Last Name (Please **print in BLOCK LETTERS)**	First Name(s) **as on student card**	Student Number	Practical Group Code (*eg*. FxA)

PHY131H1F
Term Test 2 —version 1
Tuesday, November 22, 2011
Duration: 80 minutes

PLEASE read carefully the following instructions.

Aids allowed: A calculator without communication capability. Aid sheet: one single, original, handwritten 8 1/2 × 11 inch sheet of paper, which may be written on both sides

- **Turn off** any communication device (phone, pager, PDA, iPod, etc.) you may have and place it on the floor.
- **DO NOT separate the sheets of your question paper.** Work lost or unattributable because of separated sheets will not receive any credit. You can, however, **carefully** tear off the blank pages at the end, as they do 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.
- 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.**

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. Do not use white-out.

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, equally weighted, worth **56** marks in total. The test also has one multi-part problem worth **44** marks, for which fully worked solutions are required.

Multiple-choice questions:
- Choose the letter of the best answer.
- Blank or incorrect answers are ignored.
- Multiple answers for the same question are marked as incorrect.

Long Answer Problem: To be awarded maximum credit, you must provide fully worked solutions to all parts of the long answer problem. 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.

Good luck!

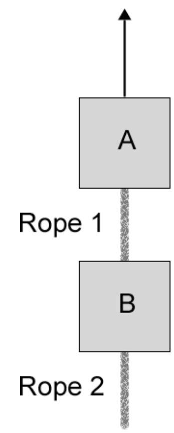
MULTIPLE CHOICE (56 marks total)

Possibly Helpful Equations and Constants

- The acceleration due to gravity near the earth's surface is $g = 9.80$ m/s^2.
- The moment of inertia of a uniform cylinder or disk rotating about its centre is $\frac{1}{2}MR^2$.
- The moment of inertia of a uniform cylindrical hoop rotating about its centre is MR^2.
- An object that slides without friction down an inclined plane that makes an angle θ with the horizontal accelerates at $a_s = g \sin\theta$.
- The quadratic equation: If $ax^2 + bx + c = 0$, then $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Question 1

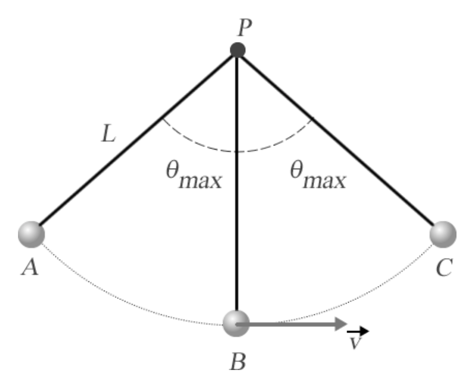
The figure shows two 1.00 kg blocks connected by a rope. A second rope hangs beneath the lower block. Both ropes have a mass of 250 g. The entire assembly is accelerated upwards (near the surface of the Earth) by a force of magnitude 39.5 N. The tension, in N, at the top end of Rope 1 is closest to:



A. 9.00 B. 13.9 C. 23.7 D. 33.5 E. 39.5

Question 2

You are supported by a string, swinging from A to B to C, and then back towards B. The length of the string from the support point P to you is L. Your mass is m and the acceleration due to gravity is g. At point B your speed is v. What is the tension in the string when you are at point B?

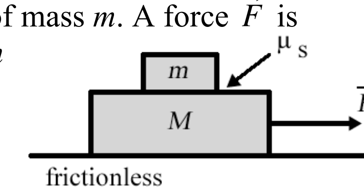


A. mg B. $mg + mv^2/L$ C. $mg - mv^2/L$

D. $\sqrt{(mg)^2 + (mv^2/L)^2}$ E. 0

Question 3

A block of mass M sits on a frictionless surface. Sitting on top of M is a block of mass m. A force $\vec{F}$ is pulling M to the right. The coefficient of static friction between blocks M and m is μ_s. If block m is not to slip, the maximum magnitude of the force, F, is



A. $m\mu_s g$ B. $M\mu_s g$ C. $(m + M)\mu_s g$

D. $\left(\dfrac{M}{m}\right)(m + M)\mu_s g$ E. 0, it will always slip

Question 4
A big wagon with a mass of 250 kg is initially rolling without friction at 3.00 m/s. It starts to rain, and the rain accumulates in the wagon at a constant rate of 10.0 kg/hr. The rain is falling straight down. The speed of the wagon, in m/s, after 2.00 hours is closest to:

A. 1.50
B. 2.78
C. 3.00
D. 3.24
E. 37.5

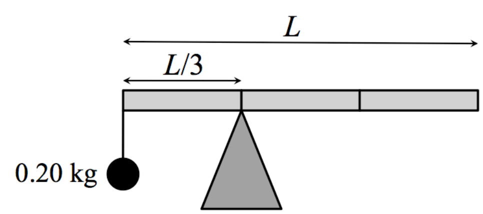
Question 5
Two sailboats have identical size and shape, but sailboat A has a significantly larger mass than sailboat B. They are both subject to the same wind and the same constant net force as they start from rest and move the same distance of 100.0 m. After traveling 100.0 m,

A. they both have the same momentum and kinetic energy.
B. they both have the same kinetic energy but sailboat A has larger momentum than sailboat B.
C. they both have the same kinetic energy but sailboat B has larger momentum than sailboat A.
D. they both have the same momentum but sailboat A has larger kinetic energy than sailboat B.
E. they both have the same momentum but sailboat B has larger kinetic energy than sailboat A.

Question 6
A thin uniform metal hoop of mass m and radius R rolls without slipping along a flat horizontal surface. The coefficient of static friction between the hoop and the surface is μ_s. As the hoop rolls, what is the force of static friction on the hoop?

A. $mg\mu_s$
B. mgR^2
C. $\frac{mg\mu_s}{2}$
D. $\frac{mg}{2}$
E. 0

Question 7
A uniform metre stick of length $L = 1.0$ m has a 0.20 kg mass suspended by a string from its left side, and rests on a pivot that is $L/3$ from the left side. If the system consisting of the metre stick and the hanging mass is in equilibrium, the mass of the metre stick is closest to:



A. 0.10 kg
B. 0.20 kg
C. 0.29 kg
D. 0.33 kg
E. 0.40 kg

Question 8
A vinyl record can be modeled as a uniform disk with a mass of 0.200 kg and a radius of 15.2 cm. When this record is spinning about its centre at 3.49 rad/s, the magnitude of its angular momentum in kg m^2 s^{-1} is closest to:

A. 8.06×10^{-3}
B. 0.0161
C. 0.0281
D. 0.0530
E. 0.106

LONG ANSWER (44 marks total)
There are three parts to the Long-Answer Problem. Clearly show your reasoning as some part marks may be awarded. Write your final answers in the provided boxes.

The following situation applies to parts A, B and C:

An 80.0 kg bungee jumper drops from rest off a bridge that is 200.0 m above a river. As he falls, air resistance is negligible, and the unstretched bungee cord attached to him uncoils. The mass of the bungee cord is negligible. When the jumper is 50.0 m below the bridge, the bungee cord is completely uncoiled and forms a straight line. Below that point, the bungee cord acts as a spring, obeying Hooke's law as it is stretched beyond its equilibrium length of 50.0 m, with a spring constant of $k = 15$ N/m.

PART A (10 marks)
What is the speed of the jumper at the moment when he is 50.0 m below the bridge? Please express your answer in m/s to 3 significant figures, and write it clearly in the box below.

PART B (10 marks)
As the bungee cord stretches, there is a moment when the net force on the jumper is zero. How far above the river will the jumper be at this time? Please express your final answer in m to 2 significant figures, and write it clearly in the box below.

PART C (24 marks)

How far above the river will the jumper be at the lowest point in his motion, just before he springs back upwards again? Please express your answer in m to 2 significant figures, and write it clearly in the box below.

ROUGH WORK (not marked)