विद्या सर्वार्थ साधिका

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MID TERM EXAMINATION
Class : XI

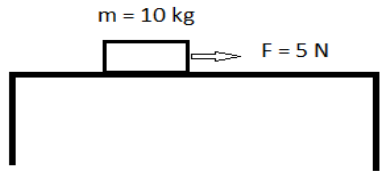
Subject: Physics M.M: 40
Date : 24/09/2019 Time: 2 Hours

General Instructions
1. All questions are compulsory. There are 20 questions in all.
2. This question paper has four sections: Section A, Section B, Section C, and Section D.
3. Section A contains ten objective questions of one mark each, Section B contains four questions of two marks each, Section C contains four questions of three marks each and Section D contains two questions of five marks each.
4. Use may use log table if necessary.

SECTION A

1. Two equal forces (4N each) act at a point inclined to each other at an angle of 120^o. The magnitude of their resultant is (1)
(a) 1N (b) 2N (c) 16N (d) 4N

2. In the figure the body of mass 10 kg is moving with constant speed. The coefficient of friction is ____ . (Take g = 10 m/s^2) (1)



(a) 5
(b) 0.5
(c) 0.05
(d) 0.005

3. A force of $-F\hat{k}$ acts on an object placed at (1, -1). The torque about the origin is (1)
(a) $F(\hat{i}-\hat{j})$ (b) $-F(\hat{i}+\hat{j})$ (c) $F(\hat{i}+\hat{j})$ (d) $-F(\hat{i}-\hat{j})$

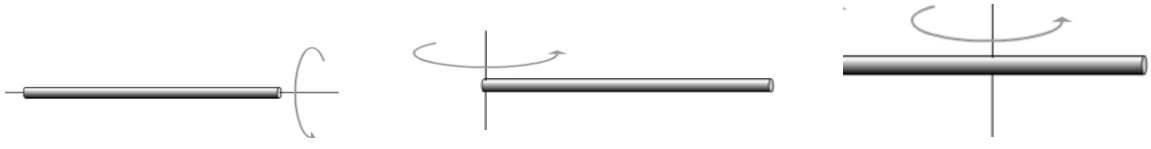
4. 'Power' of an agent at any instant is _____ product of force and velocity vectors at that instant. (1)

5. Two equal and opposite forces act on a body along two different lines of action constitute a _____. (1)

6. In an inelastic collision, final kinetic energy is always greater than initial kinetic energy. (True/False). (1)

7. The value of limiting friction is independent of the area of the surface in contact so long as the normal reaction remains the same. (True/False). (1)

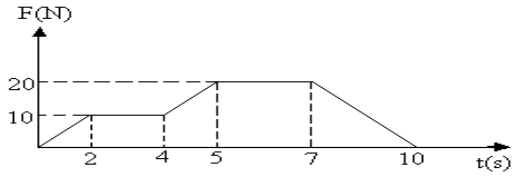
8. In which of the following cases, it is most difficult to rotate the rod? Why? (1)



(a) (b) (c)

9. What is the work done by a force $\vec{F} = (2\hat{i} - 6\hat{j})N$ on a body, which displaces it through $(-3\hat{j})$ m? (1)

10. The force-time (F-t) graph for linear motion of a body, initially at rest, is shown in the figure. Calculate the linear momentum gained by the body between 0 to 4s. (1)



SECTION B

11. Show that the rate of change of angular momentum is equal to torque. (2)

12. State the work-energy theorem. Prove it for a constant force. (2)

13. Name two kinds of motion which a rigid body can execute. State the two conditions need to be satisfied for equilibrium of the body. (2)

14. A particle of mass 'm' is just looping the loop in a vertical circle. What is the tension in the string at the lowest position if the velocity at the highest point is minimum? Draw relevant vector diagram. (2)

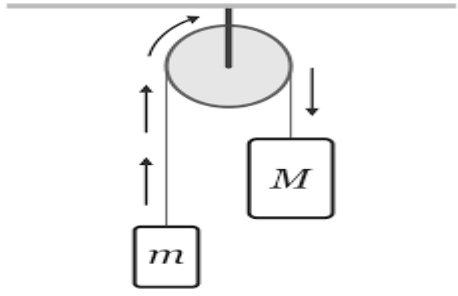
SECTION C

15. A cyclist speeding at 5m/s on a level road takes sharp circular turn of radius 3m without reducing the speed. The coefficient of static friction between the tyres and road is 0.1. Will the cyclist slip while taking the turn? Explain. (Take g = 10 m/s^2) (3)

16. Show that in a head-on collision between two balls of equal masses moving along a straight line, the balls simply exchange their velocities. (3)

17. A solid cylinder of mass 20 kg rotates about its axis with angular speed 100 rad s^{-1}.The radius of the cylinder is 0.25 m. (Given that MI of solid cylinder is ½MR^2). (3)
(a) What is the kinetic energy associated with the rotation of the cylinder?
(b) What is the magnitude of angular momentum of the cylinder about its axis?

18. (a) Is a frictional force conservative force? Support your answer. (3)
(b) Two masses m = 5kg and M= 10kg are connected at the ends of an in-extensible string passing over a friction-less pulley as shown. Calculate the acceleration of the masses when they are released.



SECTION D

19. Draw a force diagram of a moving body negotiating a curve of radius R in a banked road. Obtain the expression for the maximum possible velocity of the body. Also find the velocity when the friction is zero. (5)

20. (a) Derive an expression for the elastic potential energy stored in a stretched spring. (5)

(b) A 1 kg block is connected to a spring of spring constant 100 N/m as shown in figure. The block is released from rest with the spring in the unstretched position. The block moves '*x*' m down with constant speed before coming to rest. Find maximum extension of the spring and potential energy of the spring. Assume that the spring has a negligible mass, the pulley and surface are frictionless. (Take g=10m/s^2).