LAST NAME as on student card	First Name(s) as on student card	Student Number	Practical Group Code

PHY131H1F
Term Test —version C
Wednesday, October 9, 2013
Duration: 80 minutes

Aids allowed: A pocket calculator with no communication ability. A single aid-sheet prepared by the student, no larger than 8.5"x11", 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 practical group code** at the top of this page **and** on the answer sheet.

Locate your test version number in the header at the top of the this page, and *fill in* the circle with the corresponding version code on your answer sheet in the "Form Code" box. Mark in your student number by shading the circles at the top-right of the sheet, starting with a 0 if the first digit is a 9. It is not required to bubble in your surname on the lower half of the sheet.

Scanned Area of the Answer Sheet:

1. **Use a dark-black, soft-lead pencil or a black pen.**
2. 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.
3. If you wish to modify an answer, erase your pencil mark thoroughly, or use dry tape white-out sparingly.
4. **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 **8** multiple-choice questions, worth 3 points each, or altogether 24 points. The test also has a set of free-form questions worth 16 points, for which fully worked solutions are required. The total possible number of points is 40.

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:
π = 3.14159 is the ratio of the circumference to the diameter of a circle
g = 9.80 m/s^2 is the acceleration due to gravity near the Earth's surface.
1 minute = 60 seconds; 60 minutes = 1 hour

The quadratic equation: If $ax^2 + bx + c = 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Air resistance may be neglected in all questions, unless otherwise stated.

MULTIPLE CHOICE (16 points total)

Question 1
A bowler throws a bowling ball which slides in a forward direction along a flat, horizontal wooden floor. Consider the following forces which may or may not be acting on the ball as its slides forward on the floor:

1. A downward force of gravity
2. A forward force from the throw
3. An upward force from the floor
4. A backward frictional force from the floor

Which of the choices below lists only forces acting on the ball as it slides forward on the floor, and no forces that are not acting on the ball as it slides forward on the floor?

(a) 1, 2, 3 (b) 1, 3 (c) 1, 2 (d) 1, 2, 3, 4 (e) 1, 3, 4

Question 2
You measure the basal heart rate of five test-subjects to be: 65, 56, 73, 78, and 60, all in beats per minute (bpm). The standard deviation of these five measurements is closest to

(a) 3.0 bpm (b) 9.1 bpm (c) 1.8 bpm (d) 4.1 bpm (e) 66 bpm

Question 3
At time $t = 0$, small red marble is released from rest at the top of a smooth, frictionless incline that is at an angle θ relative to the horizontal. The red marble begins rolling down the incline. A short time later, when $t = T$, a blue marble is released from rest at the top of the same incline, and begins to roll in the same direction as the red marble. At a time $t = 2T$, what is the speed of the red marble relative to the blue marble?

(a) $2Tg\sin(\theta)$ (b) $\frac{3}{2}T^2 g\sin(\theta)$ (c) $Tg\sin(\theta)$ (d) $\frac{1}{2}T^2 g\sin(\theta)$ (e) zero

Question 4
You wish to find the average speed of a motorized toy car. You measure it to travel a distance 6.00 ± 0.50 m, over a time interval of 3.50 ± 0.30 s. The average speed is closest to

(a) 1.714 ± 0.047 m/s (b) 1.71 ± 0.15 m/s (c) 1.7143 ± 0.0098 m/s
(d) 1.71 ± 0.20 m/s (e) 1.71 ± 0.29 m/s

Question 5

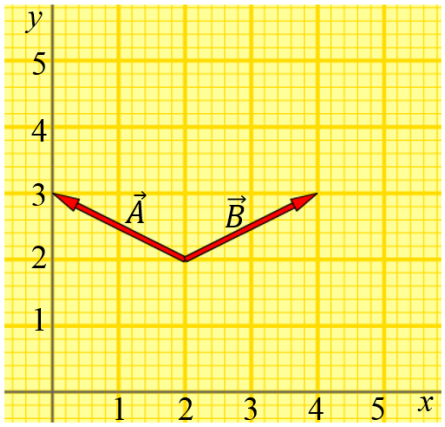
You throw a ball vertically from the top of an 80 m tower with an initial upward velocity of 10 m/s. The ball reaches a maximum height y_{max}, and spends a total amount of time t_{flight} in the air. Just before it reaches the ground, its speed is v_f. Next, you throw the same ball downward with an initial velocity of 10 m/s. Compared to the previous throw, what will change or be the same?

(a) y_{max} will be less, t_{flight} will be less, and v_f will be the same
(b) y_{max} will be the same, t_{flight} will be less, and v_f will be greater
(c) y_{max} will be less, t_{flight} will be less, and v_f will be greater
(d) y_{max} will be less, t_{flight} will be the same, and v_f will be the same
(e) y_{max} will be less, t_{flight} will be the same, and v_f will be greater

Question 6

Two vectors lie in the *x*-*y* plane, as shown. What is the sum, $\vec{A} + \vec{B}$?

(a) $2\sqrt{5}\hat{\imath}$ (b) $2\hat{\imath} + 4\hat{\jmath}$ (c) $2\hat{\imath}$
(d) $2\hat{\jmath}$ (e) $4\hat{\imath} + 2\hat{\jmath}$



Question 7

A centrifuge used for separating plasma from blood operates at a maximum rotation speed of 5000 rotations per minute (rpm). It starts at rest, and has a constant angular acceleration for 2 seconds before it reaches the maximum rotation speed. The number of complete rotations the centrifuge makes during this time is closest to

(a) 300 (b) 5000 (c) 80 (d) 3000 (e) 300,000

Question 8

Home Depot sells carpet for $1.12 per square foot. [Note that there are 12 inches in 1 foot, and 1 inch equals 2.54 cm.] You wish to cover the floor of a banquet hall with carpet. The banquet hall is 11 m wide and 19 m long. The cost will be closest to

(a) $25 (b) $2,500 (c) $2.50 (d) $250 (e) $25,000

FREE-FORM PART (16 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 [5 points]
Tennis ball launcher "A" fires a ball so that the initial velocity has an angle of 35° above the horizontal. The ball returns to the same height it was launched at after traveling a horizontal distance of 44 m. What was the initial speed v_i of the ball?

v_i =

PART B [5 points]
Tennis ball launcher "B" fires a ball with an initial velocity of 25 m/s, at an angle of 35° above the horizontal. The ball travels a horizontal distance of 48 m, then passes through the window of a building. What is the vertical distance y_f of the ball above its initial height at the moment when it passes through the window?

y_f =

PART C [6 points]

Tennis ball launcher "B" fires a ball with an initial velocity of 25 m/s, at an angle of 35° above the horizontal. At what horizontal distance (or distances) x_f from its starting point will the ball be 9.0 m above its initial height?

x_f =

ROUGH WORK (not marked)