PHYSICS

Class **PUC 2nd Yr.**
AIPMT paper problems
Topic **1 & 2-D.** **September 2015**

1. A ball is thrown vertically downwards from a height of 20 m with an initial velocity of V_0. It collides with the ground, loses 50 % of its energy and rebounds to the same height. Initial velocity in m/s is ($g = 10\ ms^{-2}$)
   (A) 20 (B) 28
   (C) 10 (D) 14

2. A projectile is fired from the surface of the earth with a velocity of 5 m/s at an angle of θ with the horizontal. Another projectile fired from another planet with 3 m/s at the same angle, follows the same trajectory as the one fired from the earth. The value of acceleration due to gravity on that planet in ms^{-2} is ($g = 9.8\ ms^{-2}$)
   (A) 3.5 (B) 5.9
   (C) 16.3 (D) 110.8

3. A particle is moving such that its position coordinates (x, y) are (2, 3) at t = 0, (6, 7) at t =2 sec and (13, 14) at t = 5 sec. Average velocity vector from t = 0 to t = 5 sec is
   (A) $\frac{1}{5}\left(13\hat{i}+14\hat{j}\right)$ (B) $\frac{7}{3}\left(\hat{i}+\hat{j}\right)$
   (C) $2\left(\hat{i}+\hat{j}\right)$ (D) $\frac{11}{5}\left(\hat{i}+\hat{j}\right)$

4. The initial velocity of a projectile from a horizontal ground is $\left(2\hat{i}+3\hat{j}\right)$. What is its velocity just before it reaches the ground?
   (A) $\left(-2\hat{i}-3\hat{j}\right)$ (B) $\left(-2\hat{i}+3\hat{j}\right)$
   (C) $\left(2\hat{i}-3\hat{j}\right)$ (D) $\left(2\hat{i}+3\hat{j}\right)$

5. A stone falls freely under gravity and covers h_1, h_2 and h_3 distances in the first five, next 5 and next 5 seconds of its motion respectively. The relation between those distances is
   (A) $h_1 = 2h_2 = 3h_3$ (B) $h_1 = \frac{h_2}{3} = \frac{h_3}{5}$
   (C) $h_2 = 3h_1$ and $h_3 = 3h_2$ (D) $h_1 = h_2 = h_3$

6. A stone is dropped from a height H. It hits the ground with a certain momentum P. If the same stone is dropped from a height 100 % more than the previous height, the momentum when it hits the ground will change by what percentage?
   (A) 100 (B) 68
   (C) 41 (D) 200

7. A boy standing at the top of a tower of 20 m height, drops a stone. Take g = 10 ms^{-2} and find the velocity with which it hits the ground in m/s.
   (A) 5 (B) 10
   (C) 20 (D) 40

8. A body is moving with a velocity 30 m/s towards east. After 10 seconds its velocity becomes 40 m/s towards north. The average acceleration of the body in ms^{-2} is
   (A) 5 (B) 1
   (C) 7 (D) 4

9. A ball is dropped from a high rise platform at t = 0. After 6 seconds another ball is thrown downwards from the same platform with a speed v. The two balls meet at t = 18 seconds. What is the value of v in m/s?
   (A) 75 (B) 55
   (C) 40 (D) 60

10. A missile is fired for maximum range with an initial velocity of 20 m/s. If g = 10 ms^{-2} the range of the missile in meters is
   (A) 20 (B) 40
   (C) 50 (D) 60

11. A particle has an initial velocity $3\hat{i}+4\hat{j}$ and has acceleration $0.4\hat{i}+0.3\hat{j}$. It's speed after 10 seconds is
   (A) 7 (B) $7\sqrt{2}$
   (C) 8.5 (D) 10

12. A particle moves a distance x in time t according to the equation $x=(t+5)^{-1}$ The acceleration of the particle is proportional to
   (A) $(\text{velocity})^{3/2}$ (B) $(\text{distance})^{2}$
   (C) $(\text{distance})^{-2}$ (D) $(\text{velocity})^{2/3}$

13. A bus is moving at a speed of 10 m/s on a straight road. A person on a scooter wishes to overtake the bus in 100 s. If the bus is at a distance of 1 km from him, with what speed in m/s should he chase the bus?
   (A) 40 (B) 25
   (C) 10 (D) 20

14. A particle starts its motion from rest under the action of a constant force. If the distance covered in the first 10 s is S_1 and that in the first 20 s is S_2 then,
   (A) $S_2=3S_1$ (B) $S_2=4S_1$
   (C) $S_2=2S_1$ (D) $S_2=S_1$

15. The distance travelled by a particle starting from rest and moving with an acceleration of 4/3 ms^{-2} in the third second is
   (A) 19/3 m (B) 6 m
   (C) 4 m (D) 10/3 m

16. A particle moves in a straight line with a constant acceleration. It changes its velocity from 10 m/s to 20 m/s while passing through a distance of 135 m in t sec. The value of t in sec is

(A) 9 (B) 10

(C) 1.8 (D) 12

17. A particle of mass m is projected with a velocity v making an angle of 45^0 with the horizontal. When the particle lands on the level ground the magnitude of the change in its momentum will be

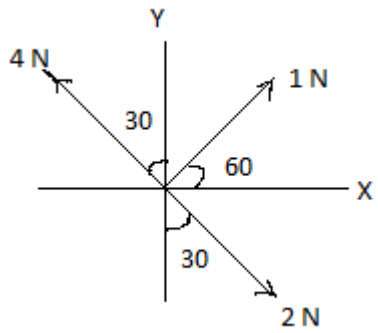
(A) 0 (B) 2 mv

(C) $\frac{mv}{\sqrt{2}}$ (D) $mv\sqrt{2}$

18. Sand is being dropped on a conveyor belt at the rate of M kg/s. The force necessary to keep the belt moving with a constant velocity of v m/s is

(A) 0 (B) Mv

(C) 2 Mv (D) $\frac{Mv}{2}$



19. Three forces acting on a body are shown in the figure. To have the resultant only along the Y-direction, the magnitude of the minimum force needed is

(A) $\sqrt{3}$ N (B) 0.5 N

(C) 1.5 N (D) $\frac{\sqrt{3}}{4}$

20. A particle moving along X-axis has an acceleration f given as a function of time as $f = f_0\left(1-\frac{t}{T}\right)$ where f_0 and T are constants. The particle at t = 0 has zero velocity. At the instant when f = 0, the particle velocity is

(A) $\frac{1}{2}f_0T$ (B) f_0T

(C) $\frac{1}{2}f_0T^2$ (D) f_0T^2

21. A car moves from X to Y with a uniform speed v_1 and returns to X with a uniform speed v_2. The average speed of the round trip is

(A) $\frac{v_1+v_2}{2}$ (B) $\frac{2v_1+v_2}{v_1+v_2}$

(C) $\sqrt{v_1 v_2}$ (D) $\dfrac{2v_1 v_2}{v_1 + v_2}$

22. A particle starting from the origin moves along a straight line in the X-Y plane. Its co-ordinates at a later time are $(\sqrt{3}, 3)$. The path of the particle makes with the X-axis an angle of (in degrees)

(A) 0 (B) 30

(C) 45 (D) 60

23. $\vec{A}$ and $\vec{B}$ are two vectors, θ is the angle between them. If $\left|\vec{A} \times \vec{B}\right| = \sqrt{3}\left(\vec{A} \cdot \vec{B}\right)$ the value of θ in degrees is

(A) 90 (B) 60

(C) 45 (D) 30

24. The position of a particle along the X-axis with respect to time is given by $x = 9t^2 - t^3$ where x is in meters and t in seconds. What will be the position of the particle when it achieves the maximum speed along the positive x-direction in m/s?

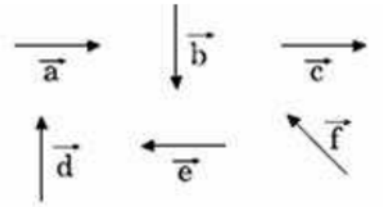
(A) 24 (B) 32

(C) 54 (D) 81

25. If vectors $\vec{A} = \cos \omega t \hat{i} + \sin \omega t \hat{j}$ and $\vec{B} = \cos \dfrac{\omega t}{2} \hat{i} + \sin \dfrac{\omega t}{2} \hat{j}$ are time dependent, find the time when they are orthogonal to each other.

(A) $t = \dfrac{\pi}{2\omega}$ (B) $t = \dfrac{\pi}{\omega}$

(C) t = 0 (D) $t = \dfrac{\pi}{4\omega}$



26. Six vectors have magnitude and directions as indicated in the figure. Which of the following statements is true?

(A) $\vec{b} + \vec{c} = \vec{f}$ (B) $\vec{d} + \vec{c} = \vec{f}$

(C) $\vec{d} + \vec{e} = \vec{f}$ (D) $\vec{b} + \vec{e} = \vec{f}$

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