CLASS TEST

PHYSICS SPECIAL CLASS TEST # 05

SECTION-I

Single Correct Answer Type **12 Q. [3 M (–1)]**

1. A small mass 'm' rests at the edge of a horizontal disc of radius 'R'. The coefficient of static friction between mass and the disc is μ. The disc is rotated about its axis at an angular velocity such that the mass slides off the disc and lands on the floor 'h' meters below. What was its horizontal distance of travel from the point it left the disc?

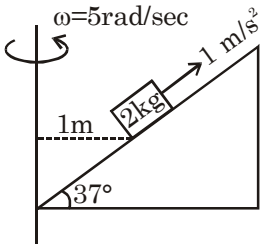
(A) $\sqrt{\mu h}$ (B) $\sqrt{\mu(R+h)^2}$ (C) $\sqrt{\mu Rh}$ (D) $\sqrt{2\mu Rh}$

2. A car moves along a circular track of radius R banked at an angle of 30° to the horizontal. The coefficient of static friction between the wheels and the track is μ. The maximum speed with which the car can move without skidding out is :-

(A) $\left[2gR(1+\mu)/\sqrt{3}\right]^{1/2}$ (B) $\left[gR(1-\mu)/(\mu+\sqrt{3})\right]^{1/2}$

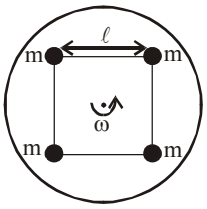
(C) $\left[gR(1+\mu\sqrt{3})/(\mu+\sqrt{3})\right]^{1/2}$ (D) $\left[Rg\left[\frac{\sqrt{3}\mu+1}{\sqrt{3}-\mu}\right]\right]^{1/2}$

3. A block of mass 2kg is placed on wedge having an angle 37° with horizontal. Wedge rotates about an axis AB as shown with angular velocity 5 rad/s. If block just start accelerating upward w.r.t. wedge with acceleration of 1 m/s^2 at the given instant find friction force acting on block. (Distance of block is 1m at the given instant) :-



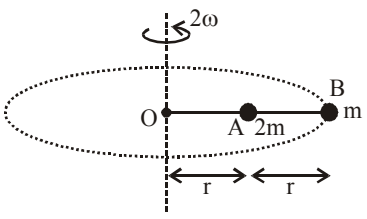
(A) 16 N (B) 8 N (C) 26 N (D) 38 N

4. Four identical point masses 'm' joined by light string of length 'ℓ' arrange such that they form square frame. Centre of table is coincide with centre of arrangment. If arrangement rotate with constant angular velocity 'ω'. Find out tension in each string



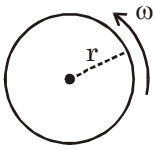
(A) $\frac{m\omega^2\ell}{4}$ (B) $m\omega^2\ell/2$ (C) $m\omega^2\ell/\sqrt{2}$ (D) $m\omega^2\ell$

5. Two particle of mass 2m and m attached to a light string as shown. Complete system is rotated in a horizontal circle with constant angular velocity 2ω about an axis passing through O point and perpendicular to plane of circle. Find out T_{OA}/T_{AB} is (T_{OA} & T_{AB} is tension in OA and AB string respectively):-



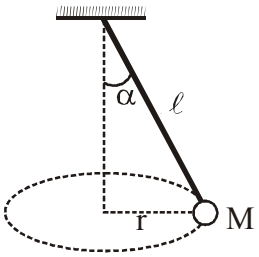
(A) 4 : 1 (B) 1 : 1 (C) 2 : 1 (D) 1 : 2

6. A thin circular ring of mass per unit length ρ and radius r is rotating at an angular speed ω as shown in figure in horizontal plane. The tension in the ring is :-

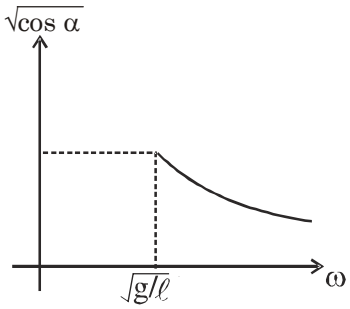


(A) $\rho\omega^2 r^2$ (B) $\frac{\rho\omega^2 r^2}{2}$ (C) $\frac{\rho\omega^2 r^2}{3}$ (D) None

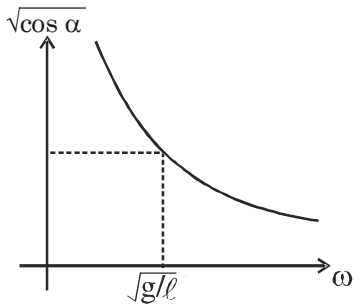
7. Mass M hangs by a massless rod of length ℓ which rotates at constant angular frequency ω, as shown in the figure. The mass moves with steady speed in a circular path of constant radius. α is the angle string makes with the vertical. Which of the following graph is correct.



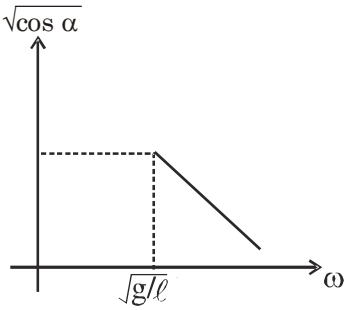
(A)



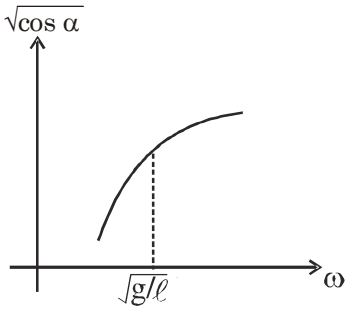
(B)



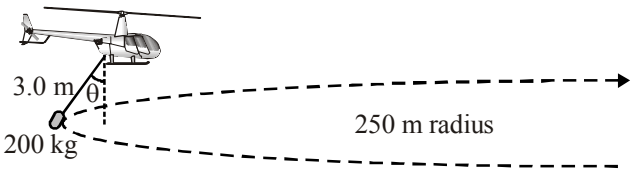
(C)



(D)

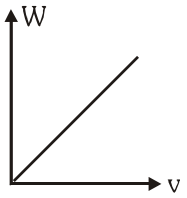


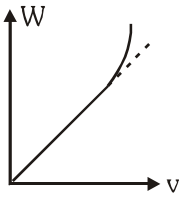
8. A helicopter carrying a 200-kg parcel at the end of a 3.0-m long cable flies in a horizontal circular path. It completes a full circle at a constant speed in 78.5 seconds. The radius of the path of the parcel is 250 m. The magnitude of the parcel's acceleration is nearly :

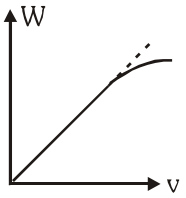


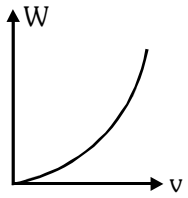
(A) 1.0 (B) 1.3 (C) 1.6 (D) 2.6

9. A crate is initially at rest on a horizontal frictionless table. A constant horizontal force F is applied. Which of the following four graphs is a correct plot of work W as a function of the crate's speed v?

(A) 

(B) 

(C) 

(D) 

10. Which of the following forces can never, under any circumstances, does work?

(A) Static friction (B) Tension (C) Normal (D) None

11. A force acting on a particle moving in the xy-plane is given by $\vec{F} = \left(2y\hat{i} + x^2\hat{j}\right)N$, where x and y are in m. The particle moves along a straight line from the origin to (5, 5). The work done by F is :

(A) 125 J (B) 66.7 J (C) 35 J (D) 25 J

12. Choose the most **CORRECT** statement.

(A) Work done by normal contact force and gravity will be the same in value if a man goes up on stairs slowly.

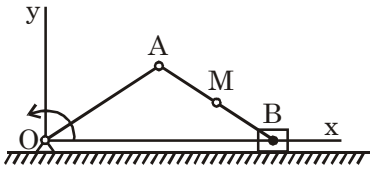
(B) Work done by normal contact force will be the greater than work done by gravity if man goes up with an acceleration.

(C) There is friction acts on climbing the stairs of the building if stairs are rough.

(D) All of the above

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

13. A crank *OA* rotates with constant angular velocity ω = 10 rad/sec. It is hinged with AB. Here *OA* = *AB* = 80 cm. Determine the equation of motion and the path of a particle M at the centre of the connecting rod. Find the equation of motion of the slider *B,* if at the start the slider was at the extreme right. The axes of coordinates are shown in Fig.



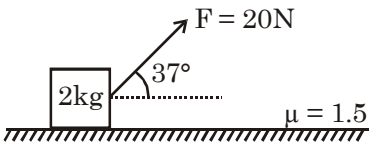
(A) The path of the particle *M* is ellipse.

(B) The path of the particle *M* is circle.

(C) The equation of motion of the slider *B* is $x = 160\cos 10t$ *cm.*

(D) The equation of motion of the slider *B* is $x = 160\cos 20t$ *cm.*

14. A block of mass 2 kg initially is at rest on a rough surface having coefficient of friction μ = 1.5. A force 20N is applied as shown in figure then which of the following is/are **CORRECT** :



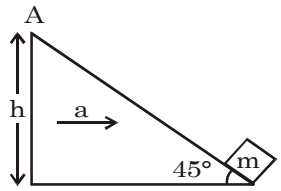
(A) Acceleration of block is $2m/s^2$.

(B) Work done by applied force (F) when block has moved by 2m is 32J.

(C) Work done by kinetic friction when block has moved by 2m is –24J

(D) Magnitude of normal contact force applied by block on the ground is 8N.

15. A block of mass m is kept on a smooth wedge of height h at rest. At t = 0, wedge starts moving with constant acceleration $a = \frac{3}{2}g$ as shown in figure. V represents the relative velocity of block w.r.t. wedge at A & H is the maximum height achieved by the block measured from ground.



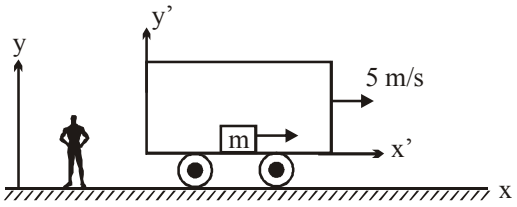
(A) $V = \sqrt{2gh}$ (B) $V = \sqrt{gh}$ (C) $H = \frac{5h}{4}$ (D) $H = \frac{3h}{2}$

16. A jumper jumps upwards . Choose the correct statement.
(A) the force exerted by the ground on him while he is attempting to jump is greater than his weight
(B) work is done by normal force on him while he attempts to jump
(C) Since the feet touching ground remain at rest while he is attempting to jump, force exerted by ground on him is equal to his weight
(D) Since the feet touching ground remain at rest while he is attempting to jump, work done by the force exerted by ground on him is zero

Linked Comprehension Type (1 Para × 3 Q.) [4 M (–1)]
(Multiple Correct Answer Type)

Paragraph for question nos. 17 to 19

Consider two frames of reference S and S', the first one being fixed to the ground and the second one fixed to a moving train moving with 5.00 m/s with respect to the ground (figure). A block of mass 4.00 kg, initially at rest with respect to S', is acted upon by a 14.0 N force for 3.00s in the positive x direction. Neglect friction.



17. According to an observer in S,
(A) the initial kinetic energy of the block is 50 J.
(B) final kinetic energy 480.5 J.
(C) the change in kinetic energy 430.5 J.
(D) the work done by the force on the block is 430.5 J.

18. According to an observer in S', what are the corresponding quantities ?
(A) the initial kinetic energy of the block is zero.
(B) final kinetic energy 220.5 J
(C) the change in kinetic energy 220.5 J
(D) the work done by the force on the block is 220.5 J

19. Mark the correct option/s
(A) Work energy theorem cannot be applied in frame S'.
(B) Work energy theorem is derived from Newton second law it is valid in all inertial reference frames.
(C) Work done by force is same in both the frames.
(D) Change in kinetic energy of both the blocks is independent of reference frames S and S'.

SPECIAL CLASS TEST # 05 **ANSWER KEY**

SECTION-I

Single Correct Answer Type — 12 Q. [3 M (–1)]

1. Ans. (D)	**2. Ans. (D)**	**3. Ans. (C)**	**4. Ans. (B)**
5. Ans. (C)	**6. Ans. (A)**	**7. Ans. (A)**	**8. Ans. (C)**
9. Ans. (D)	**10. Ans. (D)**	**11. Ans. (B)**	**12. Ans. (C)**

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

13. Ans. (A,C)	**14. Ans. (A,B,C,D)**	**15. Ans. (B,C)**	**16. Ans. (A,D)**
17. Ans. (A,B,C,D)	**18. Ans. (A,B,C,D)**	**19. Ans. (B)**	