## Practical Group Code

PHY131H1F - SUMMER
Term Test —version 1
Thursday, May 27, 2010
Duration: 80 minutes

PLEASE read carefully the following instructions.
Aids allowed: A pocket calculator with no communication ability. A single aid-sheet prepared by the student, no larger than 8.5 " $\times 11$ ", written on both sides.

- Turn off any communication device you may have and place it far from where you are sitting.
- DO NOT separate the sheets of your question paper. You can, however, "carefully" tear off the blank page at the end, as it does not have to be handed in.
- Before starting, please PRINT IN BLOCK LETTERS your name, student number, and tutorial group code at the top of this page and on the answer sheet.
- Check that the test-version numbers under the shaded circle at the top right of the answer sheet and in the title of your test paper match. If they do not, call an invigilator; if they do, do not write anything on or near the circles.


## Scanned Area of the Answer Sheet:

1. Use a dark-black, soft-lead pencil or a black pen.
2. Mark in your student number by shading the circles in the student number area.
3. Indicate your answer to a multiple-choice question by thoroughly filling the appropriate circle on the answer sheet and also by recording your answer on the test paper.
4. If you wish to modify an answer, erase your pencil mark thoroughly, or use dry tape white-out sparingly.
5. Do not write anything else on the answer sheet. Use the blank sheets at the end or the back of the question sheets for rough work.

The test consists of $\mathbf{8}$ multiple-choice questions, worth 2 points each, or altogether 16 points. The test also has a set of free-form questions worth 12 points, for which fully worked solutions are required. The total possible number of points is 28 .

## Multiple-choice questions:

- Please choose the best answer.
- Blank or incorrect answers are worth zero points.
- Multiple answers for the same question result in zero points for that question.

Free-form Questions: To be awarded maximum credit, you must provide fully worked solutions to all parts of the free-form questions. In addition to showing your work, please put your answer(s) for each part in the boxes provided. You can use the back-side of the sheets and the blank pages at the end for your rough work which will not be graded or taken into account.

When the invigilators declare the test ended, stop any writing or filling of circles on the answer sheet immediately. Please put your answer sheet inside your test paper and have the paper ready for an invigilator to pick up.

# Possibly helpful information for this test: 

## $\pi=3.14159$

## $g=9.80 \mathrm{~m} / \mathrm{s}^{\mathbf{2}}$ is the acceleration due to gravity near the Earth's surface. Air resistance may be neglected in all problems.

## MULTIPLE CHOICE (16 points total)

1. A sheet of metal is known to be exactly square. You make a measurement of the length of one of its sides to be $x=33.30 \mathrm{~cm} \pm 0.05 \mathrm{~cm}$. What is the best way to write the measured area of the square? [You may use the equation Area $=x^{2}$.]
A. $1108.89 \pm 0.05 \mathrm{~cm}^{2}$
B. $1108.9 \pm 0.3 \mathrm{~cm}^{2}$
C. $1109 \pm 2 \mathrm{~cm}^{2}$
D. $1109 \pm 3 \mathrm{~cm}^{2}$
E. $1110 \pm 80 \mathrm{~cm}^{2}$
2. Chad throws a ball straight up. Nicole watches the ball from a balcony 7.0 m above where Chad released it. The ball passes Nicole on the way up, and it has a speed of $15 \mathrm{~m} / \mathrm{s}$ as it passes her again on the way back down. How fast did Chad throw the ball?
A. $9.4 \mathrm{~m} / \mathrm{s}$
B. $14 \mathrm{~m} / \mathrm{s}$
C. $19 \mathrm{~m} / \mathrm{s}$
D. $49 \mathrm{~m} / \mathrm{s}$
E. $84 \mathrm{~m} / \mathrm{s}$
3. A cart slides without friction down a track as shown. As the cart slides beyond the point shown, what happens to its acceleration in the direction of motion and its speed?
A. Both increase.
B. The speed increases, but the acceleration decreases.
C. Both remain constant.

D. The speed decreases, but the acceleration increases.
E. Both decrease.
4. A ball thrown horizontally at $14 \mathrm{~m} / \mathrm{s}$ travels a horizontal distance of 23 m before hitting the ground. From what height was the ball thrown?
A. 13 m
B. 20 m
C. 26 m
D. 30 m
E. 49 m
5. The airspeed indicator on an airplane shows that it is moving through the air at $240 \mathrm{~km} / \mathrm{hr}$. According to the weather report, there is a $110 \mathrm{~km} / \mathrm{hr}$ wind moving from west to east. In what direction should the pilot head in order to travel due north, relative to the ground?
A. $25^{\circ}$ West of North
B. $25^{\circ}$ East of North
C. $27^{\circ}$ West of North
D. $27^{\circ}$ East of North
E. $62^{\circ}$ West of North
6. A monkey is hanging from a high branch in a tree. A zookeeper aims a tranquilizer dart gun directly at the monkey. At the moment the tranquilizer dart is released from the gun, its initial velocity is directly toward the monkey. However, at that same moment, the monkey lets go of the branch, and begins falling. Unfortunately for the zookeeper, the initial speed of the dart is too low, so it reaches a maximum height at a point $P$ before striking the monkey, as shown in the figure. When the dart is at point $P$, where will the monkey be?
A. Point $A$, higher than $P$
B. Point $B$, at the same height as $P$
C. Point $C$, lower than $P$

7. A 1 kg block is pulled along a flat concrete surface with a constant force of 10 N , directed $30^{\circ}$ above the horizontal, as shown. The block is sliding to the right, and the coefficient of kinetic friction between the block and the concrete surface is 0.62 . What is the acceleration of the block?

A. $9 \mathrm{~m} / \mathrm{s}^{2}$, to the right
B. $6 \mathrm{~m} / \mathrm{s}^{2}$, to the right
C. $3 \mathrm{~m} / \mathrm{s}^{2}$, to the right
D. zero
E. $3 \mathrm{~m} / \mathrm{s}^{2}$, to the left
8. A 1200 kg car is traveling at a speed of $23 \mathrm{~m} / \mathrm{s}$ on a level road. Suddenly, the driver sees a deer and slams on the brakes, locking all four wheels. The car skids to a halt. Determine the distance the car travels between the instant the wheels lock, and when it finally stops. Assume the coefficient of kinetic friction between the wheels and the road is $\mu_{\mathrm{k}}=0.80$.
A. 2.9 m
B. 27 m
C. 28 m
D. 34 m
E. 57 m

FREE-FORM IN TWO UNRELATED PARTS (12 points total)
Clearly show your reasoning and work as some part marks may be awarded. Write your final answers in the boxes provided.

## PART A

Two sign-posts are located a distance of $d=25.0 \pm 0.5 \mathrm{~m}$ apart. You and your friend watch cars driving along the road, and you use a stop-watch to measure the time it takes them to drive the distance between the sign-posts. You make the following five measurements for five different cars:
$t_{1}=1.85 \mathrm{~s} \quad t_{2}=1.81 \mathrm{~s} \quad t_{3}=1.88 \mathrm{~s} \quad t_{4}=1.77 \mathrm{~s} \quad t_{5}=1.83 \mathrm{~s}$
(i) What is the estimated mean time for cars to drive the distance between the sign posts? [Please write your final answer in the box provided. Express your error to one significant figure, and make sure the most precise tenth place of the value matches the tenth place of the error.]
(ii) Assume the cars are traveling at constant velocity. Use your value of estimated mean time to find the estimated mean speed of cars on this road. [Please write your final answer in the box provided. Express your error to one significant figure, and make sure the most precise tenth place of the value matches the tenth place of the error.]

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## PART B

Tarzan swings from a rope of length $L=7.5 \mathrm{~m}$, as shown. The other end of the rope is attached to a fixed branch. At the instant shown, the angle of the rope relative to the vertical is $\theta=32^{\circ}$, and Tarzan is momentarily at rest. In the box provided, sketch a free-body diagram for Tarzan, showing and labeling all the forces acting on him at this moment. Near the free-body diagram, and also in this box, add a vector, labeled $\vec{a}$, showing the correct direction of Tarzan's acceleration at this moment. If Tarzan has a mass of 82 kg , what is the magnitude of the tension in the rope at this instant? [Please write your final answer in the box provided, and express your answer to 2 significant figures.]

Free-body diagram and acceleration vector of Tarzan:


