

# Physics Mock Test 2

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## ➤ Instructions:

- Total Questions: 40
- Category I: 30 questions × 1 mark (-0.25 negative marking)
- Category II: 5 questions × 2 marks (-0.5 negative marking)
- Category III: 5 questions × 2 marks (no negative marking)
- Time Allowed: 1 hour
- Answer all questions.

## ➤ CATEGORY I

**Q1: Two bodies of same mass are projected with the same velocity at an angle 30° and 60° respectively. The ratio of their horizontal ranges will be:**

- A) 1:1
- B) 1:2
- C) 1:3
- D) 2 :  $\sqrt{2}$

**Q2: The equation for the trajectory of a projectile is  $y=(x/\sqrt{3}-x^2/60)$  m. The velocity of projection of the projectile is (Acceleration due to gravity =10 ms<sup>-2</sup>):**

- A) 8 m/s
- B) 40 m/s
- C) 16 m/s
- D) 20 m/s

**Q3: A body is projected vertically upwards at time t=0 and it is seen at a height H at time t<sub>1</sub> and t<sub>2</sub> second during its flight. The maximum height attained is (g is acceleration due to gravity):**

- A)  $\frac{g(t_2-t_1)^2}{8}$
- B)  $\frac{g(t_1+t_2)^2}{4}$
- C)  $\frac{g(t_1+t_2)^2}{8}$
- D)  $\frac{g(t_2-t_1)^2}{4}$

**Q4: An object moves in a straight line with deceleration whose magnitude varies with velocity as  $3v^2/3$ . If at an initial point, the velocity is 8 m/s then the distance travelled by the object before it stops is:**

- A) 2 m
- B) 4 m
- C) 6 m
- D) 8 m

**Q5: A particle is projected at  $60^\circ$  to the horizontal with a kinetic energy K. The kinetic energy at the highest point is:**

- A) K
- B) 0
- C)  $K/4$
- D)  $K/2$

**Q6: A man standing on a road has to hold his umbrella at  $30^\circ$  with the vertical to keep the rain away. He throws the umbrella and starts running at 10 km/h. He finds that raindrops are hitting his head vertically. The actual speed of raindrops is:**

- A) 20 km/h
- B)  $10\sqrt{3}$  km/h
- C)  $20\sqrt{3}$  km/h
- D) 10 km/h

**Q7: The horizontal range and the maximum height of a projectile are equal. The angle of projection of the projectile is:**

- A)  $\theta = \tan^{-1}(1/4)$
- B)  $\theta = \tan^{-1}(4)$
- C)  $\theta = \tan^{-1}(2)$
- D)  $\theta = 45^\circ$

**Q8: A ball is thrown with a speed  $u$ , at an angle  $\theta$  with the horizontal. At the highest point of its motion, the strength of gravity is somehow doubled. Taking this change into account, the total time of flight of the projectile is:**

- A)  $\frac{2u \sin \theta}{g}$
- B)  $\frac{3u \sin \theta}{2g}$
- C)  $\frac{3u \sin \theta}{4g}$
- D)  $\frac{(\sqrt{2}+1)u \sin \theta}{\sqrt{2}g}$

**Q9:** From the top of a tower, 80m high from the ground, a stone is thrown in the horizontal direction with a velocity of  $8\text{ms}^{-1}$ . The stone reaches the ground after a time  $t$  and falls at a distance of  $d$  from the foot of the tower. Assuming  $g=10\text{ m/s}^2$ , the time  $t$  and distance  $d$  are given respectively by:

- A) 6s, 64m
- B) 6s, 48m
- C) 4s, 32m
- D) 4s, 16m

**Q10:** A projectile is fired from the surface of the earth with a velocity of  $5\text{ m s}^{-1}$  and angle  $\theta$  with the horizontal. Another projectile fired from another planet with a velocity of  $3\text{ m s}^{-1}$  at the same angle follows a trajectory which is identical with the trajectory of the projectile fired from the earth. The value of the acceleration due to gravity on the planet is: (given  $g=9.8\text{ m s}^{-2}$ ):

- A) 3.5
- B) 5.9
- C) 16.3
- D) 110.8

**Q11:** The position  $x$  of a particle varies with time ( $t$ ) as  $x=At^2-Bt^3$ . The acceleration at time  $t$  of the particle will be equal to zero. What is the value of  $t$ :

- A)  $2A/3B$
- B)  $A/B$
- C)  $A/3B$
- D) 0

**Q12:** A particle is moving in a straight line with initial velocity and uniform acceleration  $a$ . If the sum of the distance travelled in  $t^{\text{th}}$  and  $(t+1)^{\text{th}}$  seconds is 100 cm, then its velocity after  $t$  seconds, in cm/s, is:

- A) 80
- B) 50
- C) 20
- D) 30

**Q13:** A particle starts moving rectilinearly at time  $t=0$  such that its velocity  $v$  changes with time  $t$  according to the equation  $v=t^2-t$  where  $t$  is in seconds and  $v$  is in m/s. Find the time interval for which the particle retards:

- A)  $\frac{1}{2} < t < 1$
- B)  $\frac{1}{2} > t > 1$
- C)  $\frac{1}{4} < t < 1$
- D)  $1/2$

**Q14:** If a ball is thrown vertically upwards with speed  $u$ , the distance covered by it during the last  $t$  second of its ascent is ( $g$ =acceleration due to gravity):

- A)  $ut$
- B)  $(u+gt)t$
- C)  $ut - \frac{1}{2}gt^2$
- D)  $\frac{1}{2}gt^2$

**Q15:** A body covers first 31 part of its journey with a velocity of  $2 \text{ m s}^{-1}$ , next 31 part with a velocity of  $3 \text{ m s}^{-1}$  and the rest of the journey with a velocity  $6 \text{ m s}^{-1}$ . The average velocity of the body will be:

- A)  $\frac{1}{3} \text{ m/s}$
- B)  $\frac{11}{3} \text{ m/s}$
- C)  $\frac{8}{3} \text{ m/s}$
- D)  $\frac{4}{3} \text{ m/s}$

**Q16:** A particle moving along X-axis has acceleration  $f$ , at time  $t$  given by  $f=f_0(1-t/T)$ , where  $f_0$  and  $T$  are constants. The particle at  $t=0$  and the instant when  $f=0$ , the particle's velocity  $v_x$  is:

- A)  $f_0T$
- B)  $\frac{1}{2} f_0T^2$
- C)  $f_0T^2$
- D)  $\frac{1}{2} f_0T$

**Q17:** The horizontal range of a projectile is  $4\sqrt{3}$  times its maximum height. The angle of projection will be:

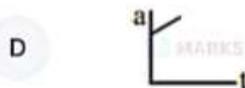
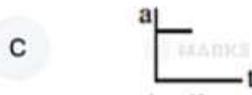
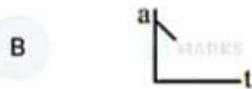
- A)  $60^\circ$
- B)  $37^\circ$
- C)  $30^\circ$
- D)  $45^\circ$

**Q18: Assertion (A):** In javelin throw, the athlete throws the projectile at an angle slightly more than  $45^\circ$ .

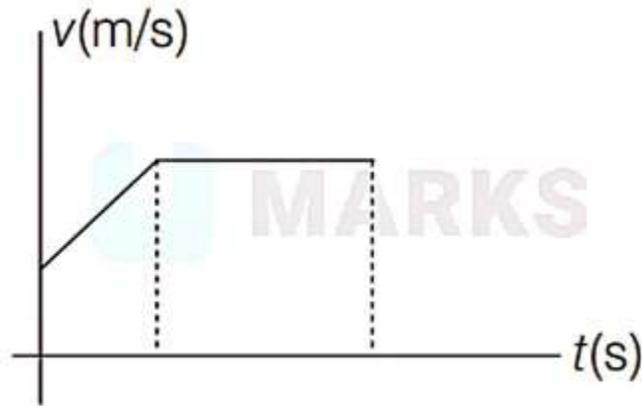
**Reason (R):** The maximum range does not depend upon angle of projection:

- A) If both assertion and reason are true and reason is the correct explanation of assertion
- B) If both assertion and reason are true but reason is not the correct explanation of assertion
- C) If assertion is true but reason is false
- D) If both assertion and reason are false

**Q19: A body moves with uniform acceleration, then which of the following graph is correct:**



**Q20: For a body moving along a straight line, the following v–t graph is obtained.**



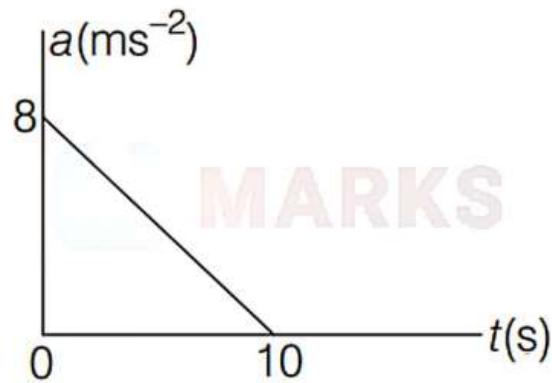
**According to the graph, the displacement during:**

- A) uniform acceleration is greater than that during uniform motion
- B) uniform acceleration is less than that during uniform motion
- C) uniform acceleration is equal to that during uniform motion
- D) uniform motion is zero

**Q21: A car is travelling at a velocity  $10 \text{ km h}^{-1}$  on a straight road. The driver of the car throws a parcel with a velocity  $10\sqrt{2} \text{ km h}^{-1}$  with respect to the car, when the car is passing by a man standing on the side of the road. If the parcel is to reach the man, the direction of throw makes the following angle with the direction of motion of the car:**

- A)  $135^\circ$
- B)  $45^\circ$
- C)  $\tan^{-1}(\sqrt{2})$
- D)  $\tan^{-1}(1/\sqrt{2})$

**Q22:** A particle starts from rest. Its acceleration  $a$  versus time  $t$  is shown in the figure. The maximum speed of the particle will be.



- A) 80 m/s
- B) 40 m/s
- C) 18 m/s
- D) 2 m/s

**Q23:** A car moving at a speed  $V$  is stopped in a certain distance when the breaks produce a deceleration ' $a$ '. If the speed of the car is ' $nV$ ', what must be the deceleration of the car to stop it in the same distance and in the same time:

- A)  $\sqrt{n} \cdot a$
- B)  $n \cdot a$
- C)  $n^2 \cdot a$
- D)  $n^3 \cdot a$

**Q24:** A bullet is fired with a velocity  $u$  making an angle of  $60^\circ$  with the horizontal plane. The horizontal component of the velocity of the bullet when it reaches the maximum height is:

- A)  $u$
- B)  $0$
- C)  $\sqrt{3} u / 2$
- D)  $u/2$

**Q25: A particle is moving along X-axis with velocity  $v=e^{-\beta x}$ . At time  $t=0$ , the particle is located at  $x=0$ . The displacement of the particle as function of time is:**

- A)  $e^{-\beta t}$
- B)  $\frac{1}{\beta}e^{(1-\beta t)}$
- C)  $\frac{1}{\beta}\log[1-\beta t]$
- D)  $\frac{1}{\beta}\log[1+\beta t]$

**Q26: An arrow is projected into air. Its time of flight is 5 s and range 200 m. What is the maximum height reached by it? (Take  $g=10 \text{ m s}^{-2}$ ):**

- A) 31.25 m
- B) 24.5 m
- C) 18.25 m
- D) 46.75 m

**Q27: A stone is thrown at 25 m/s at  $53^\circ$  above the horizontal. At what time its velocity is at  $45^\circ$  below the horizontal:**

- A) 0.5 s
- B) 4 s
- C) 3.5 s
- D) 2.5 s

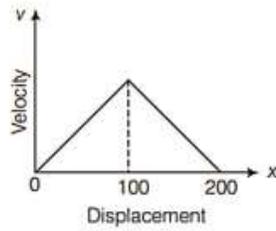
**Q28: A ball is dropped from the top of a building 100 m high. At the same instant another ball is thrown upwards with a velocity of 40 m/s from the bottom of the building. The two balls will meet after:**

- A) 3 s
- B) 2 s
- C) 2.5 s
- D) 5 s

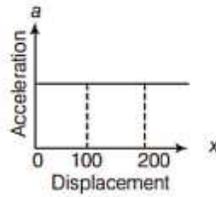
**Q29: Two stones having different masses  $m_1$  and  $m_2$  are projected at angles  $\theta$  and  $(90^\circ - \theta)$  with same velocity from the same point. The ratio of their maximum heights is:**

- A)  $\tan \theta : 1$
- B)  $1 : \tan \theta$
- C)  $\tan^2 \theta : 1$
- D)  $1 : 1$

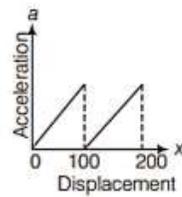
**Q30: Velocity ( $v$ ) versus displacement ( $x$ ) plot of a body moving along a straight line is as shown in the graph. The corresponding plot of acceleration ( $a$ ) as a function of displacement ( $x$ ) is:**



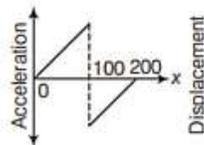
A



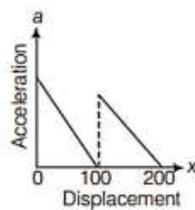
B



C



D



➤ **CATEGORY II**

**Q1: A police party is moving in a jeep at a constant speed  $v$ . They saw a thief at a distance  $x$  on a motorcycle which is at rest. The moment the police saw the thief, the thief started at constant acceleration  $a$ . Which of the following relations is true if the police is able to catch the thief:**

- A)  $v^2 < ax$
- B)  $v^2 < 2ax$
- C)  $v^2 \geq 2ax$
- D)  $v^2 = ax$

**Q2: Taking X-axis along horizontal and Y-axis along vertical, with what minimum speed must a particle be projected from the origin so that it is able to pass through a given point (30 m, 40 m)? Take  $g = 10 \text{ m s}^{-2}$ :**

- A) 60 m/s
- B) 30 m/s
- C) 50 m/s
- D) 40 m/s

**Q3: The horizontal and vertical displacements of a projectile at time  $t$  are  $x = 36t$  and  $y = 48t - 4.9t^2$ , respectively. Initial velocity of the projectile in m/s is:**

- A) 15
- B) 30
- C) 45
- D) 60

**Q4: A particle is projected with velocity  $2\sqrt{gh}$  so that it just clears two walls of equal height  $h$ , which are at a distance of  $2h$  from each other. What is the time interval of passing between the two walls:**

- A)  $2h/g$
- B)  $\sqrt{2h/g}$
- C)  $\sqrt{h/g}$
- D)  $2\sqrt{h/g}$

**Q5: Two persons A and B are located in X–Y plane at the points (0,0) and (0,10) respectively. (The distances are measured in MKS unit). At a time t=0 they start moving simultaneously with velocities  $V_A=2\hat{j}$  ms<sup>-1</sup> and  $V_B=2\hat{i}$  ms<sup>-1</sup> respectively. The time after which A and B are at their closest distance is:**

- A) 2.5 s
- B) 4 s
- C) 1 s
- D)  $10/\sqrt{2}$  s

➤ **CATEGORY III**

**Q1: A particle starts moving from rest at x=0 along the x-axis. Its velocity depends on displacement x as  $v=4\sqrt{x}$  m/s. Which of the following statements are correct?**

- A) The acceleration of the particle is constant.
- B) The acceleration of the particle is 8 m/s<sup>2</sup>.
- C) The relation between displacement and time is  $x=4t^2$ .
- D) The time taken by the particle to reach x=9 m is 1.5 s.

**Q2: A particle is moving in x–y plane according to  $r=b\cos\omega t\hat{i}+b\sin\omega t\hat{j}$ . Where  $\omega$  is constant. Which of the following statement(s) is / are true?**

- A)  $\frac{E}{\omega}$  is a constant where E is the total energy of the particle.
- B) The trajectory of the particle in x–y plane is a circle.
- C) In  $a_x$ - $a_y$  plane, trajectory of the particle is an ellipse ( $a_x, a_y$  denotes the components of acceleration).
- D)  $a=\omega^2v$ .

**Q3: The horizontal and vertical distance x & y of a projectile is given as  $x = 6t$  m &  $y = 8t-5t^2$  m. Then which of the following is true. (Take  $g = 10\text{m/s}^2$ ):**

- A) The angle of projection of the projectile is 53°.
- B) The range of the particle is 9.6 m.
- C) The maximum height reached by the particle is 4 m.
- D) The time of flight is 1.6 s.

**Q4: A projectile is thrown with an initial velocity  $V=ai^{\wedge}+bj^{\wedge}$ . Then which of the following is/are true? (Acceleration due to gravity is g):**

- A) The Range of the particle is  $2ab/g$ .
- B) If the ratio of range of projectile to maximum height reached by projectile is 2, then the ratio of a:b is 2.
- C) Particle cannot perform projectile if  $a>b$ .
- D) The angle of projection of projectile is  $\tan^{-1}(b/a)$ .

**Q5: The position vector  $r$  of a particle of mass  $m$  is given by the following equation:  $r(t)=\alpha t^3i^{\wedge}+\beta t^2j^{\wedge}$ . Where  $\alpha=10/3 \text{ ms}^{-3}$ ,  $\beta=5 \text{ ms}^{-2}$  and  $m=0.1 \text{ kg}$ . At  $t=1 \text{ s}$ , which of the following statement(s) is (are) true about the particle?**

- A) The velocity  $v$  is given by  $v=(10i^{\wedge}+10j^{\wedge}) \text{ ms}^{-1}$ .
- B) The angular momentum  $L$  with respect to the origin is given by  $L=-(5/3)k^{\wedge} \text{ Nms}$ .
- C) The force  $F$  is given by  $F=(i^{\wedge}+2j^{\wedge}) \text{ N}$ .
- D) The torque  $\tau$  with respect to the origin is given by  $\tau=-(20/3)k^{\wedge} \text{ Nm}$ .

