}000$$
$$v_\perp > 100 \text{ m/s}$$

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As cannon can haul packets with a speed of 125m/s, so the maximum value of horizontal velocity, $v_{\perp}$ will be

$$v_{\perp} = \sqrt{125^2 - 100^2} = 75\,\text{m/s}$$

The time taken to reach the top of the hill with velocity $v_{\perp}$ is given by

$$\frac{1}{2}gT^2 = h$$

putting values, T = 10 s

In 10 s the horizontal distance covered 10 × 75 = 750 m.

So, cannon has to be moved through a distance of 50 m on the ground.

So, total time taken (shortest) by the packet to reach ground across the hill = 50/2 s+ 10s+ 10s= 45s.