Physics 2211M   Test form **522**   Name _____

Summer 2015

Test 2   Recitation Section (see back of test):_____

1) Print your name, test form number (above), and nine-digit student number in the section of the answer card labeled "STUDENT IDENTIFICATION".

2) Bubble your test form number (**ABOVE**) in columns 1-3, skip column 4, then bubble in your student number in columns 5-13.

3) For each free-response question, show all relevant work supporting your answer. **Clearly box or underline your final answer.** "Correct" answers which are not supported by adequate calculations and/or reasoning will be counted wrong.

4) For each multiple-choice question, select the answer most nearly correct, **circle this answer on your test**, and bubble it in on your answer card. **Show all relevant work on your quiz.**

5) Be prepared to present your Buzzcard as you turn in your test. Scores will be posted to WebAssign after they have been been graded. **Quiz grades become final when the next quiz is given.**

6) You may use a simple scientific calculator capable of logarithms, exponentials, and trigonometric functions. **Programmable engineering calculators with text or graphical capabilities are not allowed. Wireless devices are prohibited.**
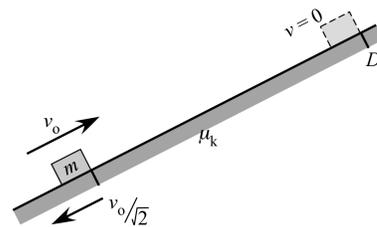
A
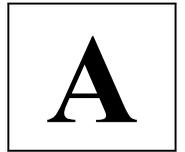
Your test form is: 522

Our next test will be on Monday, July 13!

The following problem will be hand-graded.   Show all your work for this problem.   Make no marks and leave no space on your answer card for it.

[I]   *(20 points)*   A block is given a shove up a <u>rough</u> ramp that is inclined at an angle $\theta = 27.0°$ above the horizontal, with an initial speed v_o. It slides a distance D up the incline, stops momentarily, and then slides back down the ramp. It passes its starting point moving with a speed $v_o/\sqrt{2}$.

What is the coefficient of kinetic friction between the block and the ramp?

Hint: let a_u be the acceleration magnitude while sliding <u>up</u> the incline, and let a_d be the acceleration magnitude while sliding <u>down</u> the incline. Use kinematics to relate a_d to a_u, eliminating v_o and D. Then apply the 2nd Law to each trip.

The following problem will be hand-graded. <u>*Show all your work for this problem*</u>. *Make no marks and leave no space on your answer card for it.*

[II] *(20 points)* In the figure at right, a block of mass m rests upon a block of mass $2m$. The lower block is pulled along the ground by a horizontal force P, such that the two blocks accelerate *together* to the right. The coefficient of <u>static</u> friction between the two blocks is $\mu_s = 0.50$ and the coefficient of <u>kinetic</u> friction between the lower block and the ground is $\mu_k = 0.25$.

μ_s | m | P
$2m$
μ_k
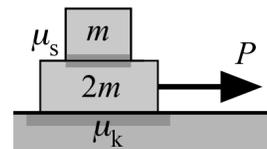
What is the maximum pulling force P for which block m will not slip off block $2m$ as they move? Express your answer as a multiple of mg.

The following problem will be hand-graded. <u>*Show all your work for this problem*</u>. *Make no marks and leave no space on your answer card for it.*

[III] *(20 points)* The SkyView Atlanta ferris wheel has a radius $R = 30.5$ m. It typically rotates with an angular speed of about 0.25 rev/min ($\omega_0 = 0.262$ rad /sec). One day, a passenger is riding the wheel when a deranged physics instructor sabotages the mechanism so that the wheel rotates at a much greater speed. The passenger—who conveniently has a metric bathroom scale in his backpack—measures his <u>apparent</u> weight a the top to be $W_T = 970$ N and his <u>apparent</u> weight at the bottom to be $W_B = 630$ N.

Construct free body diagrams for the passenger <u>at both top and bottom</u>, and use the Second Law to determine the true weight of the passenger (i.e. the gravitational force mg acting on him), and the new angular speed ω_f for the wheel.

Remember—you're always rightside-up on a ferris wheel!
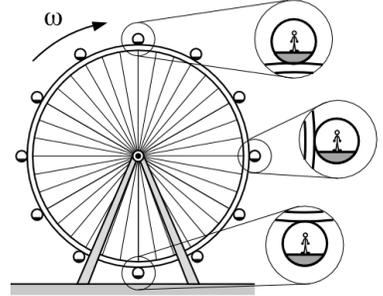
Question value 4 points

(1) A passenger is riding a glass-walled elevator that is accelerating upward, when she passes an observer who is stationary on a nearby balcony. The passenger drops a golfball from her extended hand, and both passenger and observer record their observations. The stationary observer reports that the golf ball experienced a downward gravitational force mg, and an acceleration of magnitude g. What does the passenger report?

(a) She sees an acceleration *equal* to g, due to a perceived force *equal* to the ball s true weight.
(b) She sees an acceleration *less* than g, due to a perceived force *less* than the ball's true weight.
(c) She sees an acceleration *less* than g, due to a perceived force *greater* than the ball's true weight.
(d) She sees an acceleration *greater* than g, due to a perceived force *less* than the ball's true weight.
(e) She sees an acceleration *greater* than g, due to a perceived force *greater* than the ball's true weight.

Question value 4 points

(2) A cannon fires a projectile *horizontally* from atop a cliff. The cannonball leaves the cannon traveling with a speed v, and immediately experiences a drag force of magnitude D. If a second cannonball is fired *vertically* from atop the cliff with a speed $2v$, what will be the magnitude of the drag force it experiences as it leaves the cannon?

(a) D
(b) $D + mg$
(c) $4D$
(d) $D - mg$
(e) $2D$

Question value 8 points

(3) When a car passes over the top of a hill at a speed of 16 m/s (36 mph or 58 kph), the 80-kg driver—who is not wearing his seatbelt—finds that he momentarily loses contact with his seat. What is the radius of curvature of the hill?


(a) 26 m
(b) 20 m
(c) 49 m
(d) 36 m
(e) 30 m

Question value 4 points

(4) A block M is placed on a frictionless horizontal surface, and is attached via an ideal cord to a hanging mass m, where $m < M$. Which of the diagrams below *best* characterizes the free body diagram for the hanging block, when the larger block is released?

| (a) | (b) | (c) | (d) | (e) |
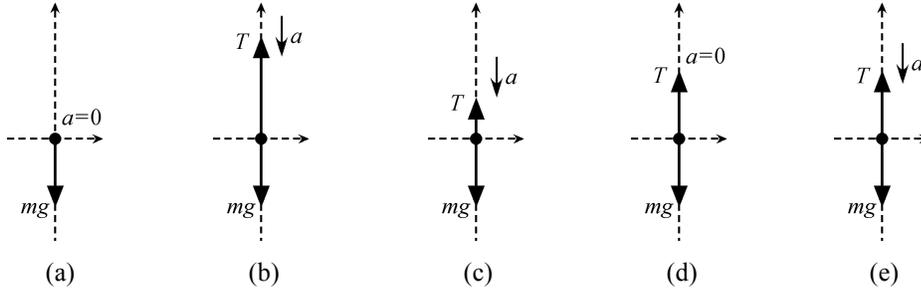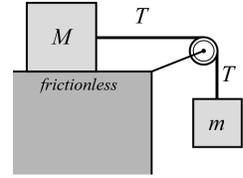
Question value 8 points

(5) You are in a closed boxcar, and cannot see your exterior surroundings. A single lighbulb hangs from the ceiling. You note that the cord, of length $L = 1.25$ m, is tilted at an angle of 17° to your left. What can you deduce about the state of motion of the boxcar?
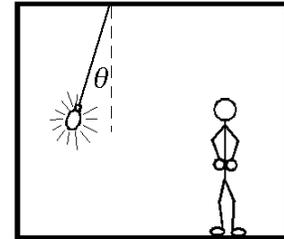

(a) The boxcar is accelerating to the right at 3.0 m/s^2.

(b) The boxcar is rest.

(c) The boxcar is moving to the right at a constant speed of 1.9 m/s.

(d) The boxcar is accelerating to the left at 3.0 m/s^2.

(e) The boxcar is moving to the left at a constant speed of 1.9 m/s.

Question value 4 points

(6)   Block A rest on block B, which in turn rests on the floor of an elevator that is moving downward at constant speed. What force is paired with the normal upward normal force by the floor on block B?

   (a)   The weight of *both* blocks A and B, acting downward on block B.
   (b)   The downward normal force by block B on the floor.
   (c)   The downward normal force by block A on block B
   (d)   The downward normal friction force of block A on block B.
   (e)   The weight of block A acting downward on block B.
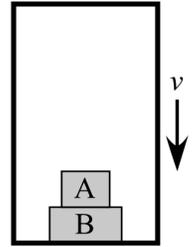
Question value 8 points

(7)   A block of weight $W = 10$ N is held *stationary* against a vertical wall by a 15-N pushing force P, directed as shown at right. The coefficient of static friction between the block and wall is $\mu_s = 0.50$. What is the magnitude and direction of the friction force acting on the block?

   (a)   8 N, downward
   (b)   1 N, upward
   (c)   4 N, upward
   (d)   6 N, upward
   (e)   2 N, downward
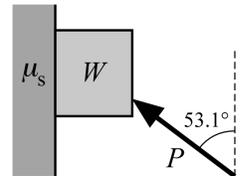
PHYS 2211M Recitation TA and Room Assignments

Tests will be returned in recitation, in the week *after* the test. In order to ensure that you receive your test back <u>as soon as possible</u>, please enter your recitation section from the table above on the front of this test.

		Room 123
TUESDAY		
	2:20–3:10 pm	M04 Kothari, Kartik
	3:20–4:10 pm	M03 Kothari, Kartik
	4:20–5:10 pm	M01 Ge, Luwei
WEDNESDAY		
	2:20–3:10 pm	
	3:20–4:10 pm	M05 Shi, Chao
	4:20–5:10 pm	M02 Shi, Chao
THURSDAY		
	2:20–3:10 pm	M08 Ge, Luwei
	3:20–4:10 pm	