Practice Physics 111 Final Exam

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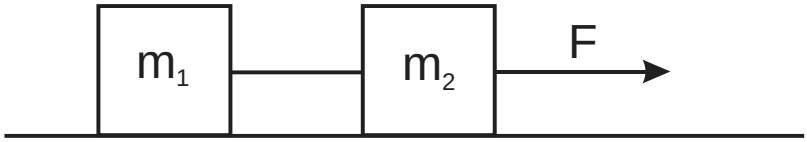
1. A student throws a set of keys vertically upward to her sorority sister, who is in a window 4.0m above. The second student catches the keys 1.50s later. With what initial speed were the keys thrown?

A) 32 m/s
B) 41m/s
C) 10m/s
D) 22 m/s
E) 82 m/s

2. Two blocks (m_1 =2kg, m_2 =4kg) are tied together by a string and pulled across a horizontal frictionless surface as shown in the figure. The external force which pulls m_2 has a magnitude of F=10N. Calculate the magnitude of the tension in the string between the two blocks.

A) 10 N
B) 1.7 N
C) 6.7 N
D) 3.3 N
E) none of the above



3. The position of a particle as a function of time is given by $\vec{r}(t) = 15t^2\hat{i} + 5t\hat{j} - 20t\,\hat{i} + 4t^4\,\hat{j}$. What is the magnitude of the acceleration at t=0.5s?

A) 22 m/s^2
B) 42 m/s^2
C) 2 m/s
D) 8.6 m/s
E) none of the other answers

4. An object moves with constant acceleration 4 m/s^2 and over a time interval reaches a final velocity of 12 m/s. If its initial velocity is -6m/s, what is its displacement during the time interval.
A) none of the other answers
B) 21 m
C) 42.1 m
D) 225 m
E) 13.5 m

5. Three forces (all in units of Newtons) acting on an object are given by $\vec{F}_1 = -2.0\hat{i} + 2.0\hat{j}$, $\vec{F}_2 = 5.0\hat{i} - 3.0\hat{j}$ and $\vec{F}_3 = -45.0\hat{i}$. The object experiences and acceleration of 3.75 m/s^2. What is the mass of the object?

A) 33.1 kg
B) 20.4 kg
C) 8.9 kg
D) 11.2 kg
E) 68 .4 kg

6. A block of mass 0.3kg slides UP a frictionless plane having an inclination of θ =25^0. The block initially moves with a speed of 4m/s. Find the magnitude of the acceleration of the block.

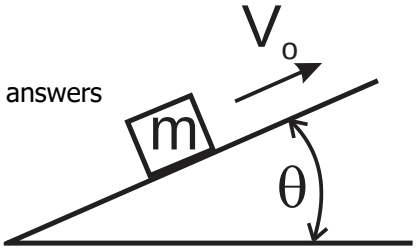
A) 8.9 m/s^2

B) 2.9 m/s^2

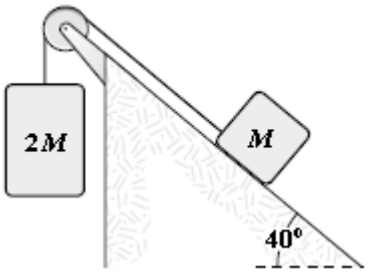
C) none of the other answers

D) 0 m/s^2

E) 4.1 m/s^2



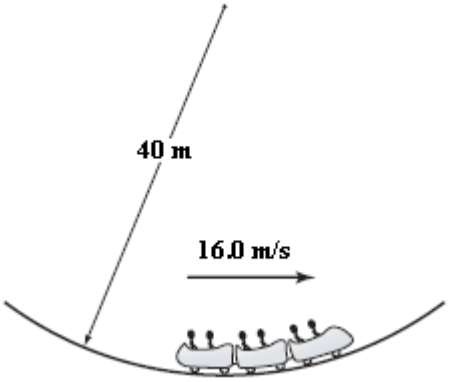
7. In the figure shown, the coefficient of kinetic friction between the block and the incline is 0.40. What is the magnitude of the acceleration of the suspended block as it falls? Disregard any pulley mass or friction in the pulley.



a. 3.4 m/s^2
b. 3.7 m/s^2
c. 4.2 m/s^2
d. 3.9 m/s^2
e. 5.4 m/s^2

8. A roller-coaster car has a mass of 500 kg when fully loaded with passengers. At the bottom of a circular dip of radius 40 m (as shown in the figure) the car has a speed of 16 m/s. What is the magnitude of the force of the track on the car at the bottom of the dip?

a. 3.2 kN
b. 8.1 kN
c. 4.9 kN
d. 1.7 kN
e. 5.3 kN



9. A pendulum is made by letting a 2.0-kg object swing at the end of a string that has a length of 1.5 m. The maximum angle the string makes with the vertical as the pendulum swings is 30°. What is the speed of the object at the lowest point in its trajectory?

a. 2.0 m/s
b. 2.2 m/s
c. 2.5 m/s
d. 2.7 m/s
e. 3.1 m/s

10. How much work is done by a person lifting a 2.0-kg object from the bottom of a well at a constant speed of 2.0 m/s for 5.0 s?

a. 0.22 kJ
b. 0.20 kJ
c. 0.24 kJ
d. 0.27 kJ
e. 0.31 kJ

11. A 1.5-kg block sliding on a rough horizontal surface is attached to one end of a horizontal spring (k = 200 N/m) which has its other end fixed. If this system is displaced 20 cm horizontally from the equilibrium position and released from rest, the block first reaches the equilibrium position with a speed of 2.0 m/s. What is the coefficient of kinetic friction between the block and the horizontal surface on which it slides?

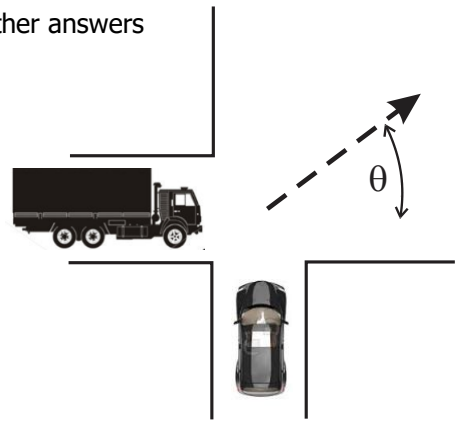
a. 0.34
b. 0.24
c. 0.13
d. 0.44
e. 0.17

12. If a 70-kg athlete were to bicycle to the summit of a 500-m high mountain while expending power at a constant rate of 746W, the amount of energy used by the athlete to cycle to the summit would be

a. 746 J
b. 3.43×10^5 J
c. 3.73×10^5 J
d. 7.46×10^5 J
e. 2.61×10^7 J

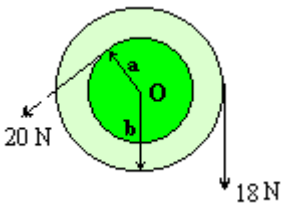
13. A car (mass 1000 kg) heading north runs a stop sign and collides with a truck (mass 3000 kg) which is heading East at a speed of 30m/s. After the collision, the car and truck are stuck together and move at an angle of 35 degrees relative to the East direction (see figure). What is the speed of the car BEFORE the collision.

A) none of the other answers
B) 14 m/s
C) 21 m/s
D) 90 m/s
E) 63 m/s



14. A multi-level pulley of rotational inertia I = 0.1 kg.m^2 is pivoted about a frictionless axis through O and perpendicular to the pulley, as shown in the figure (not to scale). If a = 10 cm and b = 15 cm (see the figure) what is the angular acceleration of the pulley ?

A) 7.0 rad/s^2 clockwise
B) 7.0 rad/s^2 counterclockwise
C) 2.0 rad/s^2 counterclockwise
D) 2.0 rad/s^2 clockwise
E) 0 rad/s^2 , equilibrium



15. A meter stick is pivoted at one end and is allowed to swing freely starting from horizontal position. Find the angular velocity ω (in rad/s) when the meter stick is in the lowest vertical position.

A) 7.7
B) 15
C) 5.4
D) 4.7
E) 11

16. A fast 9-gram bullet gets stuck in a wooden block with mass M=3 kg, initially at rest. After the impact, the block starts moving with velocity 1.5 m/s . Find the initial speed of the bullet.

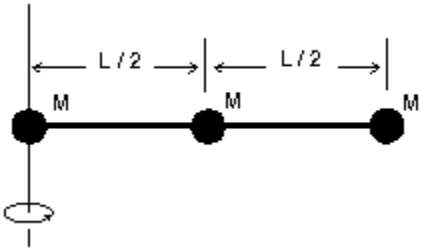
A) 250 m/s
B) 500 m/s
C) 750 m/s
D) 1000 m/s
E) 1500 m/s

17. A solid ball is at the top of an incline of vertical height H=10m. It is released from rest and rolls without slipping. The mass of the ball is M = 2 kg and radius is R = 0.2 m. Calculate the final speed of the ball at the bottom of the incline.

A) 12 m/s
B) 11 m/s
C) 9.9 m/s
D) 14 m/s
E) 22 m/s

18. Three identical objects of mass M = 4kg are fastened to a massless rod of length L = 1m as shown. The rotational inertia (in kg m^2) about one end of the rod of this array is:

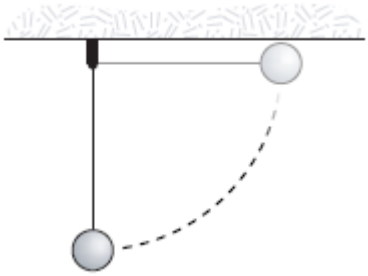
A) 1
B) 2
C) 3
D) 4
E) 5



19. Two vectors lying in the *xy* plane are given by the equations $\vec{A} = 5\hat{i} + 2\hat{j}$ and $\vec{B} = 2\hat{i} - 3\hat{j}$. The value of $\vec{A} \times \vec{B}$ is

a. $19\hat{k}$
b. $-11\hat{k}$
c. $-19\hat{k}$
d. $11\hat{k}$
e. $10\hat{i} - \hat{j}$

20. In the figure, a 1.6-kg mass swings in a vertical circle at the end of a string having negligible weight. The string is 2 m long. If the mass is released with zero initial velocity from a horizontal position, its angular momentum (in kg×m^2/s) at the lowest point of its path relative to the center of the circle is approximately



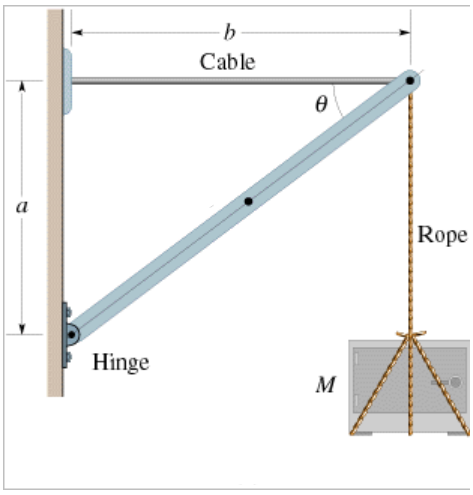
a. 40
b. 10
c. 30
d. 20
e. 50

21. A CD with rotational inertia of 2×10^{-4} kg.m^2 is freely spinning at 33 rev/min. A 5-gram chewing gum is dropped vertically onto the CD a distance of 7 cm from the axis of rotation. What is the new revolution frequency?

A) 27 rev/min
B) 29 rev/min
C) 31 rev/min
D) 33 rev/min
E) 35 rev/min

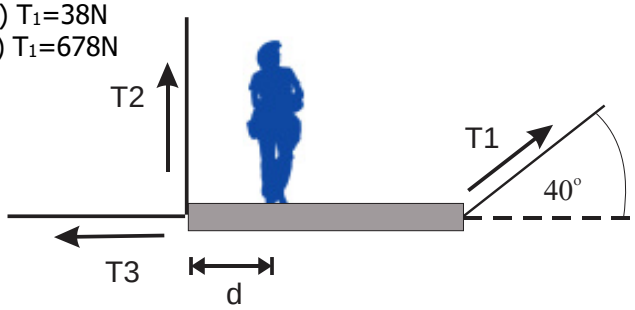
22. A safe whose mass is M = 500 kg is hanging by a rope from a massless bar whose length components are a = 4 m and b=5 m. The end of the bar near the wall is hinged and a horizontal (massless) cable attached to the wall holds up the other end. Find the tension in the horizontal cable.

A) 333 N. B) 1634 N. C) 1837 N.
D) **6125 N.** E) 4900 N.



23. A uniform plank of length 2.0m and mass 30kg is supported by three ropes as indicated by the blue vectors in the figure. Find the tension T3 when a 700N person is d=0.5m from the left end.

A) T_1=236 N
B) T_1=374N
C) T_1=501 N
D) T_1=38N
E) T_1=678N



24. What is the magnitude of the free-fall acceleration at a point that is a distance 2*R* **above the surface** of the Earth, where *R* is the radius of the Earth?

a. 4.8 m/s^2
b. 1.1 m/s^2
c. 3.3 m/s^2
d. 2.5 m/s^2
e. 6.5 m/s^2

25. What is the escape speed from a planet of mass *M* and radius *R* if *M* = 3.2 x 10^{23} kg and *R* = 2.4 x 10^6 m assuming that the object is initially at the planet's surface?

a. 5.5 km/s
b. 4.2 km/s
c. 5.2 km/s
d. 4.8 km/s
e. 3.7 km/s

26. A solid rock, suspended in air by a spring scale, has a measured mass of 9.00 kg. When the rock is submerged in water, the scale reads 3.30 kg. What is the density of the rock?(water density = 1,000 kg/ m^3).

a) 4.55 x 10^3 kg/m^3
b) 3.50 x 10^3 kg/m^3
c) 1.20 x 10^3 kg/m^3
d) **1.58 x 10^3 kg/m^3**
e) 1.35 x 10^3 kg/m^3