CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

PHYSICS **5054/04**

Paper 4 Alternative to Practical **May/June 2009**

1 hour

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 soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

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.

**[Turn over**

1 Fig. 1.1 shows four plastic containers.
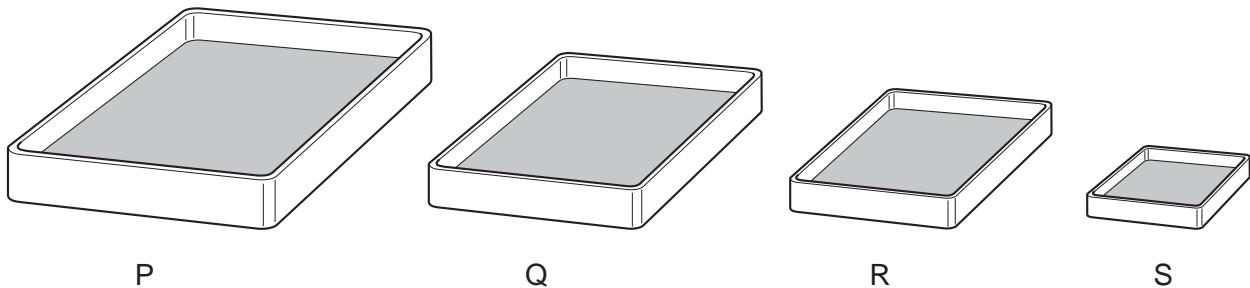
Fig. 1.1

A student half-fills the containers with water and leaves them for several days. He measures the total mass of each container and water on a top-pan balance at the same time each day for six days.

The following readings are obtained.

	mass of container and water/g			
	P	Q	R	S
initial reading	1378	573	196	129
after 1 day	1348	556	187	123
after 2 days	1316	540	178	117
after 3 days	1287	524	169	112
after 4 days	1253	509	159	105
after 5 days	1227	491	149	101
after 6 days	1192	474	140	95

(a) Complete the table below to show the loss in mass m after time t for containers P and S.

time t/days	m/g	
	P	S
0	0	0
1		
2		
3		
4		
5		
6		

[2]

(b) On the grid below, plot a graph of *m* on the *y*-axis against *t* on the *x*-axis for containers P and S. Draw a line of best fit for P and a line of best fit for S.

0

0
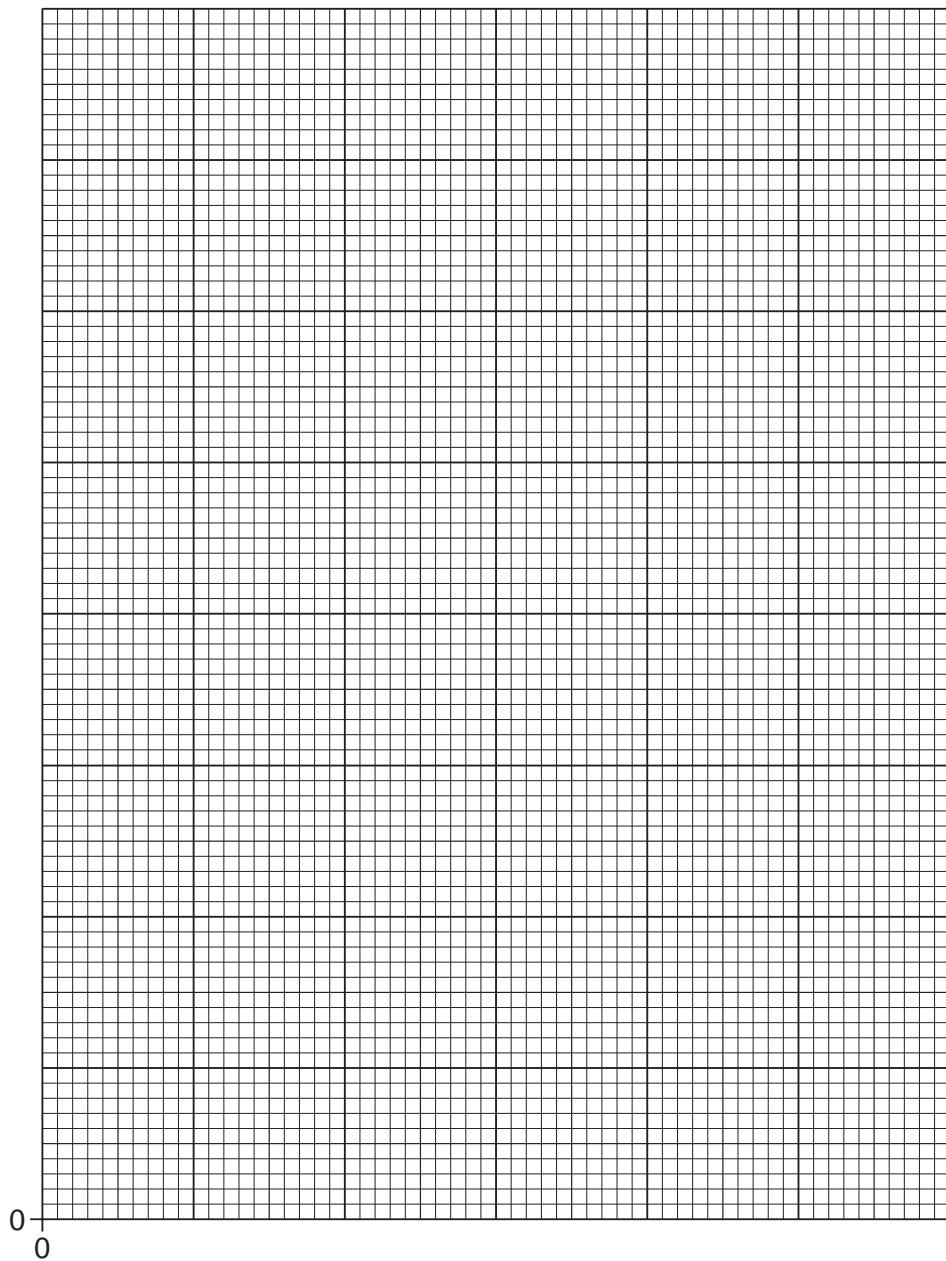
[6]

(c) Describe the relationship between *m* and *t*.

....

....

.... [2]

(d) Fig. 1.2 shows the length l and width w of one container.
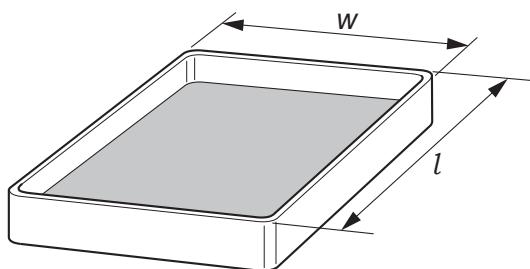

Fig. 1.2

An estimate of the surface area A of the water is given by

$$A = l\,w.$$

(i) Complete the table below, giving the values of A to the nearest cm^2.

container	l/cm	w/cm	A/cm^2
P	22.8	16.2	
Q	18.8	11.3	
R	13.2	8.9	
S	9.2	9.2	

[2]

(ii) By referring to Fig. 1.2, explain why A is only an estimate of the surface area.

....

.... [1]

(iii) The student concludes that "rate of evaporation increases with surface area".

Explain how your graph in **(b)** supports his statement.

....

.... [1]

(e) On one day during the experiment, the temperature of the room changes.

    (i) Suggest a possible reason why the temperature changes.

       ....

       .... [1]

    (ii) Explain whether this change in temperature will affect the student's conclusion in **(d)(iii)**.

       ....

       .... [1]

2 Three newton meters, a smooth ring and three lengths of thin string A, B and C are held horizontally a few centimetres above a sheet of white paper.

Fig. 2.1 shows this arrangement.
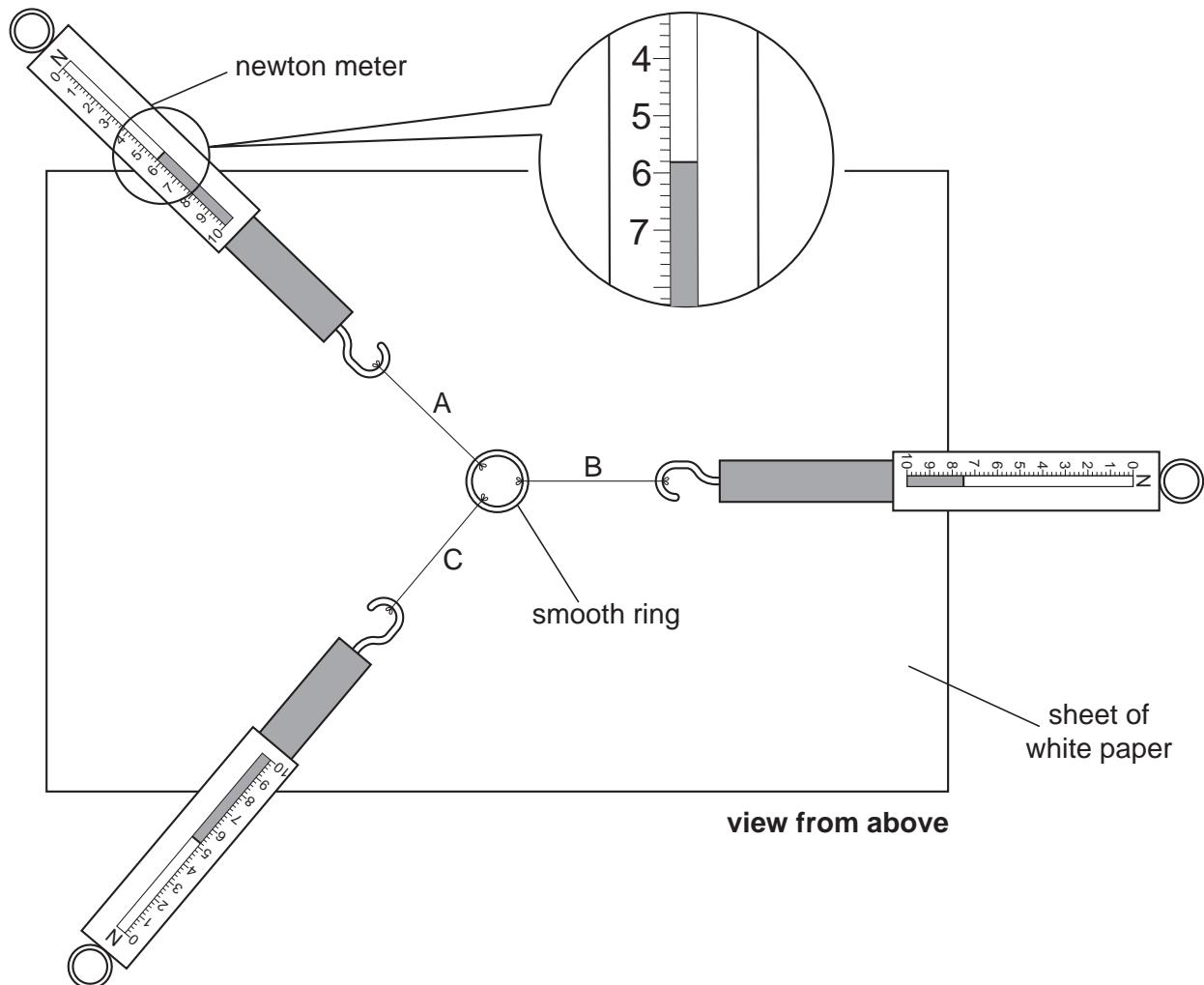
Fig. 2.1

The apparatus is used to find the vector sum of the forces in strings B and C.

The newton meters are pulled gently, then held in steady positions.

The positions of the strings A, B and C are marked with a pencil on the white paper.

(a) Explain why parallax error makes it difficult to mark the positions of the strings accurately.

....

.... [1]

(b) Measure the angle between the strings A and B.

angle = ... [1]

(c) State the value of the force shown on the newton meter pulling string A.

force = ... [1]

(d) A student draws the force diagram shown in Fig. 2.2, to find the resultant of forces B and C.


scale:
1.5 cm represents 1 N
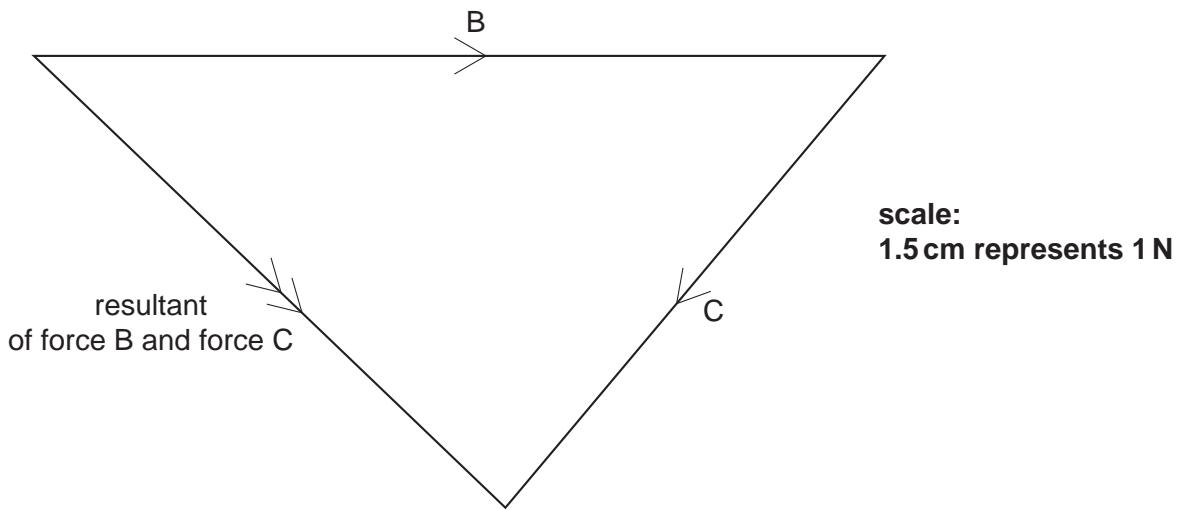
Fig. 2.2

Using the scale given, determine the magnitude of the resultant of force B and force C.

Show your working.

resultant force = ... [1]

3 Fig. 3.1 shows a transparent plastic prism on a sheet of white paper.
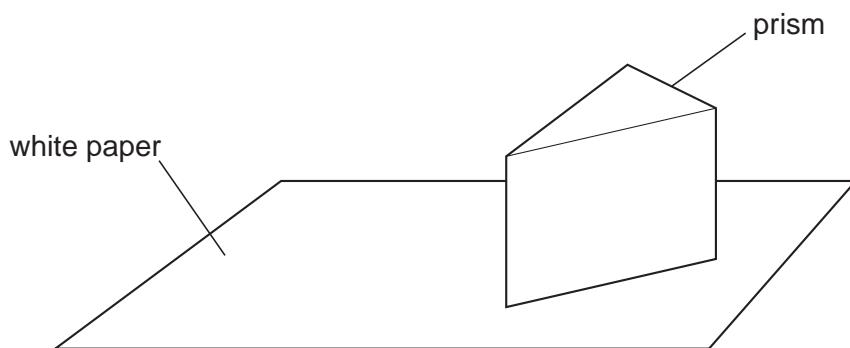

Fig. 3.1

Fig. 3.2 shows a ray of light from a ray box directed towards the prism.
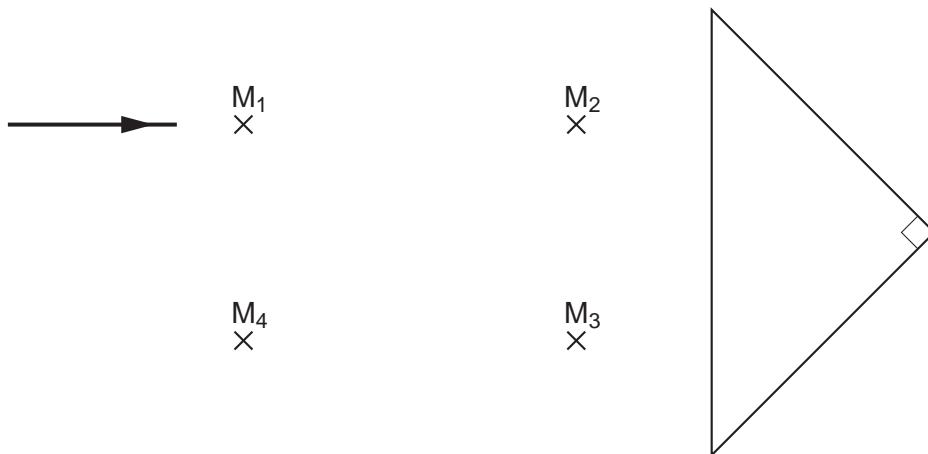
Fig. 3.2

A student makes two marks labelled M_1 and M_2 on the incident ray and two marks labelled M_3 and M_4 on the emergent ray.

(a) (i) On Fig. 3.2, continue the path of the ray through the prism. [1]

    (ii) Describe the effect that the prism has on the ray of light.

....

.... [1]

(b) A second student does not have a ray box. Describe how he can perform the same experiment using pins.

....

....

....

....

.... [2]

 [Turn over

4 Fig. 4.1 shows a block of aluminium of mass 1 kg used to measure the specific heat capacity of aluminium.
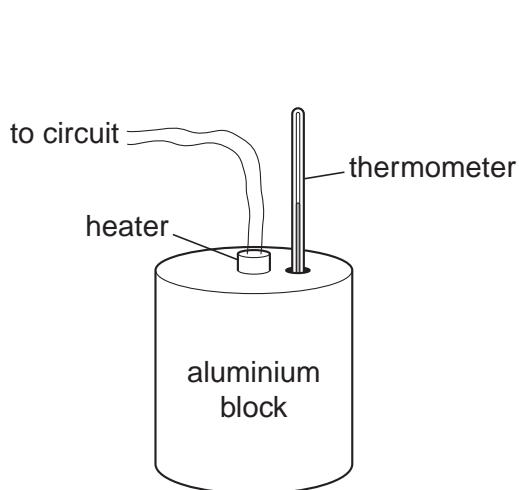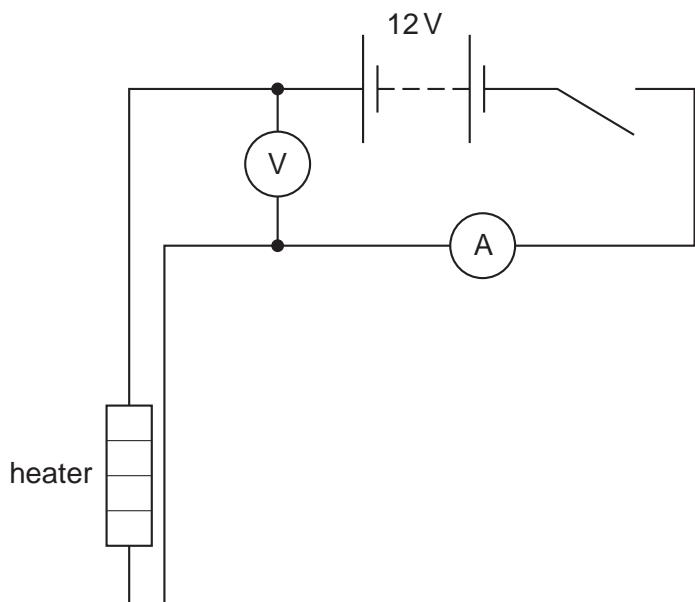
**Fig. 4.1**   **Fig. 4.2**

A heater fits into a hole in the centre of the block and a thermometer fits into a second hole.

Fig. 4.2 is the circuit containing the heater.

When the switch is closed, the meters show steady readings of 11.6 V and 4.7 A.

(a) Fig. 4.3 shows the scales of the two meters.
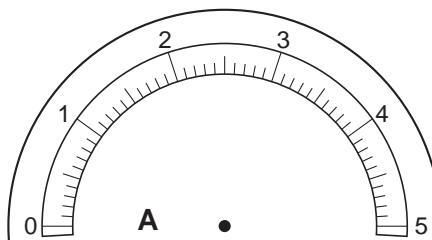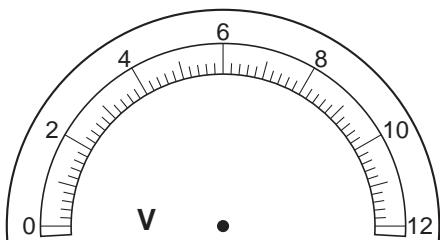
Fig. 4.3

On Fig. 4.3, draw pointers to show the readings on the meters after the switch has been closed.

[2]

(b) When the heater is switched on, the block warms up and some heat is lost to the surroundings.

State two ways of reducing this heat loss.

1. ....

....

2. ....

....
[2]

(c) The thermometer is used to measure the initial and the final temperatures of the block.

The initial temperature of the block is taken before the heater is switched on.

Explain why the final temperature of the block is taken a short time after the heater is switched off.

....

.... [1]

(d) The heater is switched on for four minutes and the temperature rise of the block is 15 °C.

Suggest a reason why the heater is not switched on for a very much longer time.

....

.... [1]

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