PHYSICS

1. The length, breadth and thickness of a rectangular sheet of metal are 4.234 m, 1.00 5 m and 2.01 cm. The volume of the sheet to correct significant figures is:

   1) 0.0855 m^3 2) 0.086 m^3 3) 0.08556 m^3 4) 0.08 m^3

2. The length of a cylinder is measured with a metre rod having least count 0.1 cm. Its diameter is measured with vernier callipers having least count 0.01 cm. Given that length is 5.0 cm and radius is 2.0 cm. The percentage error in the calculated value of the volume will be:

   1) 1.5% 2) 2.5% 3) 3.5% 4) 4%

3. A vernier calipers having 1 main scale division = 0.1cm is designed to have a least count of 0.02 cm. If *n* be the number of divisions on vernier scale and *m* be the length of vernier scale, then:

   1) n = 10, m = 0.5 cm 2) n = 9, m = 0.4 cm

   3) n = 10, m = 0.8 cm 4) n = 10, m = 0.2 cm

4. The edge of a cube is $a = 1.2 \times 10^{-2} m$. Then its volume will be recorded as:

   1) $1.7 \times 10^{-6} m^3$ 2) $1.70 \times 10^{-6} m^3$ 3) $1.70 \times 10^{-7} m^3$ 4) $1.78 \times 10^{-6} m^3$

5. In a vernier calipers, *n* divisions of its main scale match with (*n* + 1) divisions on its vernier scale. Each division of the main scale is a units. Using the vernier principle, calculate its least count.

   1) $\frac{a}{n}$ 2) $\frac{a}{n+1}$ 3) $\frac{n}{2}$ 4) $n+1$

6. In a vernier calipers (VC), N divisions of the main scale coincide with $N+m$ divisions of the vernier scale. What is the value of m for which the instrument has minimum least count?

1) 1 2) N 3) Infinity 4) $N/2$

7. A student performs an experiment for determination of $g\left(=\frac{4\pi^2 l}{T^2}\right) l \approx 1m$ and he commits an error of Δl. For the experiment takes the time of n oscillations with the stop watch of least count ΔT and he commits a human error of 0.1 sec. For which of the following data, the measurement of g will be most accurate?

	Δl	ΔT	n	***Amplitude of oscillation***
1)	5 mm	0.2 sec	10	5 mm
2)	5 mm	0.2 sec	20	5 mm
3)	5 mm	0.1 sec	20	1 mm
4)	1 mm	0.1 sec	50	1 mm

8. The pitch of a screw gauage 1 mm and there are 100 divisions on its circular scale. When nothing is put in between its jaws, the zero of the circular scale lies 6 divisions below the reference line. When a wire is placed between the jaws, 2 linear scale divisions are clearly visible while 62 divisions on circular scale coincide with the reference line. Determine the diameter of the wire.

1) 2.56 mm 2) 2.62 mm 3) 2.65 mm 4) 2.50 mm

9. Least count of vernier calipers is 0.01 cm. When the two jaws of the instrument touch each other the 5^{th} division of the vernier scale coincide with a main scale division and the zero of the vernier scale lies to the left of the zero of the main scale. Furthermore while measuring the diameter of a sphere, the zero mark of the vernier scale lies between 2.4 cm and 2.5 cm and the 6^{th} vernier division coincides with a main scale division. Calculate the diameter of the sphere.

1) 2.50 cm 2) 2.51 cm 3) 2.41 cm 4) 2.60 cm

10. Two water jets are projected from the same spot with same speed v with angles of projection $\theta_1 = 30^o$ and $\theta_2 = 60^o$ respectively. Find the horizontal distance of point of collision from point of projection.

1) $\frac{3v^2}{10g}$ 2) $\frac{v^2}{10\sqrt{3}g}$ 3) $\frac{\sqrt{3}v^2}{10g}$ 4) $\frac{v^2}{\sqrt{3}g}$

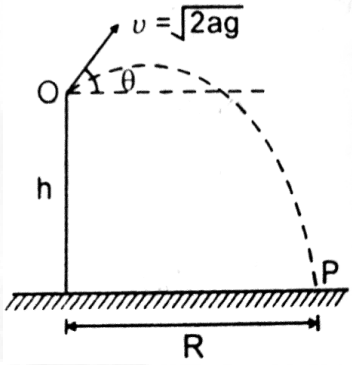
11. A projectile of mass 2kg has velocities 3 m/s and 4 m/s at two points during its flight in the uniform gravitational field of the earth. If these two velocities are perpendicular to each other, then the minimum kinetic energy of the particle during its flight is

1) 6.32 J 2) 8.40 J 3) 16.32 J 4) 5.76 J

12. A particle is projected from origin with minimum possible speed so that it is able to pass through a given point (30 m, 40 m). The range of the particle is (Take g = 10 m/s^2)

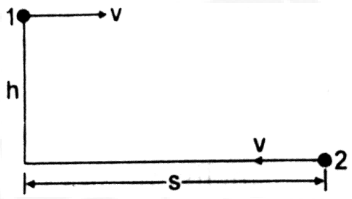
1) 60 m 2) 54 m 3) 30 m 4) 50 m

13. A particle is projected under gravity with velocity $\sqrt{2ag}$ from a point at a height h above the level plane. The maximum range R on the ground is



1) $\sqrt{\left(a^2+1\right)h}$ 2) $\sqrt{a^2h}$ 3) $\sqrt{ah}$ 4) $2\sqrt{a\left(a+h\right)}$

14. Two particles 1 and 2 are projected with same speed v as shown in figure. Particle 2 is on the ground and particle 1 is at a height h from the ground and at a horizontal distance s from particle 2. If a graph is plotted between v and s for the condition of collision of the two then (v on y-axis and s on x-axis)



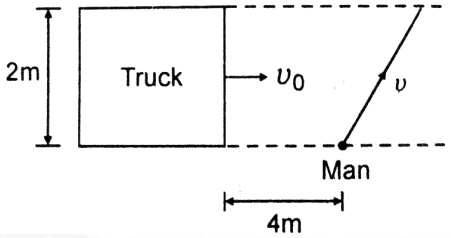
1) It will be a parabola passing through the origin

2) It will be a straight line passing through the origin and having a slope of $\sqrt{\frac{g}{8h}}$

3) It will be a straight line passing through the origin and having a slope of $\sqrt{\frac{g}{4h}}$

4) It will be a straight line not passing through the origin

15. A 2m wide truck is moving with a uniform speed $v_0 = 8 m/s$ along a straight horizontal road. A pedestrian starts to cross the road with a uniform speed v when the truck is 4 m away from him. The minimum value of v so that he can cross the road safely is

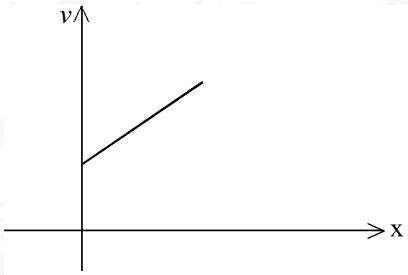


1) 2.62 m/s 2) 4.6 m/s 3) 3.57 m/s 4) 1.414 m/s

16. The distance between two moving particles at any time is a. If v be their relative velocity and v_1 and v_2 be the components of v along and perpendicular to a. The time when they are closest to each other is

1) $\frac{av_1}{v^2}$ 2) $\frac{av_2}{v^2}$ 3) $\frac{av}{v_1^2}$ 3) $\frac{av}{v_2^2}$

17. Velocity versus displacement graph of a particle moving a straight line is as shown in figure. The acceleration of the particle is



1) Constant 2) Increase linearly with x

3) Increase parabolically with x 4) None of these

18. A glass wind screen whose inclination with the vertical can be changed is mounted on a car. The car moves horizontally with a speed of 2 m/s. At what angle α with the vertical should the wind screen be placed so that the rain drops falling vertically downwards with velocity 6 m/s strike the wind screen perpendicularly.

1) $\tan^{-1}(1/3)$ 2) $\tan^{-1}(3)$ 3) $\cos^{-1}(3)$ 4) $\sin^{-1}(1/3)$

19. A very broad elevator is going up vertically with a constant acceleration of 2 m/s^2. At the instant when its velocity is 4 m/s a ball is projected from the floor of the lift with a speed of 16 m/s relative to the ground at an elevation of 30^o. The time taken by the ball to return the floor is (g = 10 m/s^2)

1) $\frac{3}{2}s$ 2) $\frac{2}{3}s$ 3) $\frac{5}{4}s$ 4) $\frac{4}{5}s$

20. A horizontal wind is blowing with a velocity v towards north-east. A man starts running towards north with acceleration a. The time after which man will feel the wind blowing towards east is:

1) $\frac{v}{a}$ 2) $\frac{\sqrt{2}v}{a}$ 3) $\frac{v}{\sqrt{2}a}$ 4) $\frac{2v}{a}$

21. A point moves in xy-plane according to equation $x = at, y = at(1-bt)$ where a and b are positive constants and t is time. The instant at which velocity vector is at $\pi/4$ with acceleration vector is given by:

1) $1/a$ 2) $1/b$ 3) $1/a + 1/b$ 4) $(a+b)/(a^2+b^2)$

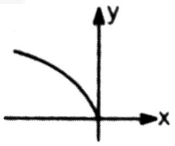
22. A particle starts from rest at A and moves with uniform acceleration $a\ m/s^2$ in a straight line. After $1/a$ seconds a second particle starts from A and moves with uniform velocity u in the same line and same direction. If $u > 2\ m/s$ then during the entire motion the second particle remains ahead of first particle for a duration.

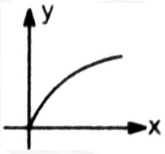
1) $2\frac{\sqrt{u(u-2)}}{a}$ 2) $\frac{a}{2}\sqrt{u(u-2)}$ 3) $\frac{2}{a}\sqrt{u(u-2)}$ 4) None of these

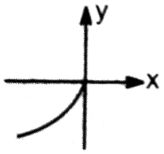
23. A particle is moving in *x*-*y* plane. At certain instant of time, the components of its velocity and acceleration are as follows, $\upsilon_x = 3m/s, \upsilon_y = 4m/s, a_x = 2m/s^2$ and $a_y = 1m/s^2$. The rate of change of speed at this moment is:

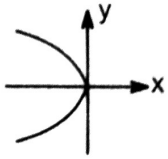
1) $\sqrt{10}\,m/s^2$ 2) $4\,m/s^2$ 3) $10\,m/s^2$ 4) $2\,m/s^2$

24. The instantaneous velocity of a particle moving in *xy*-plane is $\vec{V} = (ay)\hat{i} + (V_0)\hat{j}$, where *y* is the instantaneous *y* co-ordinate of the particle and V_0 is a positive constant and *a* is a negative constant. If the particle starts from origin then its trajectory is:

1) 

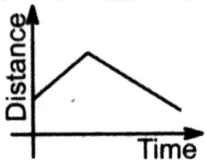
2) 

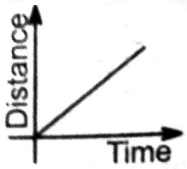
3) 

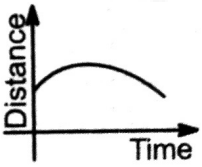
4) 

25. From a high tower at time *t* = 0, one stone is dropped from rest and simultaneously another stone is projected vertically up with an initial velocity. The graph between distance between the particles and time before either hits the ground is:

1) 

2) 

3) 

4) 

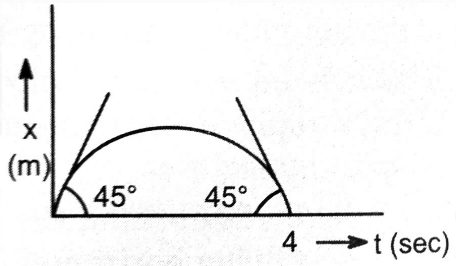
26. At a height of 0.4 m from the grounds, the velocity of projectile in vector form is $\vec{\upsilon} = (6\hat{i} + 2\hat{j})$ (the *x*-axis is horizontal and *y*-axis is vertically upwards). The angle of projection is: ($g = 10\ m/s^2$)

1) 45^o 2) 60^o 3) 30^o 4) $\tan^{-1} 3/4$

27. A particle is projected vertically upwards form O with velocity 'υ' and a second particle is projected at the same instant from P (at a height *h* above O) with velocity 'υ' at an angle of projection θ. The time when the distance between them is minimum is:

1) $\frac{h}{2\upsilon\sin\theta}$ 2) $\frac{h}{2\upsilon\cos\theta}$ 3) $\frac{h}{\upsilon}$ 4) $\frac{h}{2\upsilon}$

28. A particle moves along *x*-axis with constant acceleration and its *x*-position depend on time '*t*' as shown in the following graph (parabola); then in interval 0 to 4 sec.



1) relation between *x*-coordinate & time is $x = t - t^2/4$
2) maximum *x*-coordinate is 1 m
3) total distance traveled is 2 m
4) all the above

29. One mole of an ideal gas at standard temperature and pressure occupies 22.4 L (molar volume). If the size of the hydrogen molecule is about $1\mathring{A}$, what is the ratio of molar volume to the atomic volume of a mole of hydrogen?

1) 10^4 2) 10^3 3) 10^{27} 4) 10^{28}

30. The sun's angular diameter is measured to be 1920''. The distance *D* or the Sun from the earth is $1.496\times10^{11}m$. What is the diameter of the Sun?

1) $1.39\times10^{12}m$ 2) $1.39\times10^{2}m$ 3) $1.39\times10^{9}m$ 4) $1.39\times10^{11}m$