CLASS TEST

PHYSICS SPECIAL CLASS TEST # 02

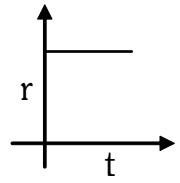
SECTION-I

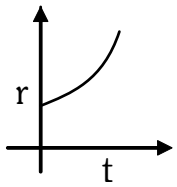
Single Correct Answer Type **8 Q. [3 M (–1)]**

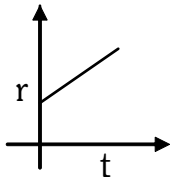
1. A car is moving on circular path of radius 100 m such that its speed is increasing at the rate of 5 m/s^2. At t = 0 it starts from rest. What is the radial acceleration of car at the instant it makes one complete round trip ?

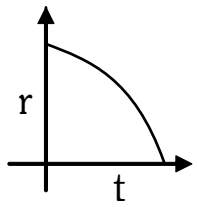
(A) 20π ms^{-2} (B) 10π ms^{-2} (C) 5 ms^{-2} (D) None of these

2. If the magnitude of tangential and normal accelerations of a particle moving on a curve in a plane be constant throughout, then which of the following graph represent the variation of radius of curvature with time?

(A) 

(B) 

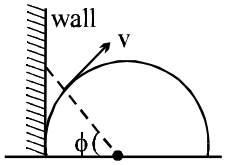
(C) 

(D) 

3. Two particles starts moving on the same circle of radius 2 m, from the same point P at t = 0, with constant tangential accelerations = 2 m/s^2 and 6 m/s^2, clockwise and anticlockwise, respectively. The point where they meet for the first time is Q. The smaller angle subtended by PQ at center of circle is

(A) 120° (B) 60° (C) 135° (D) 90°

4. On a particle moving on a circular path with a constant speed v, light is thrown from a projectors placed at the centre of the circular path. The shadow of the particle is formed on the wall. the velocity of shadow up the wall is



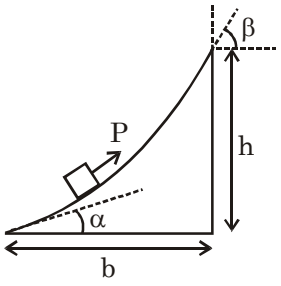
(A) v $\sec^2\phi$ (B) v $\cos^2\phi$

(C) (A) v $\cos\phi$ (D) none

5. A particle moves along the arc, of a circle of radius R according to the equation l = a sinwt, where l is the length of path, and a and w are constants. Then the magnitude of the total acceleration of the particle at the point l = 0 will be:

(A) $\frac{a^2\omega^2}{R}$ (B) $\frac{a^2\omega^2}{2R}$ (C) $2a^2\omega^2$ (D) none of these

6. A block of mass M has to be dragged up a hill of height h that does not have uniform slope from bottom to top. The externally applied force (P) is always applied to parallel to the surface, block moves with negligible velocity and the coefficient of kinetic friction (μ_k) is same everywhere. Slope of hill varies from α to β as shown in figure. Work done by force P is given by :



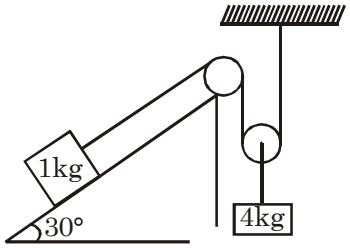
(A) Mg(μ_kh cotα + μ_kb cotβ) (B) Mg(μ_kh tanα + μ_kb tanβ)

(C) Mgh + μ_kMgb (D) $Mgh\left(\frac{\sin\alpha+\sin\beta}{2}\right)+\mu_k Mgb\left(\frac{\cos\alpha+\cos\beta}{2}\right)$

7. A smooth ring of radius R is fixed in horizontal plane. A bead of mass m is threaded onto it. Apart from the normal force due to ring, the bead experiences a repulsive force due to a central conservative force whose center is C. The potential energy of bead is $\frac{k}{x}$ where x is it's distance from C. k is a positive constant. What is the normal force exerted by ring on the bead when it reaches A. Assume that bead is released from rest at B & neglect gravity.

(A) $\frac{192k}{245R^2}$ (B) $\frac{32k}{245R^2}$ (C) $\frac{16k}{35R^2}$ (D) $\frac{16k}{49R^2}$

8. Find the work done by tension on 1 kg block when the 4kg block moves down by 1m after the system is released. All surfaces are frictionless & stings are ideal :-



(A) 25 J (B) 50J (C) 100 J (D) None of these

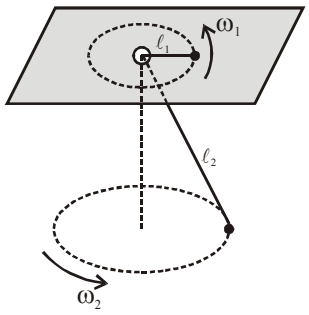
Multiple Correct Answer Type 5 Q. [4 M (–1)]

9. Angular displacement of an object moving on a circle of radius 2m is given by $\theta = \frac{\pi}{6}t + \frac{\pi}{6}t^2$ where θ is in radian and t is in s. For a time duration of t = 0 to t = 1s :

(A) Average angular velocity is $\frac{\pi}{3}$ rad/s (B) Average angular velocity is $\frac{\pi}{6}$ rad/s

(C) Average velocity is $\frac{2\pi}{3}$ m/s (D) Average velocity is 2 m/s

10. To one end of a light inextensible string of length ℓ is attached a particle of mass m resting on a smooth horizontal table. The string passes through a smooth hole in the table and to its other end is attached a small particle of same mass. The system is set in rotation as shown in figure with constant angular speed. Choose the correct option(s) :



(A) $\frac{\ell_1}{\ell_2} = \frac{\omega_2^2}{\omega_1^2}$ (B) $\frac{\ell_1}{\ell_2} = \frac{\omega_1^2}{\omega_2^2}$

(C) The motion is possible if, $\frac{1}{\omega_1^2} + \frac{1}{\omega_2^2} < \frac{\ell}{g}$ (D) The motion is possible if, $\frac{1}{\omega_1^2} + \frac{1}{\omega_2^2} > \frac{\ell}{g}$

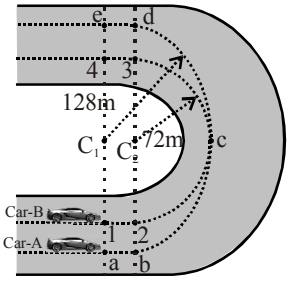
11. In the given figure race car A follows path abcde while race car B follows path 12c34 track. Each car has a constant speed corresponding to a normal acceleration of 8 m/s^2. The tracks abcde and 2c3 are semicircular track while tracks 1-2 and 3-4 are straight track. Point a and point 1 are the starting points of race and point 4 and point e are finishing points of the race. Choose the **CORRECT** statement(s) :-

(A) time taken by car A to complete the race is $t_a = 4\pi$ sec.

(B) time taken by car B to complete the race is $t_b = \left(3\pi + \frac{14}{3}\right)$ sec.

(C) car A wins the race with time difference $\left(\frac{14+3\pi}{3}\right)$ sec.

(D) car A wins the race with time difference $\left(\frac{14-3\pi}{3}\right)$ sec.



12. A particle is revolving in a circular path in the vertical plane. It is attached at one end of a string of length *l* whose other end is fixed. The velocity at the lowest point is u. The tension in the string is $\vec{T}$ and of the particle is $\vec{a}$ at any position. Then $\vec{T}.\vec{a}$ is zero at the highest point if

(A) $u \le \sqrt{2gl}$ (B) $u \le \sqrt{5gl}$ (C) $u = \sqrt{2gl}$ (D) $u > \sqrt{2gl}$

13. A particle moves along straight line acted by a force which delivers power $P = Ct^7$. Initially it's velocity is zero. Where C is constant and t is time. Then mark the correct option :-

(A) Displacement of the particle is proportional to t^5.

(B) Force acting on the particle increases with time.

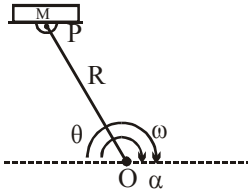
(C) Acceleration of the particle is proportional to t^3.

(D) Rate of change of kinetic energy is proportional to t^6.

Linked Comprehension Type (2 Para × 3Q.) [3 M (-1)]
(Single Correct Answer Type)

Paragraph for question nos. 14 to 16

A massless rod of length R is hinged at point O and a plank is attached to the other end of rod at point P. The rod is rotated in the vertical plane so that plank always remains horizontal. Angular velocity and angular acceleration of rod is ω and α-respectively then if μ is coefficient of friction between plank and mass then :



14. Normal force acting on the body is :-

(A) $N = m(\alpha R\cos\theta + g - \omega^2 R\sin\theta)$ (B) $N = m(\alpha R\cos\theta + \omega^2 R\sin\theta + g)$

(C) $N = m(\alpha R\cos\theta + g - \omega^2 R\sin\theta)$ (D) $N = m(\omega^2 R\sin\theta + g - \alpha R\cos\theta)$

15. If block is not moving with respect to plank then friction force acting on block is :-

(A) $m(\alpha R\sin\theta + \omega^2 R\cos\theta)$ (B) $m(\alpha R\cos\theta + \omega^2 R\sin\theta)$

(C) $\mu m(\alpha R\cos\theta + \omega^2 R\sin\theta)$ (D) $\mu m(\alpha R\sin\theta + g - \omega^2 R\sin\theta)$

16. Coefficient of friction μ such that skidding starts at the instant shown in diagram :-

(A) $\mu = \frac{\alpha R\sin\theta + \omega^2 R\cos\theta}{\alpha R\cos\theta + g - \omega^2 R\sin\theta}$ (B) $\mu = \frac{\alpha R\cos\theta + \omega^2 R\sin\theta}{\alpha R\sin\theta + g - \omega^2 R\cos\theta}$

(C) $\mu = \frac{\alpha R\cos\theta + g - \omega^2 R\sin\theta}{\alpha R\sin\theta + \omega^2 R\cos\theta}$ (D) $\mu = \frac{\alpha R\sin\theta + g - \omega^2 R\cos\theta}{\alpha R\cos\theta + \omega^2 R\sin\theta}$

Paragraph for question nos. 17 to 19

A model rocket rests on a frictionless horizontal surface and is joined by a string of length ℓ to a fixed point so that the rocket moves in a horizontal circular path of radius ℓ. The string will break if its tension exceeds a value T. The rocket engine provides a thrust F of constat magnitude along the rocket's direction of motion. The rocket has a mass m that does not change appreciably with time. Answer following questions based on above passage.

17. Starting from rest at t = 0 at what later time t_1 is the rocket travelling so fast that the string breaks ? Ignore any air resistance.

(A) $\left(\frac{2m\ell T}{F^2}\right)^{1/2}$ (B) $\left(\frac{m\ell T}{F^2}\right)^{1/2}$ (C) $\left(\frac{m\ell T}{2F^2}\right)^{1/2}$ (D) $\left(\frac{m\ell F}{T^2}\right)^{1/2}$

18. What was the magnitude of instantaneous net acceleration at time $\frac{t_1}{2}$? Obtain answer in terms of F, T and m.

(A) $\frac{[T^2+8F^2]^{1/2}}{m}$ (B) $\frac{[T^2+4F^2]^{1/2}}{2m}$ (C) $\frac{[T^2+16F^2]^{1/2}}{4m}$ (D) None of these

19. What distance does the rocket travel between the time t_1 when the string breaks and the time $2t_1$? The rocket engine continues to operate after the string breaks.

(A) $\frac{3\ell T}{2F}$ (B) $\frac{2\ell T}{3F}$ (C) $\frac{\ell T}{2F}$ (D) $\frac{2\ell T}{F}$

SPECIAL CLASS TEST # 02			ANSWER KEY

SECTION-I

Single Correct Answer Type **8 Q. [3 M (–1)]**

1. Ans. (A)	2. Ans. (B)	3. Ans. (D)	4. Ans. (A)
5. Ans. (A)	6. Ans. (C)	7. Ans. (A)	8. Ans. (A)

Multiple Correct Answer Type **5 Q. [4 M (–1)]**

9. Ans. (A,D)	10. Ans. (A,C)	11. Ans. (A,B,D)	12. Ans. (A,B,C)
13. Ans. (A,B,C)			

Linked Comprehension Type **(2 Para × 3Q.) [3 M (-1)]**

(Single Correct Answer Type)

14. Ans. (C)	15. Ans. (A)	16. Ans. (A)	17. Ans. (B)
18. Ans. (C)	19. Ans. (A)		