Physics 101 **Feb 3rd, 1996**
Final Exam **Time : 2 hours**

NAME:_____

ID. No._____ **section** _____

Encircle your section

sect. 1. 11, MWF & 1, F	**Dr. Bodakian**
sect. 2. 9,TT & 11, TT	**Dr. Zableet**
sect. 3. 9,TT & 2-4 F	**Dr. Katul**

Physics 101 Final Exam **Feb. 3rd, 1996**
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Part A:

I. The apparent weight of a 60-kg man in an elevator going up with an acceleration of 2.0 m/s^2 is in N :

a) 530 b) 590 c) 650 d) 710

e) none of the above, my answer is : _____

_____

II. A body sliding down a 30° incline of $\mu_k = 0.20$, has a constant acceleration of :

a) $2g$ b) g c) $g/2$ d) $g/3$

e) none of the above, my answer is : _____

_____

III. A curve of 9.0 m radius of curvature is banked 9.0°. The maximum allowable car speed without slipping is in km/h :

a) 20 b) 30 c) 40 d) 50

e) none of the above, my answer is : _____

_____

IV. A 0.15-kg ball is moving at a speed of 40 m/s when it is struck by a bat that reverses its direction and gives it a speed of 60 m/s.
What average force was exerted by the bat if it was in contact with the ball for 5.0 ms.

a) 1500N b) 600 N c) 2500 N d) 3000 N

e) none of the above, my answer is : _____

_____

V. A soccer player kicks a ball at an angle of 37° above the horizontal with an initial speed of 15 m/s. Assuming that the ball reaches the highest point of its trajectory, at what time will it be reached ?

a) 1.55 s b) 0.92 s c) 1.93 s d) 0.56 s

e) none of the above, my answer is : _____

_____

Physics 101 **Final Exam** **Feb. 3rd, 1996**
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VI. 1) An automobile of mass 1360 kg has wheels 76.2 cm in diameter and of mass 27.2 kg each. Taking into account the rotational kinetic energy of the wheels about their axles, what is the total kinetic energy of the automobile when traveling at 80 km/h?

a) 1.54×10^3 J b) 2.84×10^4 J c) 3.84×10^5 J d) 2.84×10^5 J

e) none of the above, my answer is :_____

2) Considering that each wheel has a mass distribution equivalent to that of a uniform disk, what percentage of the kinetic energy belongs to the rotational motion of the wheels about their axles ?

a) 2.0 % b) 2.7 % c) 3.2 % d) 3.9 % e) 6.0 %

f) none of the above, my answer is :_____

VII. The pulley of an Atwood machine is a brass disk of mass 120 g. Masses m_1 = 450-g and m_2 = 455-g are suspended at the extremities of a massless string that runs without slipping over the pulley. It is found that the larger mass descends 1.6 m in 8.0 s starting from rest. The value of g (gravity acceleration) under the conditions of the experiment is in m/s^2.

a) 8.7 b) 9.1 c) 9.5 d) 9.7 e) 9.8

e) none of the above, my answer is :_____

VIII. A 4.0 kg block extends a spring 16 cm from its unstretched position. The block is removed and a 0.5-kg body is hung from the same spring. If the spring is then stretched and released, the period of oscillation of the system is:

a) 0.42 s b) 0.15 s c) 0.55 s d) 0.28 s

e) none of the above, my answer is :_____

Physics 101 **Final Exam** **Feb. 3rd, 1996**
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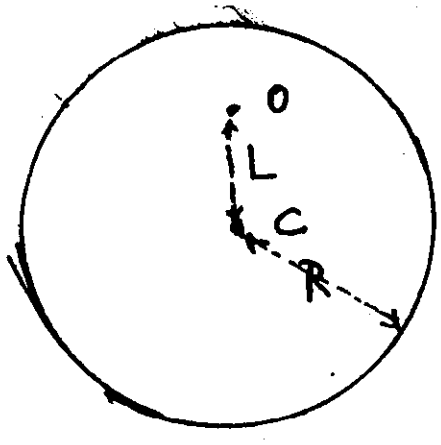
Part B :

I. A physical pendulum has the shape of a disk of radius R. The pendulum swings about an axis perpendicular to the plane of the disk and at distance L from the center of the disk.



a) Show that the angular frequency of the oscillations of this pendulum is $\omega = \sqrt{\frac{gL}{\frac{R^2}{2} + L^2}}$

b) For what value of L is this frequency at a maximum ?

Physics 101 **Final Exam** **Feb. 3rd, 1996**
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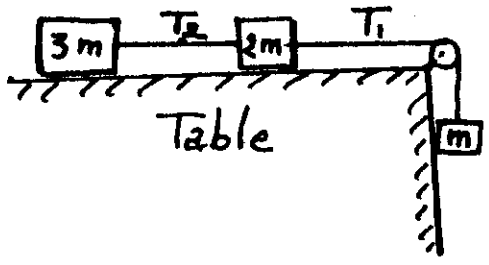
II. Consider the system shown by the adjacent figure. The table is frictionless and the pulley is light and frictionless.



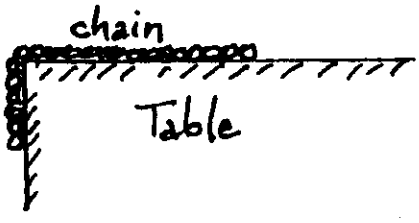
a) Find the acceleration of the system for m = 1.0-kg

b) Find the tensions T_1 and T_2.

c) Find the work done by T_2 on 2 m as m falls through 1.0 m.

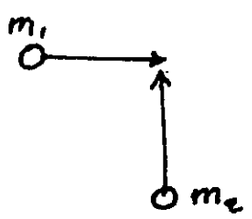
Physics 101 **Final Exam** **Feb. 3rd, 1996**
Time : 2 hours

III. A chain of mass m and length L is held on a frictionless table with one fifth of its length over the edge. Find the work required to pull the hanging part back on the table.



Physics 101 **Final Exam** **Feb. 3rd, 1996**
Time: 2 hours

IV. Two skaters collide and embrace in a completely inelastic collision. That is they stick together after impact. One, whose mass m_1, is 70-kg, is initially moving east at 6.0 km/h while the other, whose mass m_2 is 50-kg is initially moving north at 8.0 km/h.



Calculate :

a) The final velocity of the couple.

b) The initial kinetic energy of the skaters.

c) The final kinetic energy of the skaters.

d) The fraction of the initial kinetic energy of the skaters lost because of the collision.

V. A uniform disk rotates about a fixed axis, starting from rest and accelerating with a constant angular acceleration. At one time it is rotating at 10 rev/s. After completing 60 more complete revolutions its angular speed is 15 rev/s.

Calculate :

a) Its angular acceleration in rev/s^2

b) The time required to complete the 60 revolutions.

c) The time required from the start to attain the 10 rev/s angular speed.

Physics 10

Final Exam

Feb. 3rd , 1996
Time : 2 hours

VI. A particle moves back and forth along the x-axis between the points x = 0.20 m and x = -0.20 m. The period of the motion is 1.2 s and it is simple harmonic. At a time t = 0 the particle is at x = 0.0 m and its velocity is positive.

a) What is the frequency of the motion ?

b) What is the angular frequency ?

c) What is the amplitude of the motion ?

d) What is the phase constant ?

e) At what time will the particle reach the point x = 0.10 m for the first time ?

f) What is the speed of the particle when it is at x = 0.10 m ?