		Surname		Type
Group Number		Name		A
List Number		e-mail		
Student Number		Signature		

ATTENTION:Each question has only one correct answer and is worth one point. Be sure to fill in completely the circle that corresponds to your answer on the answer sheet. Use a pencil (not a pen). Only the answers on your answer sheet will be taken into account.

1. Which one of the following is wrong?

(a) The planets follow elliptical orbits in which one of their focuses is the Sun. (b) The torque applied by the solar gravitational field to the planets is zero. (c) The period of a planet in a gravitational field is directly proportional to the square of the radius of its orbit. (d) Planets have equal areas at equal time intervals along their orbit in the gravitational field of a star. (e) The gravitational force between two masses is inversely proportional to the square of the distance between them.

2. Consider the circular motion of a satellite around the earth. Which one of the following is wrong?

(a) The square of the velocity of a satellite is inversely proportional to the distance from the center of the earth. (b) The centripetal acceleration is provided by the Earth's gravitational force. (c) Escape velocity from the orbit is the same as the speed in orbit. (d) The square of the period of a satellite is proportional to the cube of distance from the earth. (e) Angular momentum is preserved in circular motion of a satellite.

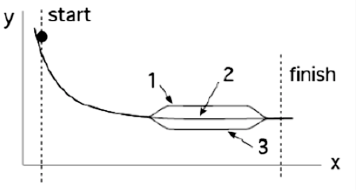
3. What is the conditions for a static equilibrium of rigid bodies?

(a) None of them. (b) Bodies should be both in the translational and in the rotational equilibrium. (c) Bodies should be only in translational equilibrium. (d) Bodies should be only rotational equilibrium. (e) Bodies should be neither in translational nor rotational equilibrium.

4. A force $\vec{F} = 174\text{N}\ \hat{\imath} + 203\text{N}\ \hat{\jmath} - 166\text{N}\ \hat{k}$ is exerted on an object at a point located by the position vector $\vec{r} = 1.0\text{m}\ \hat{\imath} - 1.0\text{m}\ \hat{\jmath}$ from a reference point O. Evaluate the torque exerted by this force about point O.

(a) $166\ \hat{\imath} + 166\ \hat{\jmath} + 377\ \hat{k}$ (b) 0 (c) $166\ \hat{\imath} + 377\ \hat{k}$ (d) $-166\ \hat{\imath} - 166\ \hat{\jmath} - 377\ \hat{k}$ (e) $-166\ \hat{\imath} + 166\ \hat{\jmath} + 377\ \hat{k}$

5. An object starts from rest and slides down on frictionless hill. Which path leads to the highest speed at the finish?



(a) can not be known (b) 3 (c) 1 (d) 2 (e) all results in the same final speed

6. Which one of the following is equivalent to the torque unit in SI unit system?

(a) $\text{kg/m}^2\text{s}^2$ (b) kgm^2/s (c) kgm^3/s^2 (d) kgm^2/s^2 (e) kg/ms^2

7. A stream of water from a hose is sprayed on the wall. If the speed of the water is 6 m/s and the hose sprays 450 cm^3/s, what is the average force exerted on the wall by stream of water in N? Assume that the water does not spatter back appreciably. The density of water is 1.0 g/cm^3.

(a) 4.1 (b) 6.5 (c) 2.7 (d) 3.4 (e) 5.8

8. A massless string is wrapped around a pulley with a radius of 2.0 cm and no appreciable friction in its axle. The pulley is initially not turning. A constant force of 50 N is applied to the string, which does not slip, causing the pulley to rotate and the string to unwind. If the string unwinds 1.2 m in 4.9 s, what is the moment of inertia of the pulley?

(a) 1.7 kgm^2 (b) 0.2 kgm^2 (c) 0.017 kgm^2 (d) 0.17 kgm^2 (e) 1.4 kgm^2

Questions 9-10

A 1200 kg car is moving along a straight highway at 5 m/s. Another car with mass 1800 kg and speed 30 m/s ahead of the previous one.

9. What is the speed of the center of mass of the two-car system in m/s?

(a) 30 (b) 10 (c) 40 (d) 5 (e) 20

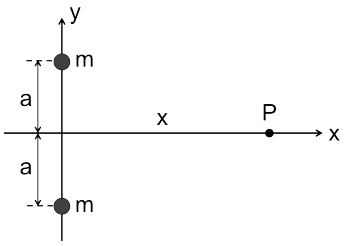
10. Find the magnitude of the total momentum of the system in kg.m/s.

(a) 6×10^4 (b) 9×10^4 (c) 12×10^4 (d) 3×10^4 (e) 1.5×10^4

11. A bicycle is traveling north at 5.0 m/s. The mass of the wheel, 2.0 kg, is uniformly distributed along the rim, which has a radius of 20 cm. What are the magnitude and direction of the angular momentum of the wheel about its axle?

(a) 5.0 kgm^2/s vertically upwards (b) 2.0 kgm^2/s towards the east (c) 2.0 kgm^2/s towards the west (d) 5.0 kgm^2/s towards the east (e) 5.0 kgm^2/s towards the west

12. Two particles with masses m are placed at the (0, a) and (0, -a) points on y-axis. Find the magnitude of gravitational acceleration (g) at the point P(x,0) on x-axis.

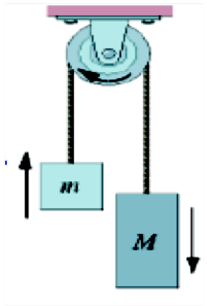


(a) $\frac{4Gmx}{(x^2+a^2)^1/2}$ (b) 0 (c) $\frac{2Gmx}{(x^2+a^2)^3/2}$ (d) $\frac{4Gmx}{(x^2+a^2)^3/2}$ (e) $\frac{2Gmx}{(x^2+a^2)^1/2}$

13. Let us assume a planet with a radius of 500 km with a gravitational acceleration of 4 m/s^2. What is the threshold value of the escape speed for a rocket on this planet?

(a) 3000 m/s (b) $\sqrt{3000}$ m/s (c) $\sqrt{2000}$ m/s (d) 2000 m/s (e) 1000 m/s

Questions 14-18



In the figure, a block has mass M= 0.50 kg, the other has mass m = 0.40 kg, and the pulley, which is mounted in horizontal frictionless bearings, has a radius of R = 5.00 cm. When released from rest, the heavier block falls 125.0 cm in 5.0 s (without the cord slipping on the pulley). Take g = 10 m/s^2.

14. What is the magnitude of the blocks' acceleration?

(a) 1.0 m/s^2 (b) 0.02 m/s^2 (c) 0.1 m/s^2 (d) 0.15 m/s^2 (e) 0.01 m/s^2

15. What is the tension in the part of the cord that supports the heavier block?

(a) 4.90 N (b) 5.05 N (c) 5.10 N (d) 5.00 N (e) 4.95 N

16. What is the tension in the part of the cord that supports the lighter block?

(a) 4.00 N (b) 4.04 N (c) 4.10 N (d) 3.96 N (e) 3.90 N

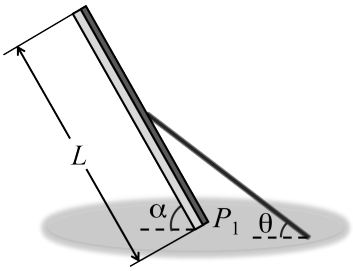
17. What is the magnitude of the pulley's angular acceleration?

(a) 200.0 rad/s^2 (b) 1.0 rad/s^2 (c) 0.2 rad/s^2 (d) 2.0 rad/s^2 (e) 20.0 rad/s^2

18. What is its rotational inertia?

(a) 0.200 kgm^2 (b) 0.027 kgm^2 (c) 0.300 kgm^2 (d) 0.030 kgm^2 (e) 0.225 kgm^2

Questions 19-21



The figure shows a 18 kg, uniform ladder of length L hinged to a horizontal platform at point P_1 and anchored with a steel cable attached at the ladder's midpoint. At the equilibrium, the angle α between the ladder and the floor is 60.0°, and the angle θ between the rope and the floor is 30.0°. (cos(60°)=0.5, sin(60°)=0.86, sin(30°)=0.5, cos(30°)=0,86 and g = 10 m/s^2).

19. Calculate the tension in the cable when a 76-kg person is standing three-quarters of the way up the ladder.

(a) 1880 N (b) 2611 N (c) 1093 N (d) 1320 N (e) 2186 N

20. Calculate the horizontal force component in the hinge when a 76-kg person is standing three-quarters of the way up the ladder.

(a) 2200 N (b) 2602 N (c) 1560 N (d) 1100 N (e) 1135 N

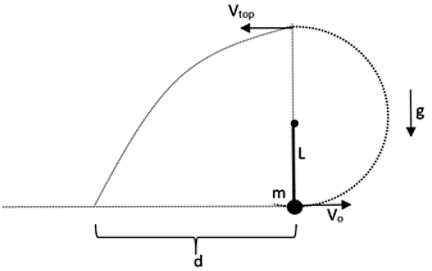
21. Calculate the vertical force component in the hinge when a 76 kg person is standing three-quarters of the way up the ladder.

(a) 940 N (b) 1593 N (c) 1220 N (d) 1600 N (e) 2590 N

22. A 120 kg refrigerator, 2.00 m tall and 85.0 cm wide, has its center of mass at its geometrical center. You are attempting to slide it along the floor by pushing horizontally on the side of the refrigerator. The coefficient of static friction between the floor and the refrigerator is 0.300. Depending on where you push, the refrigerator may start to tip over before it starts to slide along the floor. What is the highest distance above the floor that you can push the refrigerator so that it won't tip before it begins to slide?

(a) 1.63 m (b) 0.71 m (c) 1.00 m (d) 1.21 m (e) 1.42 m

Questions 23-25



A ball of mass m hangs from a string of length L. It is hit in such a way that it then travels in a vertical circle. The initial speed of the ball after being struck is V_0. (Assume that there is no frictional forces doing work on the ball and massless string. g is the magnitude of the gravitational acceleration.)

23. Find the speed of ball at the highest point of the circle, (V_{top}=?).

(a) $\sqrt{V_0^2+4gL}$ (b) $\sqrt{V_0^2-2gL}$ (c) $\sqrt{V_0^2+2gL}$ (d) $\sqrt{V_0^2-4gL}$ (e) $\sqrt{V}$

24. Find the tension in the string when the ball is at the top of the circle.

(a) $\frac{mV_0^2}{L}-3mg$ (b) $\frac{m(V_0^2-4gL)}{L}$ (c) $\frac{mV_0^2}{L}$ (d) $\frac{mV_0^2}{L}+3mg$ (e) $\frac{mV_0^2}{L}-5mg$

25. Find the distance d when the ball left the string at the top of the circle.

(a) $2\sqrt{\frac{(V_0^2-4gL)L}{g}}$ (b) $\sqrt{\frac{(V_0^2-4gL)L}{g}}$ (c) $2\sqrt{\frac{(V_0^2+4gL)L}{g}}$ (d) $4\sqrt{\frac{(V_0^2-4gL)L}{g}}$ (e) $2\sqrt{\frac{(V_0^2-2gL)L}{g}}$