Physics 2211 A/B  Test form $\boxed{611}$  Name ____________________________

Fall 2015

**Exam 1**  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.**

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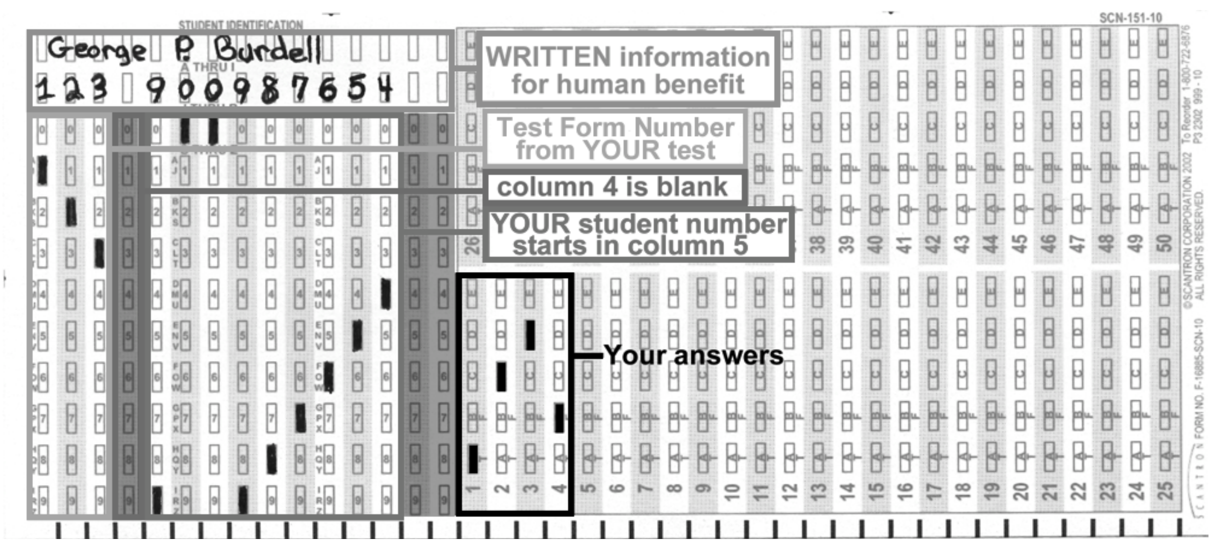
**Your test form is: $\boxed{611}$**

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# Our next test will be on Monday, October 05!

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*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.*

**[I]** *(20 points)* The tortoise and the hare are in a footrace, covering a straight-line distance $D$. The tortoise maintains a steady, plodding speed $v_o$ throughout the race. The hare starts out at a rapid pace $5v_o$, but stops to complacently take a nap after completing ¼ of the distance. He awakens to see the tortoise still plodding along, now 90% finished. In a panic, the hare sets off at his maximum speed, $6v_o$.

Who wins the race? By what time interval $\Delta t$ does the winner beat the loser?

*Express your answer for* $\Delta t$ *algebraically in terms of* $D$ *and* $v_o$.

*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]** *(20 points)* During a manned mission to Mars, Astronaut Mark Watney is stranded on the Red Planet (where the local acceleration is $g = 3.71\ \text{m/s}^2$). In frustration, he throws a stone upward with initial speed $v_1 = 22.2$ m/s, then reaches down to pick up and throw a second stone upward. If he releases the second stone at a moment when the first stone has reached a height $H = 44.4$ m, with what minimum speed $v_2$ must he throw the second stone so that it will strike the first stone *before* it reaches its maximum height?

*Your grader is likely to award more credit if you work algebraically (using the symbols H, g, and $v_1$), saving numerical calculations only for intermediate and/or final values…*

*Don't forget to use the Mars value for g in your calculation!*

*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]** *(20 points)* Two ships depart from the island of Bermuda at noon. Ship S travels in a direction $\theta_S$ = 17.0° east of north with a speed $v_S$ = 22.9 knots. Ship T travels in a direction $\theta_T$ = 23.5° south of west with a speed $v_T$ = 19.3 knots. As the sun sets at 7:00pm, what is the velocity of Ship T relative to Ship S?

*Your work will be graded on the quality of your vector diagram, as well as the accuracy of your answer!*

*You are expected to use the process of vector decomposition for this problem; use of the "Law of Cosines" will be penalized as an error in basic physics.*

*The next two questions involve the following situation:*

A wind-up spring-powered toy car begins at rest at the origin. It moves with a time-dependent acceleration, given by the expression

$$\vec{a}(t) = \langle +\frac{a_0}{T}\, t \rangle, \quad \text{for } 0 \le t \le \mathrm{T}$$

Here, $a_o$ and $T$ are constants having units of accleration and time, respectively. At time $T$, the spring winds down, and the car begins to coast with a constant velocity.

*Question value 5 points*

(1) What is the average velocity of the car between times $t = 0$ and $t = T$?

(a) $\vec{v}_{av} = \langle +\frac{a_0 T}{6} \rangle$

(b) $\vec{v}_{av} = \langle +\frac{a_0 T}{2} \rangle$

(c) $\vec{v}_{av} = \langle +\frac{a_0}{T} \rangle$

(d) $\vec{v}_{av} = \langle +\frac{a_0 T}{4} \rangle$

(e) $\vec{v}_{av} = \langle +\frac{a_0}{3T} \rangle$

*Question value 5 points*

(2) What is the final coasting velocity of the car after the spring winds down?

(a) $\vec{v}_f = \langle +\frac{a_0 T}{4} \rangle$

(b) $\vec{v}_f = \langle +\frac{a_0}{3} \rangle$

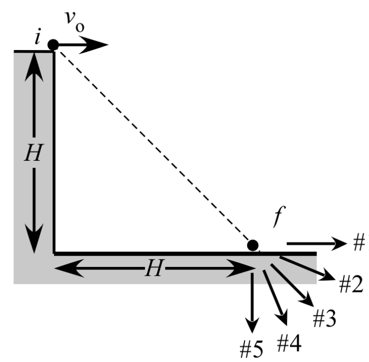
(c) $\vec{v}_f = \langle +\frac{a_0}{2T} \rangle$

(d) $\vec{v}_f = \langle +\frac{a_0}{T^2} \rangle$

(e) $\vec{v}_f = \langle +\frac{a_0 T}{2} \rangle$

*The next two questions involve the following situation:*

A cannonball is fired horizontally with an initial speed $v_o$, from atop a cliff of height $H$. The cannonball is observed to land a horizontal distance from the base of the cliff that is coincidentally exactly equal to $H$.




*Question value 5 points*

(3) Which of the arrows in the figure best depicts the velocity of the cannonball at impact?

(a) #4
(b) #2
(c) #5
(d) #1
(e) #3

*Question value 5 points*

(4) What is the specific value of $v_o$ that will result in the trajectory described?

(a) $v_o = \sqrt{H/2g}$

(b) $v_o = \sqrt{gH/2}$

(c) $v_o = \sqrt{2gH}$

(d) $v_o = \sqrt{2H/g}$

(e) $v_o = \sqrt{gH}$

*Question value  5 points*

(5) Fill in the blanks:  A motion diagram depicts an object that is slowing down.  In the diagram, the ________ between successive frames must be __________ in size.

(a) displacements  ;  decreasing
(b) time intervals  ;  increasing
(c) displacements  ;  increasing
(d) positions  ;  decreasing
(e) time intervals  ;  decreasing

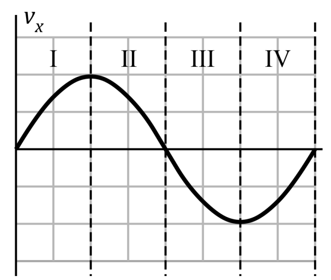
*Question value  5 points*

(6) Fill in the blanks:  A car on a circular track begins at rest and experiences a constant angular acceleration around the track.  As it moves, the magnitude of it's acceleration vector _________ and the direction of its acceleration vector ________ .

(a) remains constant  ;  is always tangential
(b) decreases at first, but then increases ;  changes from being entirely radial to being entirely tangential.
(c) remains constant  ;  maintains a fixed orientation somewhere *between* tangential and radial
(d) increases  ;  is always radial
(e) increases  ;  changes from being entirely tangential to mostly radial

*Question value  5 points*

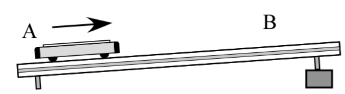
(7) The plot at right depicts the velocity-versus-time graph for a particle that stars at rest at the origin.  During which interval(s) is the particle moving toward the origin?

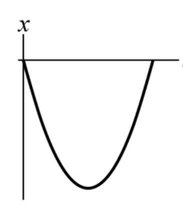



(a) During interval II only.
(b) During intervals III and IV.
(c) During none of the intervals shown.
(d) During intervals II and IV.
(e) During intervals II and III.

*Question value 5 points*

(8) A cart is given an initial shove up an inclined ramp (top).  The cart starts at A, coasts up the track and stops at B, and then returns back down the track to A.  An observer collects position data and constructs the *x*-vs-*t* graph shown at right (bottom).  What coordinate system was the observer using to collect data?




(a) The coordinate system that was used cannot be inferred from the graph.
(b) A system with the origin at B and the positive direction pointing *downslope*.
(c) A system with the origin at A and the positive direction pointing *downslope*.
(d) A system with the origin at B and the positive direction pointing *upslope*.
(e) A system with the origin at A and the positive direction pointing *upslope*.

# PHYS 2211 A/B Recitation TA and Room Assignments

Tests will be returned in recitation, ideally in the *same* week as the test is given. In order to ensure that you receive your test back as soon as possible, please enter your recitation section from the table above on the front of this test.

| | Clough 123 | Clough 125 | Clough 127 | Clough 131 |
|---|---|---|---|---|
| WEDNESDAY | | | | |
| 1:05 – 1:55 pm | B01 Dark, Jason | | | |
| 2:05 – 2:55 pm | | A01 Coenen, Ashley | | |
| 3:05 – 3:55 pm | | | B06 Coenen, Ashley | A05 Cowan, Erika |
| 4:05 – 4:55 pm | B05 Eswar, Aditya | B02 Dark, Jason | A02 Coenen, Ashley | A06 Cowan, Erika |
| THURSDAY | | | | |
| 1:05 – 1:55 pm | | | | |
| 2:05 – 2:55 pm | A03 Eswar, Aditya | B08 Cowan, Erika | B03 Dark, Jason | |
| 3:05 – 3:55 pm | | | A07/B07 Dark, Jason | |
| 4:05 – 4:55 pm | A04 Eswar, Aditya | | B04 Dark, Jason | |
| 5:05 – 5:55 pm | | | A08 Dark, Jason | |