Physics 2211 ABC Test form **441** Name _____
Fall 2014
Test 4 Recitation Section (see back of test):_____

A

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.

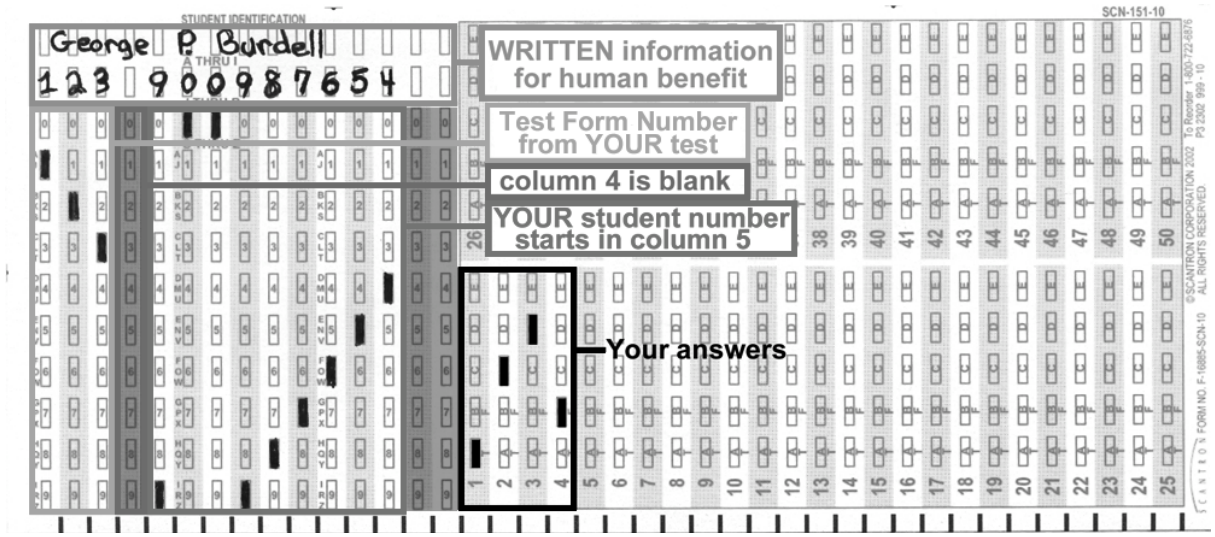
3) For each free-response question, show all relevant work supporting your answer. **Clearly box or underline your final answer.** "Correct" answers which are not supported by adequate calculations and/or reasoning will be counted wrong.

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.**

Your test form is: 441

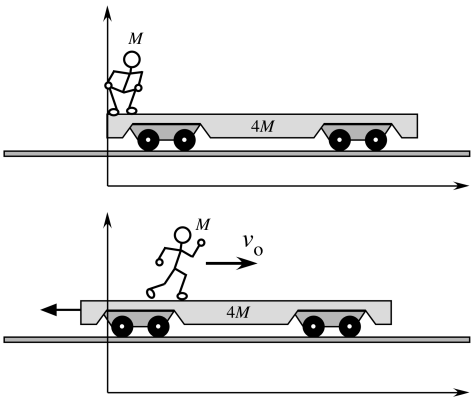


Our next test will be on Monday, November 17!

Our Final Exam will be on Thursday, December 11 [Period Ten, 8:00am]

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] A sumo wrestler (mass M) is at rest at the very end of a flatcar (mass $4M$, length L) that is initially at rest. He then begins to run toward the other end of the flatcar with a speed v_o, *measured relative to the car, not the ground*.

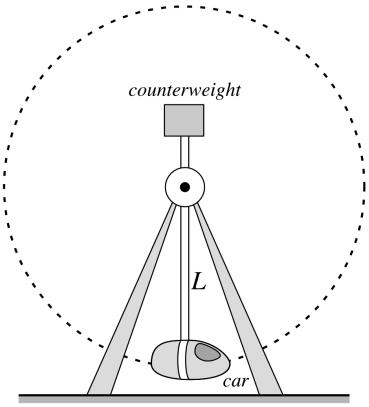


(A) *(12 points)* Determine the velocity of both the sumo and the flatcar, as measured by an observer on the gound. (You may presume that there is negligible rolling friction between the flatcar's wheels and the ground.)

(B) *(8 points*) How far has the flatcar rolled at the moment the sumo reaches the other end of the car? How far is the sumo from his starting position, at that moment? [No, it is *not* simply L!]

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.

[II] In a carnival ride known as the Loop-O-Plane, passengers are strapped into an enclosed car that is whirled in a vertical circle by a rigid arm of length $L = 5.0$ m. As the car passes through the highest point, passengers are inverted in their seats.

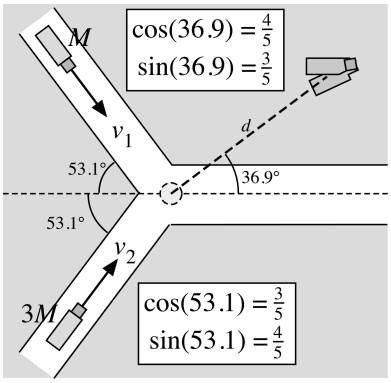


(A) *(12 points)* A passenger riding in the car experiences a perceived weight equal to **half** his true body weight, pushing him *up in to his seat* as he passes through the highest point of his path. At that moment, what is the angular speed of the car? Express your answer in revolutions per second.

(B) *(8 points*) If the car maintains the same angular speed throughout its full arc, what will be the passenger's perceived weight as he passes through the very bottom of the arc? Express your answer as a fraction or multiple of *mg*.

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.

[III] You are a traffic investigator, inspecting the aftermath of a two-truck collision at a Y-intersection. The first truck is unloaded, having mass *M*. The second truck is loaded, and has a mass 3*M*. Just before the collision, a traffic radar system clocked the unloaded truck moving at the posted speed limit, v_1= 35 mph (15.6 m/s).



(A) *(12 points)* Skid marks for the two vehicles indicate that they slid together at an angle of 36.9° north of east. From this information, determine the speed $v_2$of the loaded truck just before the collision. Was it exceeding the posted speed limit?

(B) *(8 points)* The skid marks along the pavement extend for a distance *d* = 9.5 m. What is the coefficient of friction between the trucks' tires and the ground? [Hint: your work in Part A should help you find their speed just *after* they collide.]

Question value 8 points

(1) A rocket powered sled of mass m = 500 kg generates 12,000 N of thrust. The sled is launched up a frictionless 20° ramp. Which of the paths at right best describes the trajectory of the sled after it leaves the ramp and becomes airborne? (You may assume that the rocket sled continues to aim its nose 20° above the horizontal, after leaving the ramp.)

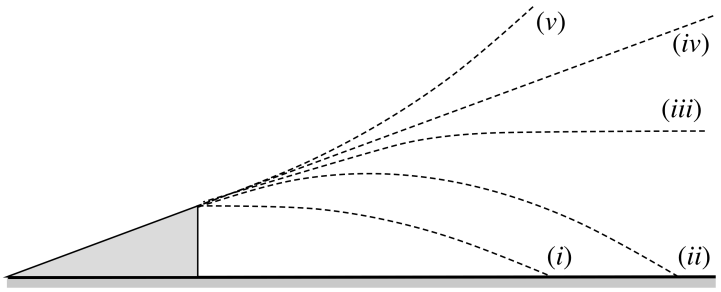
(a) Path (*iii*)

(b) Path (*iv*)

(c) Path (*i*)

(d) Path (*ii*)

(e) Path (*v*)



Question value 8 points

(2) A conical pendulum consists of a cord of length L = 75 cm that can sustain a maximum tension T = 250 N. The pendulum bob has a mass m = 0.50 kg. With what *maximum* angular speed can the bob be rotated without breaking the cord?

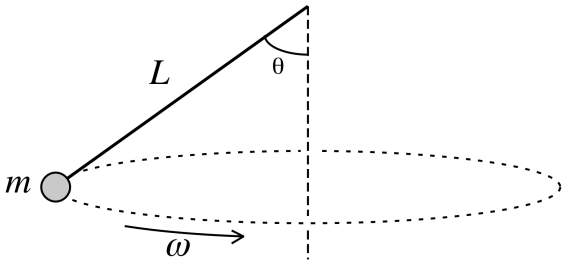
(a) ω_{max}= 2.9 rev/sec

(b) ω_{max}= 4.1 rev/sec

(c) ω_{max}= 3.6 rev/sec

(d) ω_{max}= 5.5 rev/sec

(e) ω_{max}= 4.7 rev/sec



Question Value 8 points

(3) Tom pushes an empty shopping cart with mass m, applying a force of magnitude F for a time T. Bob pushes a loaded shopping cast with mass $3m$, applying a force of magnitude $4/3\ F$ for a time $T/2$. Both carts begin at rest. What are the relative momenta of the two carts, when Tom and Bob stop pushing?

(a) $p_B = 2p_T$

(b) $p_B = \frac{4}{3}p_T$

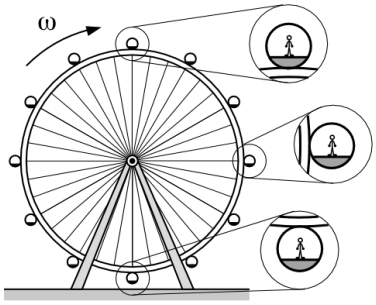
(c) $p_B = p_T$

(d) $p_B = \frac{1}{2}p_T$

(e) $p_B = \frac{2}{3}p_T$

Question value 8 points

(4) You are riding in the London Eye, a very large ferris wheel that usually rotates at a leisurely speed of two revolutions per hour. However, a maniac has sabotaged the control mechanism, causing the eye to rotate at two revolutons *per minute*! Rank in order, from greatest to least, your *perceived weight* at the top (W_T), your *perceived weight* at the bottom (W_B), and your *true weight* ($W_o = mg$).



(a) $W_B > W_o > W_T$

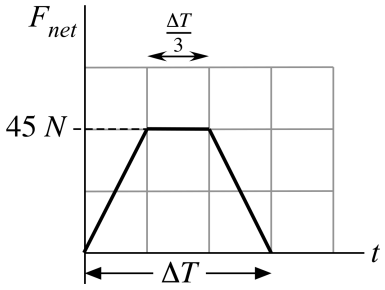
(b) $W_B = W_T > W_o$

(c) $W_B = W_o > W_T$

(d) $W_o > W_B = W_T$

(e) $W_T > W_o > W_B$

The next two questions involve the following situation:
A basketball of mass m = 0.650 kg strikes the ground moving downward with a speed v_i= 4.00 m/s, and rebounds upward a few moments later with a speed v_f = 2.00 m.s. The graph at right shows the net force acting on the ball while it is in contact with the earth.



Question value 4 points
(5) What is the magnitude of the total impulse delivered to the ball by the earth?

(a) 1.30 N·s

(b) 3.90 N·s

(c) 2.60 N·s

(d) 1.95 N·s

(e) 2.90 N·s

Question value 4 points
(6) What is the total time ΔT that the ball is in contact with the earth?

(a) 0.33 seconds

(b) 0.13 seconds

(c) 0.04 seconds

(d) 0.21 seconds

(e) 0.09 seconds

Question value 4 points extra credit
(7) When is the final exam for this class?

(a) Period Ten — Thursday December 11 at 8:00 am

(b) Period One — Monday December 8 at 8:00am

(c) Period Seven — Wednesday December 10 at 8:00am

(d) Period Fourteen — Friday December 12 at 11:30am

(e) I don't know because I didn't read the front page of this test.

PHYS 2211 ABC 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 as soon as possible, please enter your recitation section from the table above (G01–G10) on the front of this test.

	Clough 125	Clough 127	Clough 131	Clough 325
WEDNESDAY				
12:05 – 12:55 pm	A01 Shi, Chao			
1:05 – 1:55 pm				B01 Shi, Chao
2:05 – 2:55 pm	C01 Liberi, Brandon			A06/B02 Shi, Chao
3:05 – 3:55 pm				B05/C06 Ravipati, Akshay
4:05 – 4:55 pm		A05/C07 Strauss, Hunter		C02 Shi, Chao
5:05 – 5:55 pm	A02 Zhou, Jiarun	B06 McMahon, Brian		
THURSDAY				
12:05 – 12:55 pm	B03 Liberi, Brandon			
1:05 – 1:55 pm		C03 Kosaraju, Raj		
2:05 – 2:55 pm	B08 Kharbouch, Adel	A03 Lall, Siddharth		
3:05 – 3:55 pm		A07/B07 Lall, Siddharth	C04 Tao, Liangyu	
4:05 – 4:55 pm	A08/C08 Tao, Liangyu			
5:05 – 5:55 pm	C09 Zhou, Jiarun	A04/B09 Strauss, Hunter		
6:05 – 6:55 pm	B04/C05 Minderman, John			