UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3818926035

PHYSICS **5054/42**

Paper 4 Alternative to Practical **October/November 2013**

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 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.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

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.

This document consists of **8** printed pages.

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1 A student investigates how a magnetic force varies with distance.

A bar magnet is attracted to the iron base of a clamp stand, as shown in Fig. 1.1.
A newton meter is attached to the magnet.

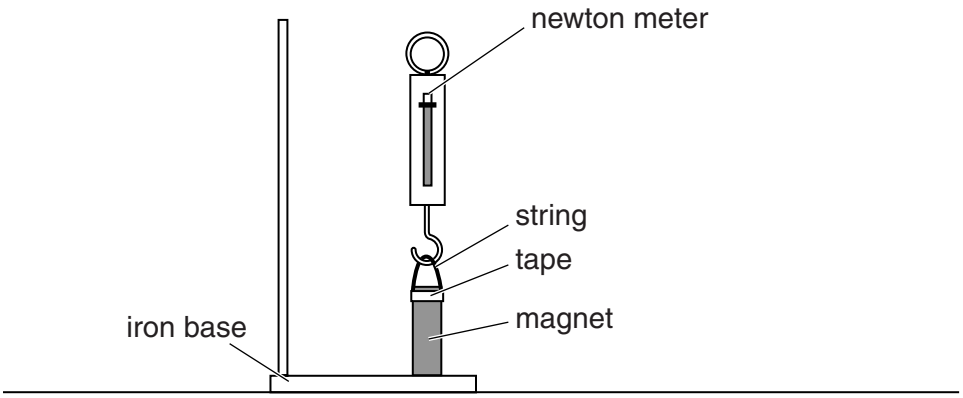


Fig. 1.1

The student pulls the newton meter vertically upwards and measures the force *F* required to pull the magnet off the iron base.

(a) (i) Explain why it is difficult to measure *F* accurately.

.....

..... [1]

(ii) Describe a method the student can use to measure *F* more accurately.

.....

..... [1]

(b) Fig. 1.2 shows the maximum reading on the newton meter as the magnet is pulled off the base.

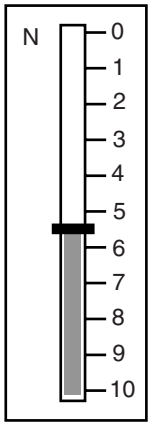


Fig. 1.2

Record the force *F* shown on the newton meter.

F = ... [1]

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(c) The student places one sheet of paper between the magnet and the iron base and measures the force F to pull the magnet off the base.
He repeats the experiment, each time increasing the number n of sheets of paper.
The results obtained are recorded in Fig. 1.3.

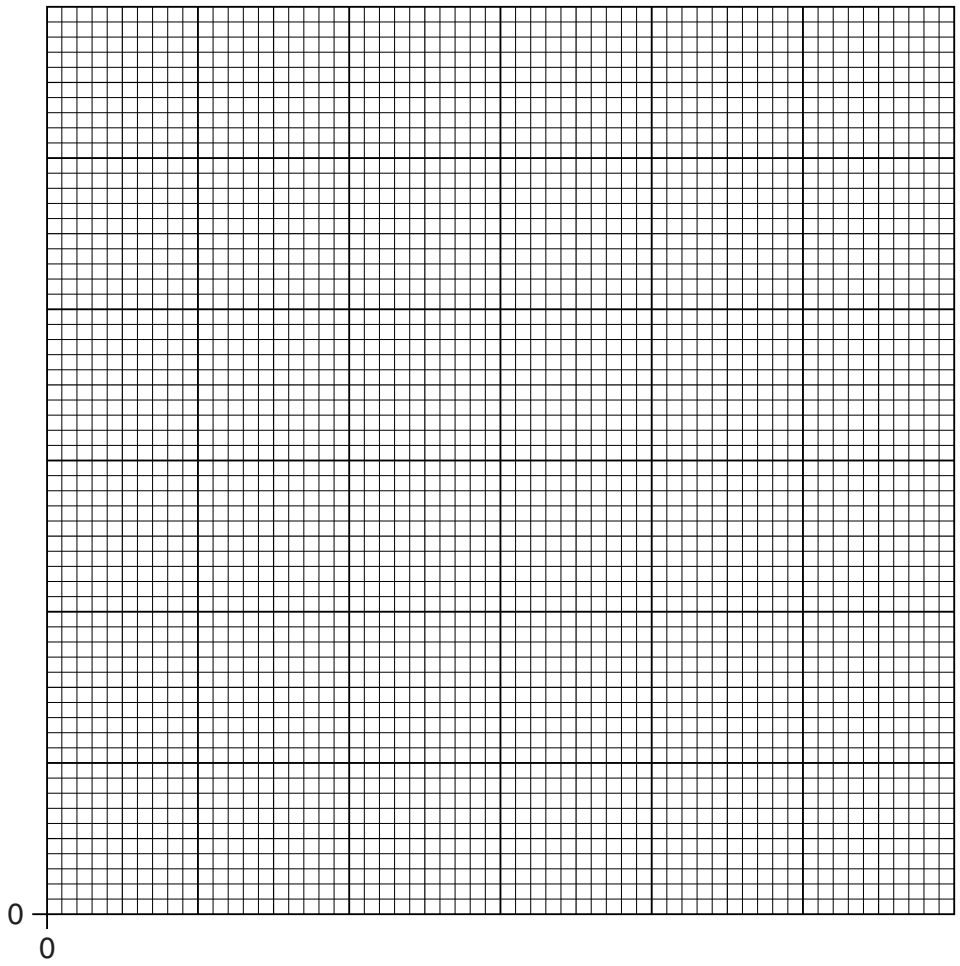
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n	F/N
0	
1	3.5
2	2.5
3	1.5
4	1.0
5	0.5

Fig. 1.3

On Fig. 1.3, add your value for F from **(b)**.

(i) On Fig. 1.4, plot a graph of F/N on the y-axis against n on the x-axis.
Start your axes from the origin. Draw a smooth curve of best fit.



[4]

Fig. 1.4

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(ii) Describe how F varies with n.

.....

..... [1]

(d) The newton meter shown in Fig. 1.2 is not suitable for measuring F when there are more than 5 sheets of paper. Suggest why.

.....

.....[1]

(e) **(i)** The student repeats the experiment using paper of a different thickness. His new value of F when $n = 1$ is 3.0N. State which paper is thicker. Give a reason for your answer.

.....

..... [1]

(ii) Explain how using very thin paper improves the experiment.

.....

..... [1]

(f) Very thin sheets may be made from aluminium foil.

State and explain whether aluminium foil is a suitable material for this experiment.

.....

..... [1]

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2 A student investigates the reflection of light.

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The student has available:

- a pin board,
- a sheet of plain paper,
- a plane mirror,
- optical pins,
- a pencil, ruler and protractor.

(a) Describe how the student uses the apparatus to verify that the angles of incidence and reflection are equal.
Include a clear labelled diagram in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) The student carries out the experiment carefully.
Describe one practical technique that improves the accuracy of the experiment.

.....

.....

..... [1]

3 A student uses a lemon to make a simple electric cell.

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He inserts a copper strip and an iron nail into the lemon, as shown in Fig. 3.1.

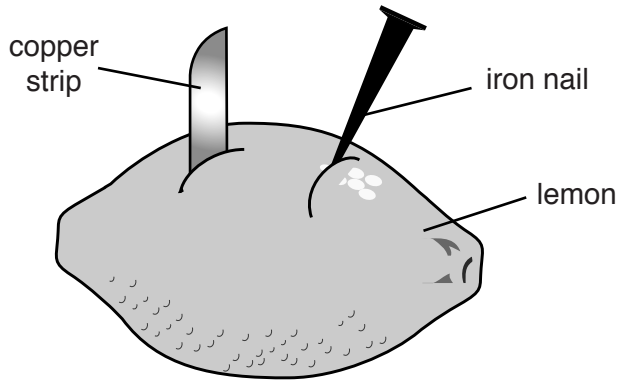


Fig. 3.1

The student connects a centre-zero voltmeter between the copper strip and the iron nail to measure the e.m.f. produced by the lemon cell.

(a) Fig. 3.2 shows the voltmeter with the reading obtained.

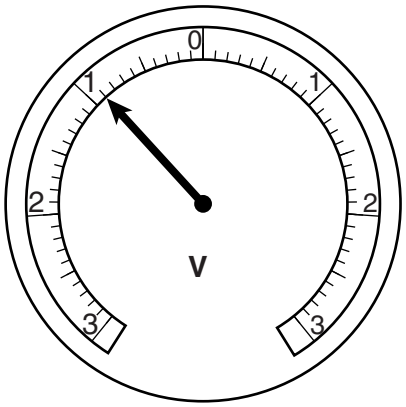


Fig. 3.2

(i) Record the e.m.f. shown on the voltmeter.

e.m.f. = ... [1]

(ii) Suggest how the connecting leads from the voltmeter can be securely attached to the strip and to the nail.

..... [1]

(iii) State what happens if the connections to the voltmeter are reversed.

..... [1]

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(b) Suggest one reason why lemons are **not** used to power simple electronic equipment such as digital watches.

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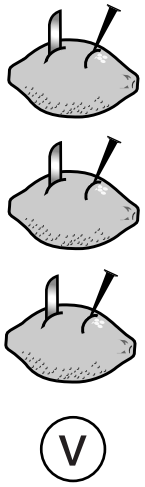
..... [1]

(c) **(i)** The student connects three lemon cells in **series** and measures the total e.m.f. with the voltmeter.

1. State the total e.m.f. that you would expect.

e.m.f. = ... [1]

2. On Fig. 3.3, draw the connections that the student uses.



[1]

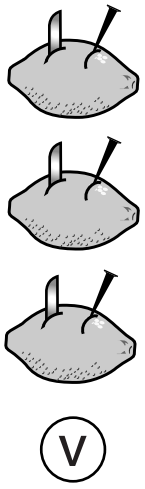
Fig. 3.3

(ii) The student connects three lemon cells in **parallel** and measures the total e.m.f. with the voltmeter.

1. State the total e.m.f. that you would expect.

e.m.f. = ... [1]

2. On Fig. 3.4, draw the connections that the student uses.



[1]

Fig. 3.4

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4 A student is given a bag of ten similar marbles.

(a) The student uses a 30 cm ruler to determine the average diameter of the marbles.

Describe how the student obtains an accurate value.
Include a labelled diagram showing how any additional apparatus is used.

.....

.....

.....

.....

..... [3]

(b) The student then measures the diameter *d* of one marble accurately using a micrometer. The scale of the micrometer is shown in Fig. 4.1.

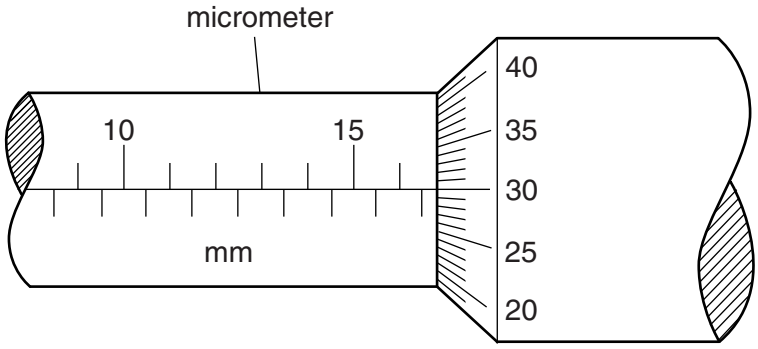


Fig. 4.1

(i) State the reading shown on the micrometer.

d = ... [1]

(ii) Describe how the student checks that the marble is spherical.

.....

..... [1]

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