CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

**PHYSICS** **0625/23**

Paper 2 Core **May/June 2012**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

## READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
You may lose marks if you do not show your working or if you do not use appropriate units.
Take the weight of 1 kg to be 10 N (i.e. acceleration of free fall = 10 m/s$^2$).

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

| For Examiner's Use | |
| --- | --- |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | |
| 12 | |
| **Total** | |

This document consists of **15** printed pages and **1** blank page.

UNIVERSITY *of* CAMBRIDGE
International Examinations

**[Turn over**

**1** Fig. 1.1 shows how the speed of a truck varies during a period of 80 s.
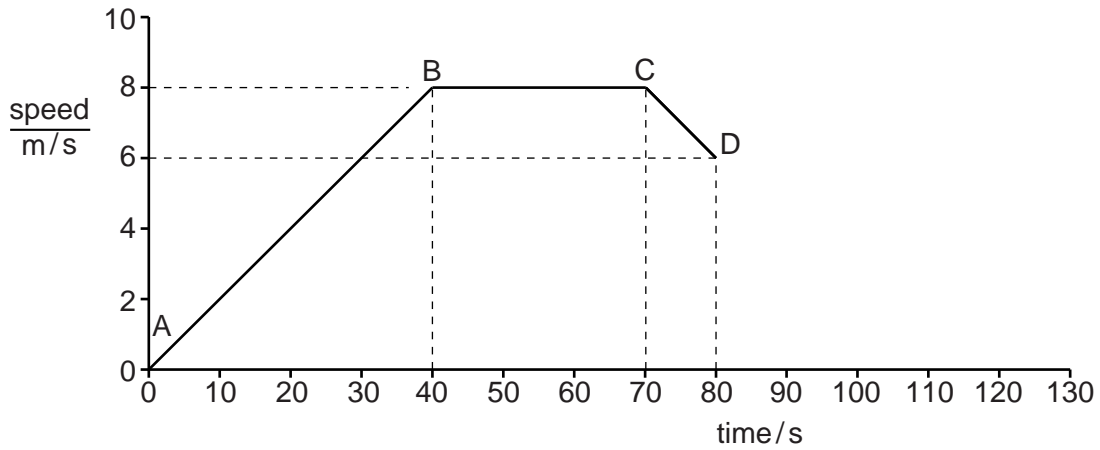
**Fig. 1.1**

**(a)** In which section of the journey is the truck

  **(i)** travelling at constant speed, .......................................................................................

  **(ii)** increasing its speed? ...............................................................................................
                                                                                                                    [2]

**(b)** Calculate the distance travelled by the truck in

  **(i)** the section BC,

distance = ........................................... m  [4]

  **(ii)** the section CD.

distance = ........................................... m  [2]

**(c)** After point D, the truck takes 30 s to come to rest.

  On Fig. 1.1, draw a line to show this part of the motion of the truck.          [1]

[Total: 9]

**2** Fig. 2.1 shows a simple mercury barometer alongside a mercury manometer that contains some trapped gas.
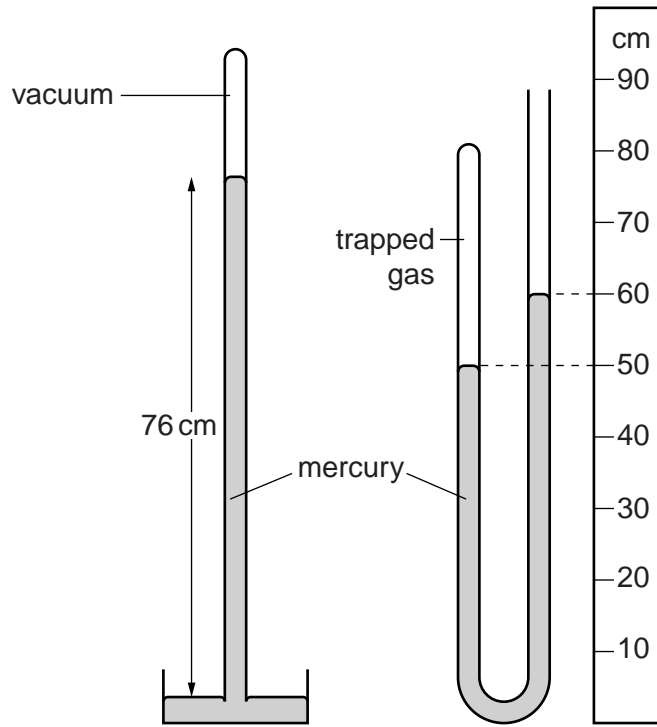
**Fig. 2.1**

From Fig. 2.1 find

**(a)** the pressure of the atmosphere,

pressure of atmosphere = ......................... cm of mercury  [1]

**(b)** the pressure of the trapped gas.

pressure of trapped gas = ......................... cm of mercury  [3]

**(c)** The atmospheric pressure increases.

State what happens to the levels of mercury in the manometer.

left-hand level ...................................................................................................................

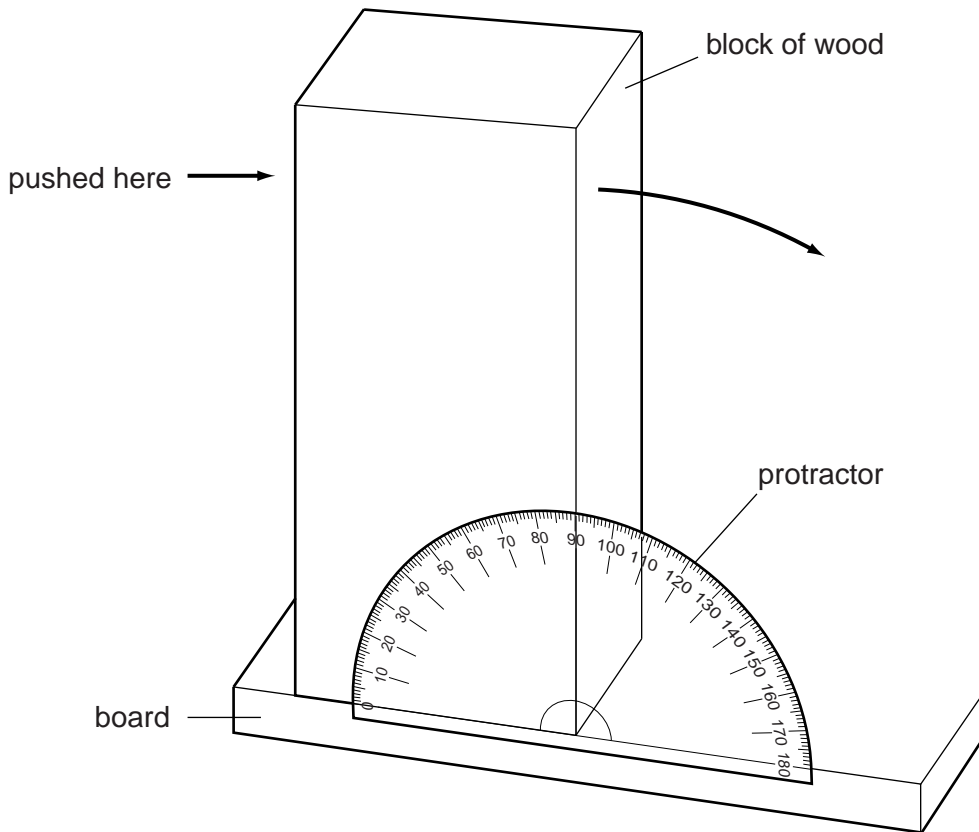right-hand level ..................................................................................................................
[2]

[Total: 6]

**3** Fig. 3.1 shows a rectangular block of wood on a flat, rough horizontal board.



**Fig. 3.1**

The block is pushed at the top, as shown in Fig. 3.1, and it tilts to the right.

**(a)** On the front face of the block, draw the line that will be vertical at the instant before the block topples over. [1]

**(b)** Use the protractor shown on Fig. 3.1 to measure the angle through which the block tilts before it topples over.

angle = ................................................ [1]

**(c)** The block is put back on the board, as in Fig. 3.1. This time, instead of the block being pushed, the left-hand edge of the board is raised.

State the angle that the board makes with the horizontal at the instant the block topples over.

angle = ................................................ [1]

**(d)** State how your answer to **(c)** might differ if the procedure is repeated after several centimetres have been cut off the top of the block.

.................................................................................................................................

......................................................................................................................... [1]

[Total: 4]

**4** Two geologists are collecting rocks from the bottom of a cliff. The rocks are loaded into a basket and then pulled up the cliff on the end of a rope, as shown in Fig. 4.1. The basket of rocks is brought to rest at the top of the cliff.
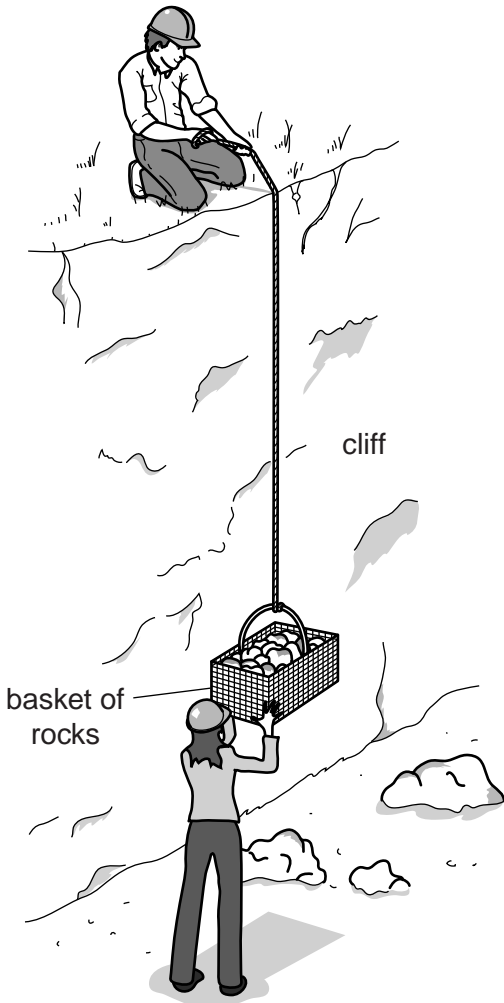
cliff

basket of
rocks

**Fig. 4.1**

**(a) (i)** Which form of energy that the basket possesses is significantly greater at the top of the cliff than when it is at the bottom of the cliff?

.......................................................... [1]

**(ii)** Which two measurements must be made in order to calculate the increase in energy in **(i)**?

1. ................................................................

2. ................................................................

[2]

**(b)** Which form of energy in his body has the man at the top of the cliff used in order to raise the basket of rocks?

.................................................................. [1]

**(c)** State the measurement needed, in addition to those in **(a)(ii)**, in order to calculate the useful power developed by the man at the top of the cliff.

................................................................................................................................ [2]

[Total: 6]

**5** The boy shown in Fig. 5.1 has just thrown a number of stones into a pond, one after the other. Fig. 5.1 shows the crests of the waves a short time after the stones landed in the water.
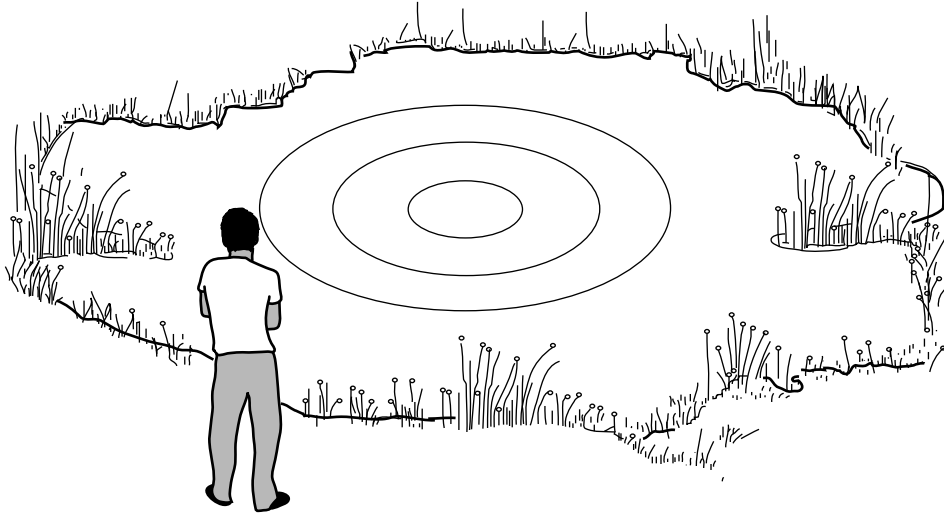


**Fig. 5.1**

**(a)** On Fig. 5.1, mark with a cross the point where the stones hit the water. [1]

**(b)** Fig. 5.2 shows a section through the surface of the water before the stones land.

air

surface ───────────────────────────────

water

**Fig. 5.2**

On Fig. 5.2, sketch what the section of the surface might look like at the instant shown in Fig. 5.1. [2]

**(c)** Later, the boy throws a single stone into the water. Fig. 5.3 shows, from above, the position of the wavefront at 2 s, 4 s and 6 s after the stone landed.
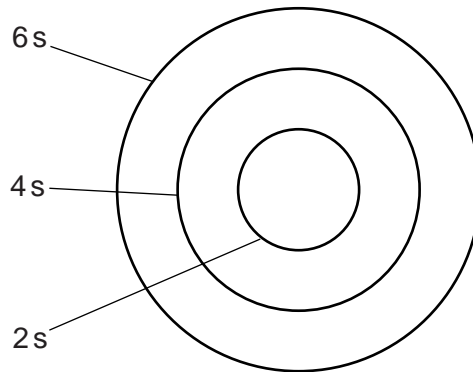
**Fig. 5.3**

**(i)** From Fig. 5.3, what can be deduced about the speed of the wave?

.......................................................................................................................................

.......................................................................................................................................

.................................................................................................................................. [2]

**(ii)** On Fig. 5.3, draw the wavefront 8 s after the stone landed.                        [2]

[Total: 7]

**6** The liquid-in-glass thermometer in Fig. 6.1 has a scale from −10 °C to 110 °C.

**Fig. 6.1**

**(a)** Two of the temperatures marked on the thermometer are known as *fixed points*.

State the values of these fixed points.

................ °C and ................°C  [1]

**(b)** The bulb of the thermometer shown in Fig. 6.1 is put into some boiling water.
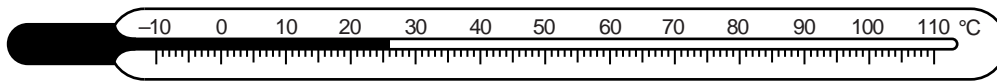
**(i)** What happens to the liquid in the bulb when its temperature is raised?

...................................................................................................................................

**(ii)** What is seen happening to the liquid in the capillary tube when the bulb is put in the boiling water?

...................................................................................................................................

...................................................................................................................................

[3]

**(c)** On a certain day in a cold country, the air temperature is −12 °C.

On Fig. 6.1, use an arrow to show approximately where the surface of the liquid will be at this temperature. [1]

[Total: 5]

**7** A teacher is trying to find an unusual way to measure the speed of sound using an echo method.

She has a firework, which will make a loud bang at ground level when ignited. She also has a stopwatch and a tape measure.

**(a)** To obtain an echo, she needs a suitable reflector.

Suggest something that she could use as a reflector.

.................................................................................................................................... [1]

**(b)** She stands a measured distance of 360 m from her chosen reflector and ignites the firework in a safe manner.

**(i)** When should she start the stopwatch?

.......................................................................................................................

**(ii)** When should she stop the stopwatch?

.......................................................................................................................
[2]

**(c)** After she stops the stopwatch, its appearance is as shown in Fig. 7.1.



**Fig. 7.1**

**(i)** Using this reading and the distance from **(b)**, calculate the speed of sound in air.

speed of sound = ........................................ m / s [4]

**(ii)** Suggest one reason why the speed calculated in **(c)(i)** might not be quite correct. Assume that the stopwatch and tape measure function correctly.

.......................................................................................................................

.......................................................................................................................

.................................................................................................................................... [1]

[Total: 8]

8    (a)   In terms of molecules, explain why solids expand when they are heated.

..................................................................................................................................

..................................................................................................................................

..................................................................................................................................

..................................................................................................................................

.......................................................................................................................... [2]

(b)   (i)   State one example where the expansion or contraction of a solid is a problem. Describe how this problem is solved. You may draw a diagram if it helps to clarify your answer.

.......................................................................

.......................................................................

.......................................................................

.......................................................................

.......................................................................

.......................................................................

.......................................................................                                   [2]

(ii)   Describe one example where the expansion or contraction of a solid is useful. You may draw a diagram if it helps to clarify your answer.

.......................................................................

.......................................................................

.......................................................................

.......................................................................

.......................................................................

.......................................................................

.......................................................................                                   [2]

[Total: 6]

**9** A solenoid with many turns is connected across a sensitive centre-zero millivoltmeter, as shown in Fig. 9.1.

sensitive centre-zero
millivoltmeter
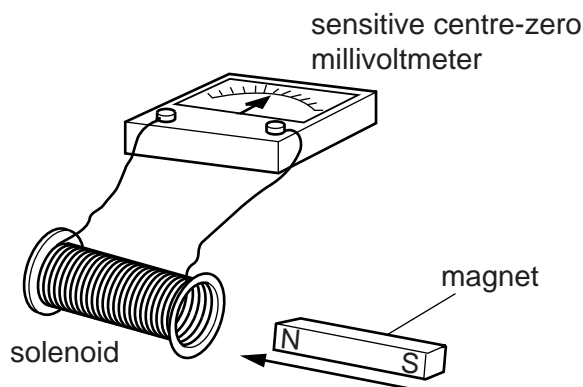
magnet

solenoid

N
S

**Fig. 9.1**

**(a)** The N pole of a magnet is moved into the solenoid, and then held stationary in the solenoid.

Describe what happens to the needle of the millivoltmeter during this process.

.......................................................................................................................................

................................................................................................................................. [2]

**(b)** The N pole is then removed from the solenoid.

Describe what happens to the needle during this process.

.......................................................................................................................................

................................................................................................................................. [1]

**(c)** Complete the following sentence.

When the N pole moves into the solenoid, ........................................................ is

...................................................... in the solenoid. [2]

[Total: 5]

**10** A length of bare uniform resistance wire is included in the circuit of Fig. 10.1. Contact C can be moved to any position along the resistance wire.
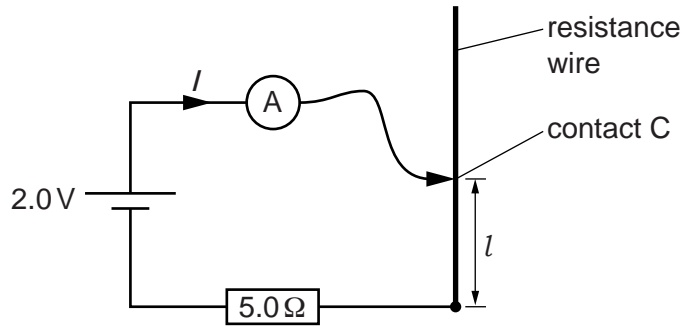


**Fig. 10.1**

**(a)** On the axes of Fig. 10.2, sketch the graph that relates the current *I* in the circuit to the length $l$ of the resistance wire.
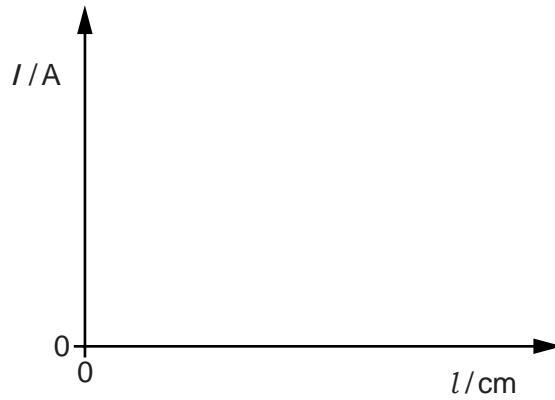


**Fig. 10.2**                                                                                      [2]

**(b)** Calculate the reading on the ammeter when the length $l$ is zero.

ammeter reading = ........................................... A  [3]

**(c)** Contact C is moved so that the resistance of the length $l$ of the resistance wire is $15.0\,\Omega$.

Calculate

**(i)** the total resistance of the circuit,

resistance = .................................................... $\Omega$

**(ii)** the new ammeter reading.

ammeter reading = .................................................... A

[2]

**(d)** When $l = 25\,cm$, the reading on the ammeter is half that found in **(b)**.

Calculate the resistance of 25 cm of the resistance wire.

resistance = ............................................ $\Omega$ [2]

**(e)** Which of the following effects is caused by the current in the resistance wire?

Tick the boxes alongside **two** correct effects.

heating        ☐

light          ☐

sound          ☐

magnetism      ☐                                                    [2]

[Total: 11]

**11 (a)** A particular radioactive source is known to emit either α-particles or β-particles.

Describe an experiment involving a solid absorber to determine which type of particle is being emitted. Include a diagram of the experimental arrangement.

diagram

[1]

method

.......................................................................................................................................

.......................................................................................................................................

.......................................................................................................................................

................................................................................................................................. [4]

statement of how the results identify the particles

.......................................................................................................................................

.......................................................................................................................................

................................................................................................................................. [1]

**(b)** The table below gives the count-rate obtained from a radioactive source over a period of 80 minutes.

| time/minutes | 0 | 15 | 30 | 42 | 58 | 80 |
|---|---|---|---|---|---|---|
| $\dfrac{\text{count-rate}}{\text{counts/s}}$ | 400 | 228 | 128 | 80 | 44 | 16 |

From this table, estimate the half-life of the radioactive source.

half-life = ................................. minutes  [1]

[Total: 7]

**12** Fig. 12.1 represents a neutral atom.
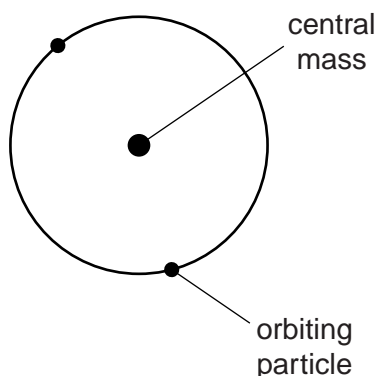


**Fig. 12.1**

  **(a)** What name do we give to

   **(i)** the central mass, ........................................................................................................

   **(ii)** the two orbiting particles? ...........................................................................................
   [2]

  **(b)** The central mass contains two neutrons.

   **(i)** What other type of particle does it contain? .............................................................

   **(ii)** How many of these other particles are there? .........................................................
   [2]

   **(iii)** Use nuclide notation, $^{A}_{Z}X$, to describe the nuclide in Fig. 12.1, writing appropriate
   numbers in place of *A* and *Z*.

$$^{............}_{............}X$$
   [2]

   [Total: 6]

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