| Centre No. | | | | | | Paper Reference (complete below) | | | | | | | Surname | Initial(s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Candidate No. | | | | | | | | | | / | | | Signature | |

Paper Reference(s)

**4420/03 4437/09**

Examiner's use only

| | | |
|---|---|---|

Team Leader's use only

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# London Examinations IGCSE

## Physics – 4420

Paper 3

## Science (Double Award) – 4437

Paper 9

# Foundation and Higher Tiers

Thursday 1 November 2007 – Afternoon

Time: 1 hour 15 minutes

| Question Number | Leave Blank |
|---|---|
| 1 | |
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| Total | |

**Materials required for examination**
Ruler, protractor, compasses, pencil and calculator

**Items included with question papers**
Nil

### Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s), the paper reference and your signature.
The paper references are shown above. Write the one for which you have been entered. Check that you have the correct question paper.
Answer **ALL** the questions in the spaces provided in this question paper.
Show all the steps in any calculations and state the units.
Calculators may be used.

### Information for Candidates

The marks for individual questions are shown in round brackets: e.g. **(2)**.
There are 4 questions in this question paper. The total mark for this paper is 50.
There are 16 pages in this question paper. Any blank pages are indicated.

### Advice to Candidates

Write your answers neatly and in good English.



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***Turn over***

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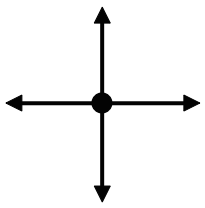
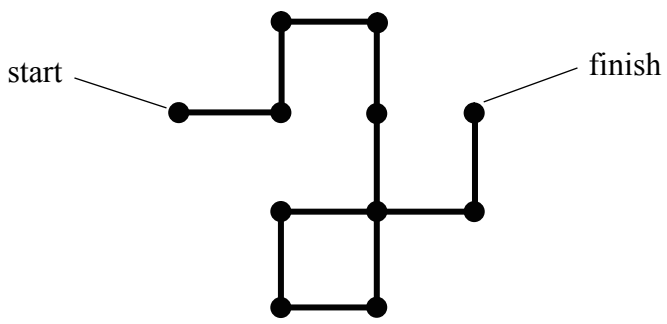
**1.** A student writes a computer program to model the random motion of a particle.

(a) In this program a particle starts from a certain point and moves away by taking a step in one of four possible directions. The steps are all of the same length.



After each step the particle is not allowed to retrace its previous step.
Therefore it must take one of three possible directions.

**Example**




(i) Measure and record the length of one step in the path.

One step = ..... mm
**(1)**

(ii) How many steps have taken place from start to finish?

Number of steps from start to finish = .....
**(1)**

(iii) The shortest distance from start to finish is called the **path length**.
Measure and record the path length.

Path length = ..... mm
**(1)**

(iv) Add **one** more step to the above path so that the path length no longer equals a whole number of steps.

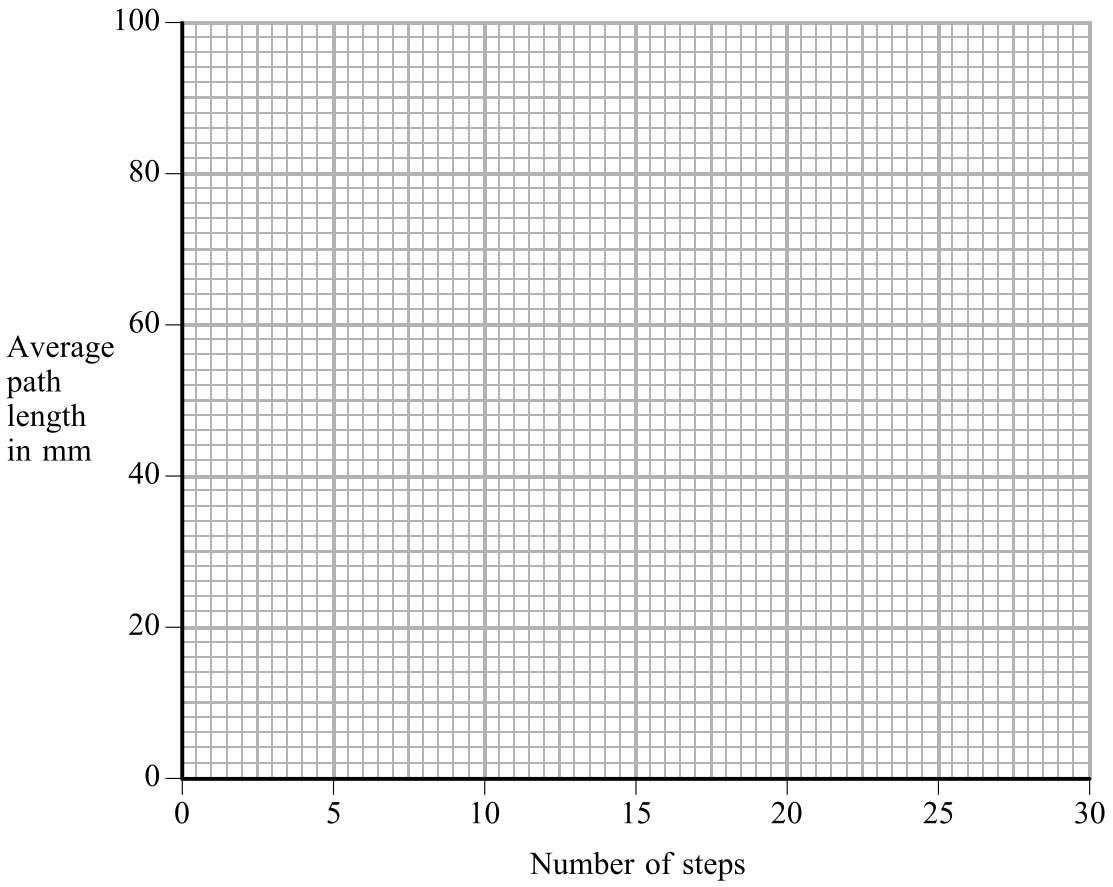
**(2)**

Leave blank

(b) The program was run many times. Each time the path length was measured after every 5 steps. The table shows the averaged results.

| Number of steps | Average path length (mm) |
|---|---|
| 0 | 0 |
| 5 | 40 |
| 10 | 57 |
| 15 | 70 |
| 20 | 81 |
| 25 | 92 |
| 30 | 100 |

(i) Use the grid to plot a graph of average path length against number of steps. Draw the best-fit curve for your plotted points.




**(3)**

(ii) Use your graph to find the average path length in mm for 17 steps.

Average path length = ..... mm

**(1)**

Leave blank

(c) This model is supposed to show the random motion of a particle.
List **three** ways in which it does **not** represent the random motion of a particle.

1 .....

2 .....

3 .....

**(3)**

**Q1**

**(Total 12 marks)**

**QUESTION 2 IS ON PAGE 6**

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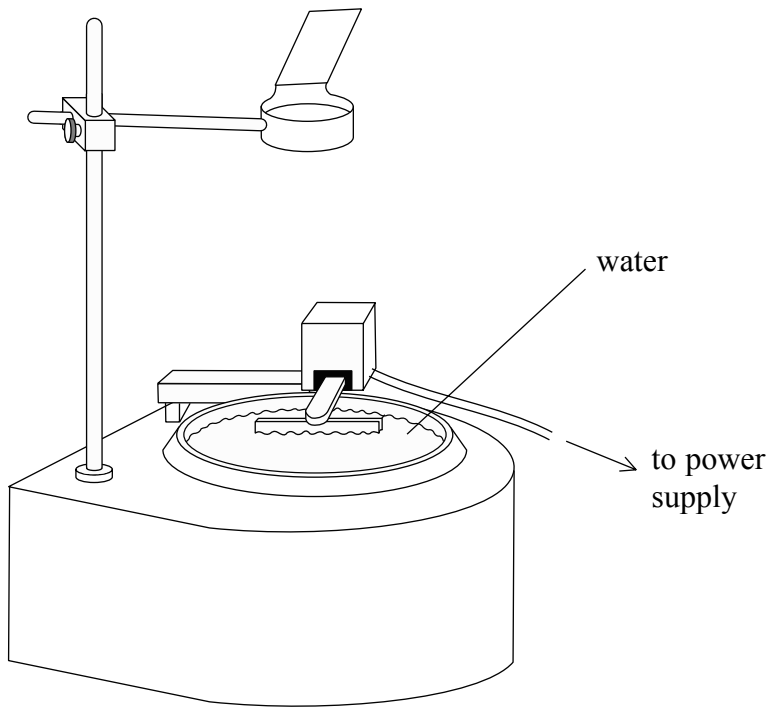
**2.** A teacher uses a ripple tank to demonstrate the behaviour of plane water waves.




The water waves pass from deep to shallow water. The wave patterns are projected onto a screen.

(a) State **one** safety concern that you would have with the apparatus.

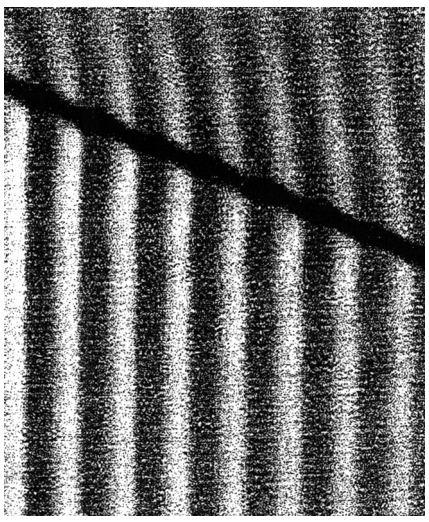
.....

.....

**(1)**

Leave blank

(b) The image below is what appeared on the screen during the demonstration.



The distance between two neighbouring bright lines (or dark lines) is the wavelength of the waves.

(i) Explain why it is difficult to measure a single wavelength accurately from this image.

.....

.....

**(1)**

(ii) Explain how the accuracy could be improved.

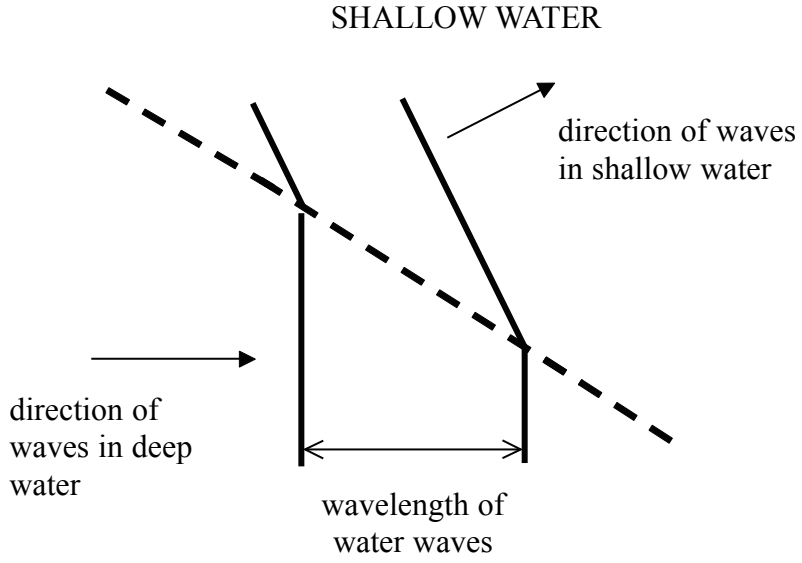
.....

.....

**(2)**

Leave blank

(c) After the demonstration the teacher gives you a worksheet. Part of the worksheet is shown below.




Measure and record:

(i) the wavelength of the waves in deep water

Wavelength of waves in deep water = ..... mm

**(1)**

(ii) the wavelength of the waves in shallow water

Wavelength of waves in shallow water = ..... mm

**(1)**

(iii) the angle through which the direction of the waves changes when passing from deep to shallow water. On the diagram show how you did this.

Angle = ..... °

**(3)**

Leave blank

(d) The teacher repeated the demonstration for several depths of the shallow water. Some students took measurements from different worksheets. The table shows information gathered from five students.

| Student | Change of direction (°) | Wavelength in shallow water (mm) |
|---|---|---|
| Maria | 10 | 26 |
| Ranjeet | 15 | 24 |
| Rio | 20 | 22 |
| Carmen | 25 | 20 |
| James | 30 | 31 |

(i) Which student has a result that does not fit the trend of the other results?

.....

**(1)**

(ii) Give a reason for your choice.

.....

.....

**(1)**

(iii) Does your data from (c) fit the trend shown in the table? Explain your answer.

.....

.....

**(2)**

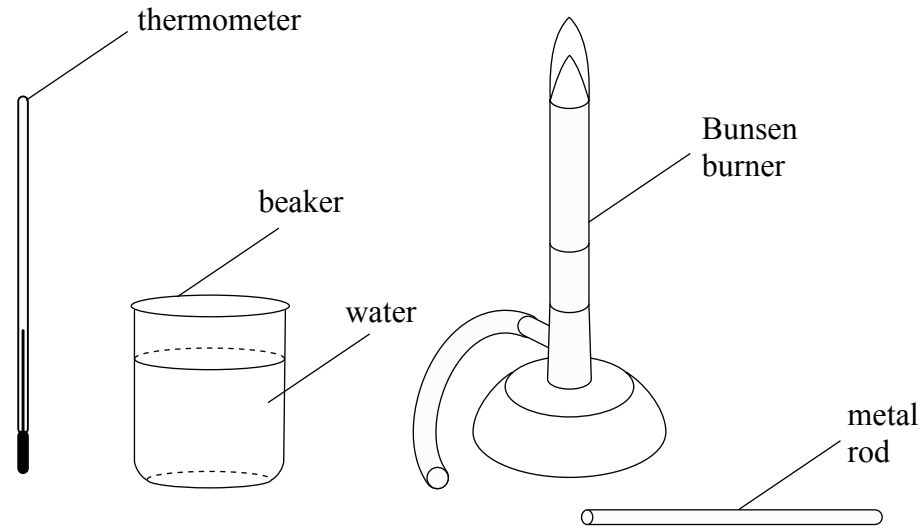
**Q2**

**(Total 13 marks)**

Leave blank

**3.** You are to investigate which is the hottest part of a Bunsen flame by heating a metal rod and then placing the rod into water.

(a) Describe how you would use the apparatus below to determine the hottest part of the flame.

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**(4)**

Leave blank

(b) List **four** things that you should keep constant when comparing the temperature of different parts of the flame.

1 .....

2 .....

3 .....

4 .....

**(4)**

(c) Name an extra piece of apparatus that would make the investigation

(i) more reliable

.....

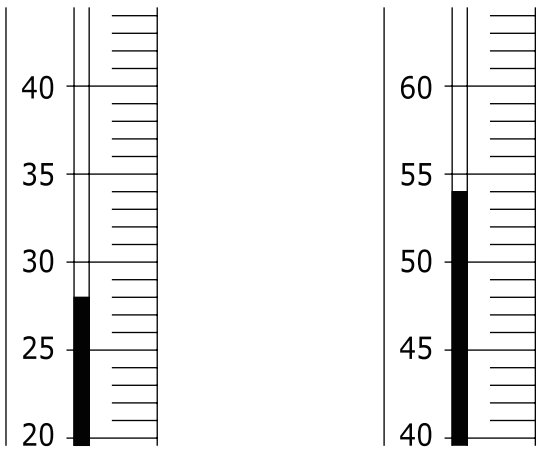
**(1)**

(ii) safer

.....

**(1)**

(d) During the investigation the following thermometer readings were observed. Record each reading and calculate the temperature difference.




..... .....

Temperature difference = ..... °C

**(2)**

**(Total 12 marks)**

**Q3**





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H 2 8 0 2 6 A 0 1 2 1 6

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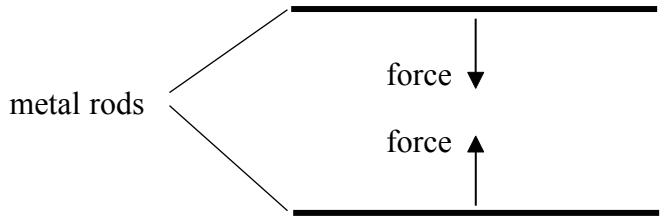
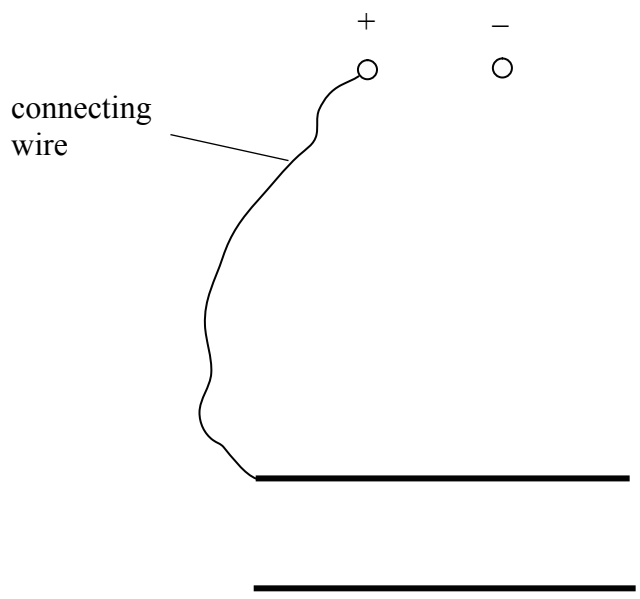
**4.** Metal rods with currents in the same direction attract as shown.




(a) Two metal rods are to be connected in series to a d.c. power supply, an ammeter and a variable resistor.

(i) Complete the diagram of the circuit. The power supply, one connecting wire and the two metal rods are already shown.




**(4)**

(ii) Add arrows to show the direction of the current in all parts of the circuit.

**(2)**

(iii) Explain whether the metal rods in your circuit will attract.

.....

.....

**(1)**

Leave blank

(b) In another experiment one of the metal rods is suspended from two identical metal springs. The other metal rod is fixed vertically below the suspended metal rod. The rods are both horizontal. The rods and the springs are connected into a circuit.

Diagram 1 shows the separation of the rods when there is a current of 1 A in the springs and the rods.

**Diagram 1**

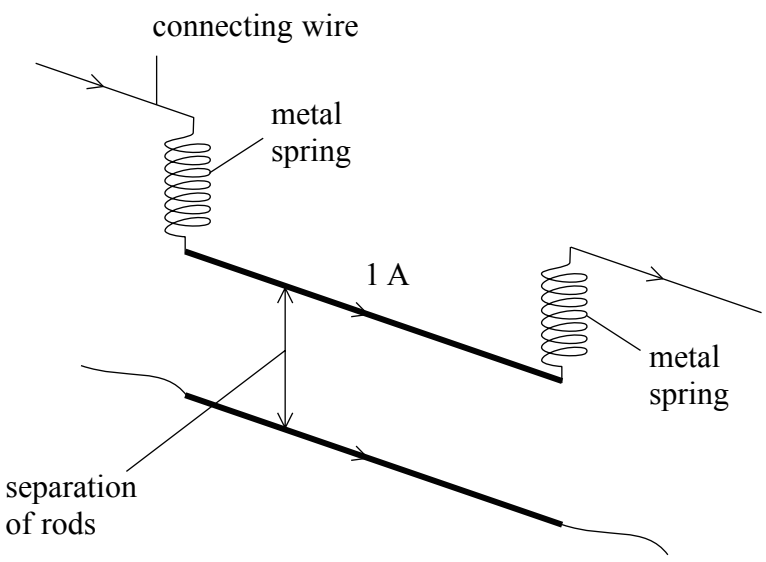



Diagram 2 shows the separation of the rods when the current is adjusted to 2 A.

**Diagram 2**

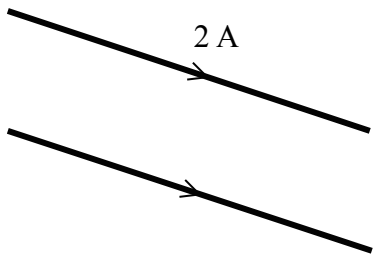
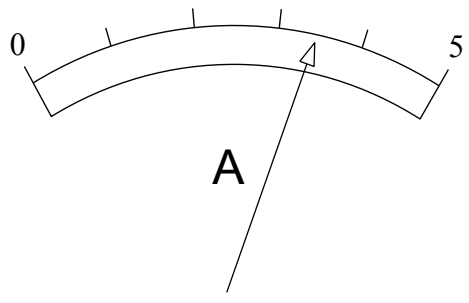



Diagram 3 shows the ammeter after another adjustment to the current.

**Diagram 3**



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(i) Measure the separation in mm of the rods with the current of 2 A.

Separation = ..... mm
**(1)**

(ii) Read the value of current, in A.

Current = ..... A
**(1)**

(iii) Suggest a value for the separation of the rods for the current shown in Diagram 3.

Separation = ..... mm
**(1)**

(iv) The circuit is removed and there is no current in the rods.
You can now use the apparatus to see if Hooke's law is obeyed for two identical metal springs in parallel. You are provided with some small unknown masses to extend the springs.
**Where** would you place the masses? Explain your answer.

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**(3)**

**Q4**

**(Total 13 marks)**

**TOTAL FOR PAPER : 50 MARKS**

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