Family Name (Please **print in BLOCK LETTERS)**	Given Name(s) **as on student card**	Student Number	Practical Group Code (F1C =morning or F3C =afternoon)

PHY132H1F
Term Test —version 2
Tuesday, October 12, 2010
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.

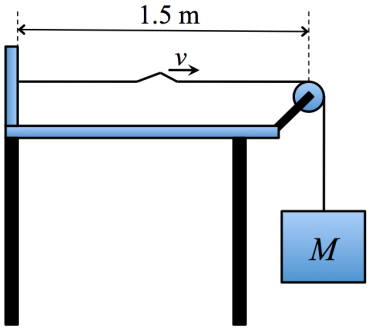
When the invigilators declare the test ended, **stop any writing or filling of circles** on the answer sheet immediately. Please put your answer sheet **inside your test paper** and have the paper ready for an invigilator to pick up.

Possibly helpful information for this test:
$\pi = 3.14159$ Speed of light in a vacuum is $c = 3.00 \times 10^8$ m/s
Planck's constant is $h = 6.63 \times 10^{-34}$ J s Mass of the electron $m_e = 9.11 \times 10^{-31}$ kg
The near point for a normal eye is 25 cm. The speed of sound in air is 343 m/s, unless told otherwise.
$g = 9.80$ m/s^2 is the acceleration due to gravity near the Earth's surface.
1 cm = 10^{-2} m 1 mm = 10^{-3} m 1 μm = 10^{-6} m 1 nm = 10^{-9} m
The index of refraction of air is $n = 1.00$

MULTIPLE CHOICE (16 points total)

1. A form of sound-proofing is a fine wire mesh which is held at a fixed distance from a flat wall. When sounds waves are normally incident on the wall, they first encounter the mesh. About half of the sound intensity is reflected, and half is transmitted. The transmitted sound waves can then travel the distance, d, reflect off the wall, travel the distance d again, and then combine with the original reflected sound from the wire mesh. If the two sound waves are exactly out of phase at this point, they will destructively interfere, reducing the total reflected sound intensity. If $d = 2.54$ cm (one "inch"), what is the minimum frequency for which the sound-proofing will work properly?
   A. 13,500 Hz
   B. 135 Hz
   C. 141 Hz
   D. 6750 Hz
   E. 3380 Hz

2. A 2.0 m long string with a mass of 4.0 grams is tied to a wall at one end, stretched horizontally to a pulley 1.5 m away from the wall, then tied to a hanging mass, M, as shown. When you pluck the string, sending a traveling pulse down the string, it travels at a speed $v = 35$ m/s. What is the mass, M?



   A. 3.3 kg
   B. 0.0071 kg
   C. 0.25 kg
   D. 2.5 kg
   E. 0.33 kg

3. The lens in your digital camera has a diameter of 2.5 mm, and according to the manufacturers specifications, its f-number is "F4.0". The lens is held a certain distance away from the detector in order to produce a well-focused picture of a flower that is 15 cm away. You then turn to take a picture of a distant landscape. How far must the lens be moved, and in which direction, in order to obtain a well focused picture of the landscape?
   A. 20 mm farther from the detector
   B. 0.71 mm closer to the detector
   C. 1.4 mm closer to the detector
   D. 11 mm farther from the detector
   E. 11 mm closer to the detector

4. A rectangular block of amber has a small insect embedded in it. The insect appears to be 7.0 mm below the flat surface of the amber. The index of refraction of amber is known to be 1.54. What is the insect's actual distance beneath the surface?
   A. 18 mm
   B. 2.8 mm
   C. 4.5 mm
   D. 11 mm
   E. 7.0 mm

5. The near point (the smallest distance at which an object can be seen clearly) and the far point (the largest distance at which an object can be seen clearly) are measured for six different people, and listed in the table below.

	near point (cm)	far point (cm)
Avishka	40	∞
Berenice	30	300
Chadwick	25	500
Danya	25	∞
Edouard	80	200
Francesca	50	∞

   Which of the following choices lists all the farsighted people, ranked by the power of the lens needed to correct their hyperopic vision? [They are ranked from largest to smallest power required.]
   A. Francesca, Avishka, Danya
   B. Berenice, Avishka, Francesca, Edouard
   C. Danya, Avishka, Francesca
   D. Edouard, Francesca, Avishka, Berenice
   E. Edouard, Berenice, Chadwick

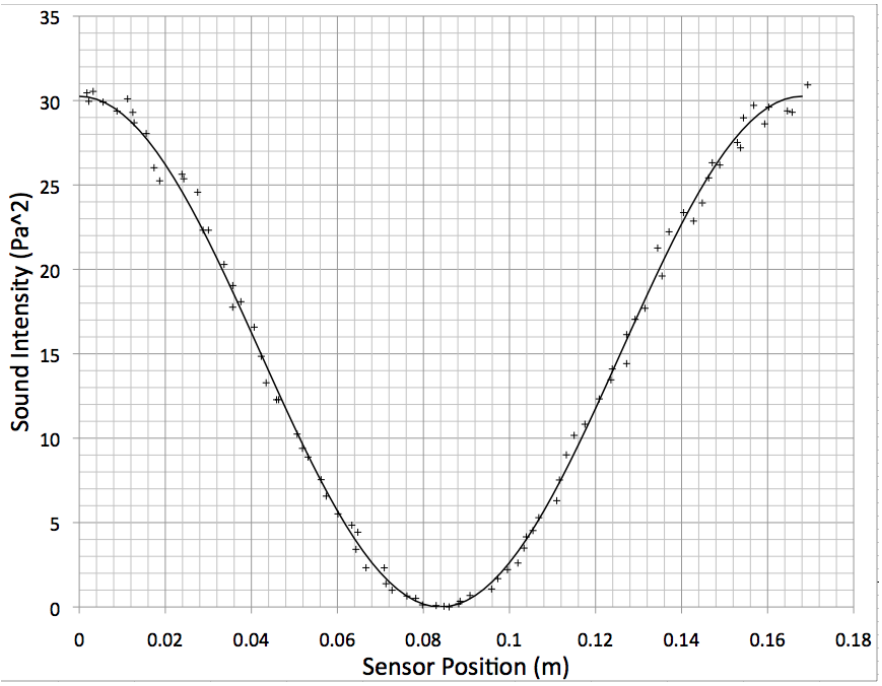
6. What is the speed of an electron with a de Broglie wavelength of 0.30×10^{-9} m?
   A. 3.6×10^{6} m/s
   B. 2.2×10^{-24} m/s
   C. 6.6×10^{-16} m/s
   D. 2.4×10^{6} m/s
   E. 2.0×10^{3} m/s

7. A dressing mirror mounted on a vertical wall is 1.7 m tall. The bottom is 0.30 m above the floor. A bare light-bulb hangs on the ceiling a horizontal distance of 1.0 m away from the wall with the mirror. The light-bulb is 3.0 m above the floor. How long is the streak of reflected light across the floor, as measured perpendicularly away from the wall with the mirror?
   A. 3.8 m
   B. 0.11 m
   C. 0.33 m
   D. 2.1 m
   E. 1.9 m

8. A typical 100 Watt incandescent light-bulb emits only 2.7 Watts of visible light. The average wavelength of this visible light is about 550 nm. Estimate the number of visible photons emitted by the light-bulb each second.
   A. 10^{27}
   B. 10^{19}
   C. 10^{21}
   D. 10^{25}
   E. 10^{23}

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 set up standing sound waves in a tube filled with air. The frequency of the sound was set to 270 Hz. It was a "closed-closed" tube, which you measure to have a length of $L = 0.171$ m ± 0.002 m. You used a sound sensor which displayed the square of the pressure amplitude, called "Sound Intensity", versus sensor position. Estimate the *m*-number for the mode of the standing wave, the wavelength of the sound, and the error in this wavelength. [Please write your answers in the boxes provided. *m* should be displayed to 1 significant figure. Display the wavelength, λ, as *value* ± *error*, with the error displayed to 1 significant figure.]



$m =$

$\lambda =$ ±

PART B

Two trains approach one another on a long, straight track. The first train is traveling North at 36.0 m/s relative to the ground in still air. The frequency of the note emitted by the whistle on the first train is 462 Hz. A passenger is on the second train, which is moving at South a speed of 15.0 m/s relative to the ground. What is the frequency of the whistle as heard by the passenger on the second train?

$f =$

ROUGH WORK (not marked)