First Name(s) as on student card Student Number

Practical Group Code

PHY131H1S

Term Test 1 —version 1 Tuesday, February 1, 2011 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 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 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:

 $\pi = 3.14159 \text{ is the ratio of the circumference to the diameter of a circle.}$ $g = 9.80 \text{ m/s}^2 \text{ is the acceleration due to gravity near the Earth's surface.}$ Common Prefixes: $k = \text{``kilo-''} = 10^3$ $c = \text{``centi-''} = 10^{-2}$ $m = \text{``milli-''} = 10^{-3}$ $\mu = \text{``micro-''} = 10^{-6}$ $n = \text{``nano-''} = 10^{-9}$ 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.

MULTIPLE CHOICE (16 points total)

- 1. You are filling boxes with tennis balls for shipment. Each box is a cube, 0.30 m on each side, and you find you can pack a maximum of 125 tennis balls in one box. If you wish to ship 250 tennis balls in a single box, also shaped like a cube, what should be the length of one side of this box?
 - A. 0.60 m
 - B. 1.2 m
 - C. 0.38 m
 - D. 0.42 m
 - E. 2.4 m
- 2. A jogger runs at a constant speed $v_J = 10$ km/hr to the right. A walker walks at a constant speed $v_W = 5$ km/hr to the left, towards the jogger. When the jogger and the runner are a distance D = 3 km away from each other, a bird flying at a constant speed $v_B = 30$ km/hr to the right passes the jogger. When the bird reaches the walker, it turns around and flies back to the jogger at the same speed. When it reaches the jogger it turns around again and flies to the walker. It continues flying back and forth between the jogger and the



walker. When the jogger and walker meet each other, how far, in km, has the bird flown?

- A. 3
- B. 6
- C. 1
- D. 2
- E. 9

3. The motion diagram shown in the figure represents a pendulum released from rest at an angle of 45° from the vertical. The dots in the motion diagram represent the positions of the pendulum bob at eleven moments separated by equal time intervals. Also given is a "compass rose" in which directions are labeled with the letters of the alphabet. What is the direction of the acceleration of the object at moments 0 and 10?



- A. D at moment 0, F at moment 10
- B. E at moment 0, A at moment 10
- C. B at moment 0, H at moment 10
- D. D at moment 0, B at moment 10
- E. zero acceleration at moment 0, zero acceleration at moment 10
- 4. A rocket, initially at rest on the ground, accelerates straight upward with constant acceleration of 26.0 m/s^2 . The acceleration period lasts for time 8.50 s until the fuel is exhausted. After that, the rocket is in free fall. What is the maximum height reached by the rocket?
 - A. 3430 m
 - B. 4980 m
 - C. 939 m
 - D. 2490 m
 - E. 4040 m
- 5. A medical technician uses X-ray imaging to make 12 independent measurements of the diameter of a tumor in a patient's left lung. The average of her 12 measurements is 4.81 mm, and the estimated standard deviation is 0.14 mm. The measurements appear to be normally distributed. The technician needs to report a final value and an error to the supervising physician in order to determine what kind of treatment to recommend for this patient. If her report states that the diameter is 4.81 mm, what should she state as the error in this average?
 - A. 0.04 mm
 - B. 0.14 mm
 - C. 0.005 mm
 - D. 0.01 mm
 - E. 0.28 mm
- 6. A field mouse trying to escape a hawk runs East for 5.0 m, then turns right and runs South for 4.0 m, then digs a hole and goes straight down for 1.5 m. What is the magnitude of the net displacement of the mouse?
 - A. 6.4 m
 - B. 6.6 m
 - C. 5.2 m
 - D. 5.6 m
 - E. 7.4 m

- 7. You drop a rock from the observation deck of the CN tower. About half a second later, long before the first rock hits the ground, you drop a second rock. Both rocks are initially released at rest, and air resistance may be neglected. As the two rocks fall, the distance between them
 - A. increases.
 - B. decreases.
 - C. stays the same.
- 8. An airplane flies horizontally at 40 m/s at a constant altitude of 50 m. The pilot drops a heavy package, which falls to the flat, horizontal ground below. Where does the package land relative to the airplane's new position at the instant the package lands?
 - A. 100 m behind the airplane
 - B. 400 m behind the airplane
 - C. directly beneath the airplane
 - D. 50 m behind the airplane
 - E. 500 m behind the airplane

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

In Practicals you attach a Fan Accessory to a cart, which causes it to accelerate along a horizontal metal track. You release it from rest, and measure that it travels a distance of 1.30 ± 0.04 m in a time of 1.78 ± 0.05 s. From these two measurements, and the assumption that the acceleration of the cart is constant, what do you conclude is the acceleration of the cart? [Please write your final answer in the box provided, with units and error. Both the value and error should have the correct number of significant figures.]

a =

PART B

A cat is chasing a mouse. The mouse runs in a straight line along the horizontal floor, directly away from the cat at a speed of 1.2 m/s. At a specific moment, the mouse is 0.80 m in front of the cat, and the cat leaps with an initial velocity at an angle of 25° above the horizontal. At what initial speed must the cat leap in order to land on the poor mouse? [Please write your final answer in the box provided, in units of m/s, to the correct number of significant figures.]

 $v_{\rm ic} =$

ROUGH WORK (not marked)