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Examiners' Report
June 2011

GCE Physics 6PH07 01

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June 2011

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Introduction

This paper is the international alternative to coursework and therefore the questions are closely related to the coursework criteria in the specifcation. We strongly recommend that centres ensure that their candidates are familiar with these criteria. We also expect that as this is a practical alternative paper, candidates will consider significant figures and units carefully.

There was no evidence that candidates were short of time: all questions were usually answered. The best responses focused on the questions asked and used the guidance and hints in the question to frame answers.

The multiple choice questions were generally well answered. Question 3 was the least well answered: candidates were expeted to work out what the area represented from their understanding of the concept of an area under a graph. They could also access the correct answer by elimination.

Comentary on the longer questions and some exemplar material is given on following pages.

Question 6 (a)

This question required candidates to evaluate and analyse the results from an experiment. Most candidates commented appropriately on the inconsistent precision in the extension reading or the apparent lack of repetition: fewer spotted that the force column had no untits or that the mass readings lacked precision.

(a) Criticise the results.

(2)

The number of decimal places for extension are not constant. Force has no unit

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Examiner Comments

This is a good answer which gained both marks: it is short and to the point.

(a) Criticise the results.

(2)

* Extension values are not given to the same decimal place and extension.
* No repeat and average readings of mass are given.
* Unit of force is not given in the result table.
* Close values of mass have been taken.

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Examiner Comments

This answer gives four points but still only gains two marks.
It is not clear what the candidate meant by 'close values' of mass.

Try to use precise scientific language in your answers.

Question 6 (b) (c)

Candidates were expected to draw a line of best fit which, while going through as many points as possible, balanced the number of points on either side of the line. The relationship was generally described well.

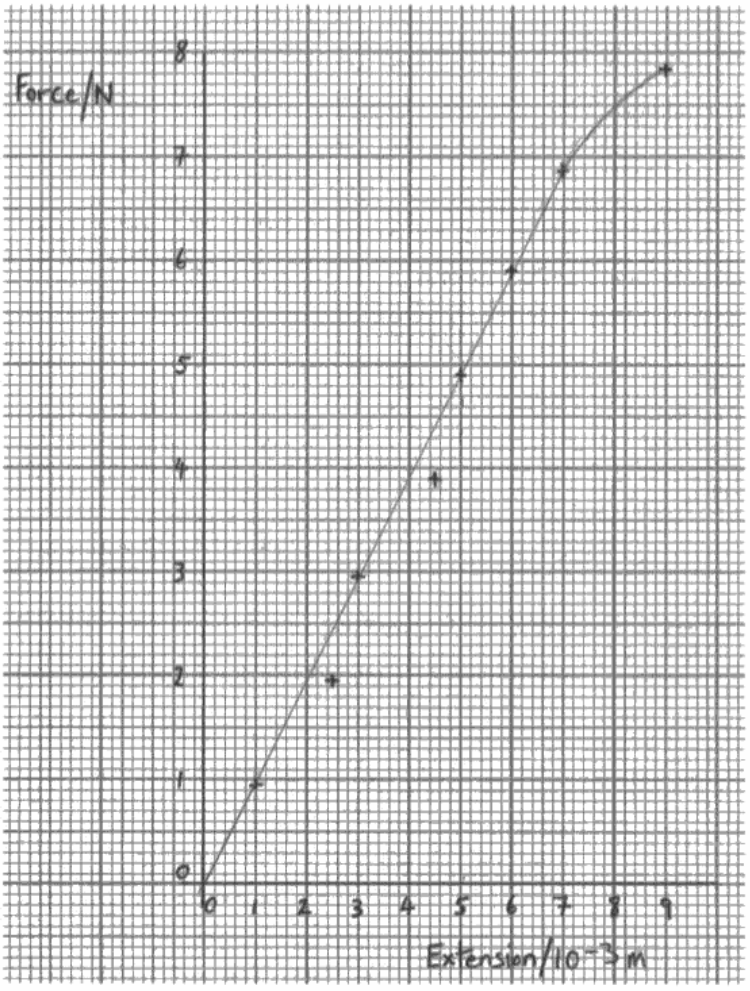
Canddiates are expected to demonstrate that they have used their graph by drawing a large triangle using at least half the range. Few candidates gave the correct unit and power of ten. Even fewer adjusted their answer to a suitable number of significant figures which took into account the measuring instruments used.

SECTION B

Answer ALL questions in the spaces provided.

6 A student's results and graph from an experiment to find the stiffness k of a material are shown below.

Mass / kg	Force	Extension / m
0.1	0.98	0.001
0.2	1.96	0.0025
0.3	2.94	0.003
0.4	3.92	0.0045
0.5	4.91	0.005
0.6	5.89	0.006
0.7	6.87	0.007
0.8	7.85	0.009



(b) Draw in a line of best fit and comment on the relationship between force and extension shown by the graph.

(2)

force is directly proportiond to extension up to the proportionality limit of the ma terial.

(c) Use the graph to determine a value for k.

(3)

$G = K$

$K = \frac{4.9 - 2.9}{5 - 3}$

$= 1\,\text{N} \quad 1\times10^{-3}\,\text{Nm}^{-1} \quad 1000\,\text{Nm}^{-1}$

$k = \frac{1000\,\text{Nm}^{-1}}{1\times10^{-3}\,\text{Nm}^{-1}}$

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Examiner Comments

Although this candidate has recognised that the line may curve, too many points are below the line. The comment on the line recognises the limit of proprtionality.

No triangle is shown on the graph but the unit and power of ten are correct.

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Examiner Tip

Not all lines of best fit are straight lines.
Show triangles for gradients on your graph.

SECTION B

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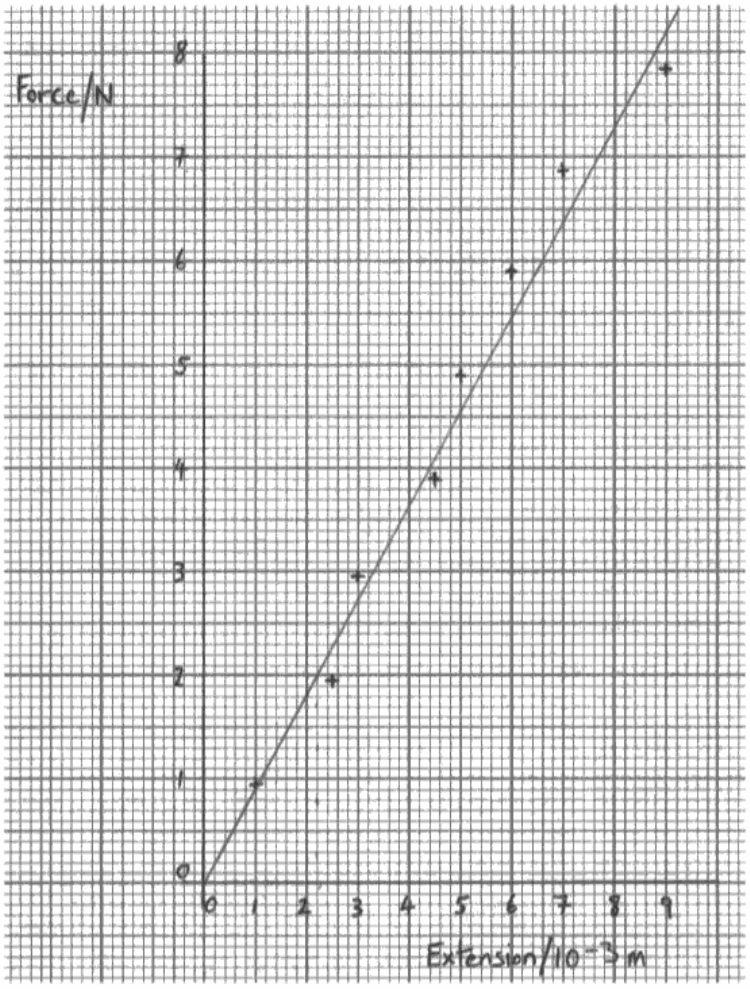

(b) Draw in a line of best fit and comment on the relationship between force and extension shown by the graph.

(2)

It shows that force is directly proportional to extension

(c) Use the graph to determine a value for k.

(3)

$k = \frac{F}{e}$ $\quad \frac{2}{0.0022} = 909.09 \text{ N/m}$ $\quad 0.0022$

$k =$ 909.09 N/m

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Examiner Comments

This is a good line of best fit. Unfortunately two marks were lost in part (b) because a large triangle was not used and the answer is given to too many significant figures.

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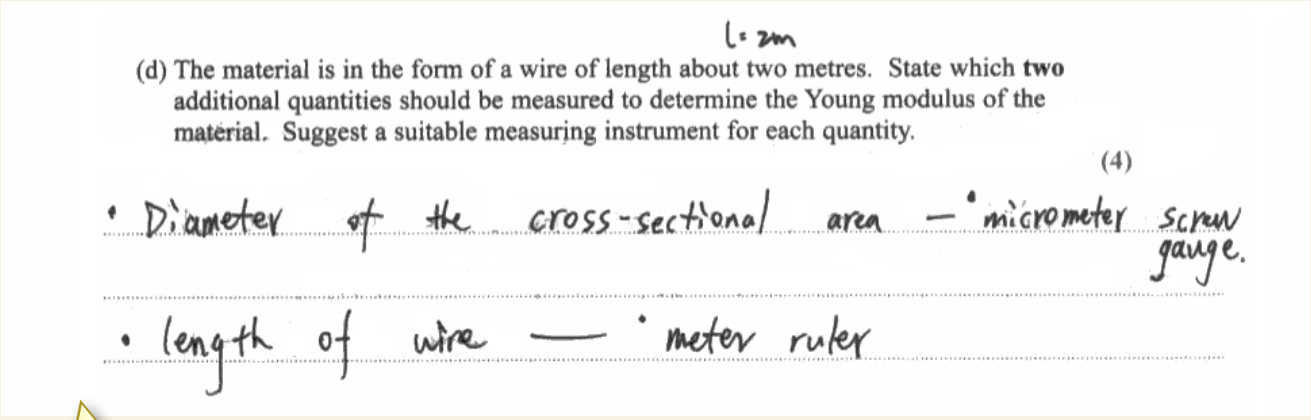
Examiner Tip

Remember to check the number of significant figures.

Question 6 (d)

The question asked for two required measurements. Some candidates listed quantities which could not be measured directly such as cross-sectional area, others gave extension which had already been measured, or several measurements expecting the examiner to choose the correct ones.



l = 2m

(d) The material is in the form of a wire of length about two metres. State which **two** additional quantities should be measured to determine the Young modulus of the material. Suggest a suitable measuring instrument for each quantity.

(4)

• Diameter of the cross-sectional area — micrometer screw gauge.

• length of wire — meter ruler

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Examiner Comments

This is a good succinct answer.

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Examiner Tip

As the question only asks for two measurements, this is all you should give.

Question 7

The more able candidates used the headings in the question to structure their answers rather than just writing a general method. The question was well answered by the majority of candidates who chose the correct experiment, although there were some poor circuit diagrams when candidates chose to use an ohmmeter.

Most candidates selected appropriate measuring instruments with confidence but the reasons for choosing them were often weak, for example explaining how a voltmeter would be connected in parallel rather than commenting on the precision or range in the context of this experiment.

Comments on safety did not always include the hazard as well as a precaution.

7 You are to plan an experiment to investigate the variation of the resistance of a negative temperature coefficient thermistor with temperature. You are to use a graphical method. Assume that standard laboratory apparatus is available.

Your answer should include:

(a) a labelled diagram of the apparatus to be used,

(1)

(b) a list of any additional apparatus required that is not shown in the diagram,

(1)

(c) the quantities to be measured,

(1)

(d) an explanation of your choice of measuring instrument for **two** of these quantities,

(4)

(e) which is the independent and which is the dependent variable,

(1)

(f) how the data collected will be used,

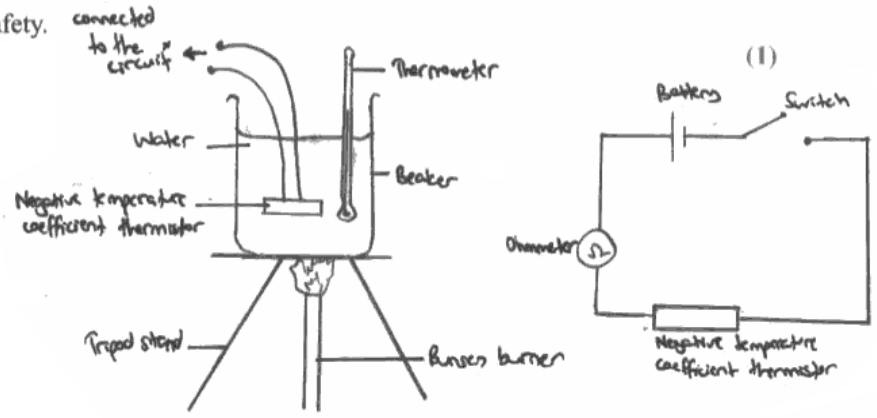
(1)

(g) the main source of uncertainty and/or systematic error,

(1)

(h) a comment on safety.

(1)



Additional apparatus required are switch, ~~volt-ammeter~~ battery, ohmmeter, connecting wires with crocodile clips, ~~ice cubes~~

Measure the temperature of the water in the beaker by using a thermometer.

Measure the resistance of the negative temperature coefficient thermistor by using an ohmmeter.

The temperature of the water in the beaker is measured by using a thermometer because ~~the~~ it has the smallest scale division of 0.1 °C.

The resistance of the negative temperature coefficient thermistor is measured by using an ohmmeter because it has high precision which is 0.1 Ω.

The independent variable is the temperature of the water bath.

The dependent variable is the resistance of the negative temperature coefficient thermistor.

The resistance of the thermistor is measured at each temperature (water bath) such as 10°C, 20°C, 30°C, 40°C, 50°C, 60°C, 70°C and 80°C.

A graph of resistance against temperature should be plotted. Draw a line of best fit for the graph and observe the general pattern of the graph.

The main source of systematic error is a zero error of the ohmmeter.

Parallax error also may occur when taking the reading of the thermometer because the eye is not at the same level with the meniscus of the mercury in the thermometer.

Handle the water bath with care because spillage of hot water bath may cause scalding.

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Examiner Comments

This is almost a perfect answer but the candidate has shown an ohmmeter incorrectly in a circuit.

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Examiner Tip

Make sure that you know how an ohmmeter is used.

7 You are to plan an experiment to investigate the variation of the resistance of a negative temperature coefficient thermistor with temperature. You are to use a graphical method. Assume that standard laboratory apparatus is available.

Your answer should include:

(a) a labelled diagram of the apparatus to be used,

(1)

(b) a list of any additional apparatus required that is not shown in the diagram,

(1)

(c) the quantities to be measured,

(1)

(d) an explanation of your choice of measuring instrument for **two** of these quantities,

(4)

(e) which is the independent and which is the dependent variable,

(1)

(f) how the data collected will be used,

(1)

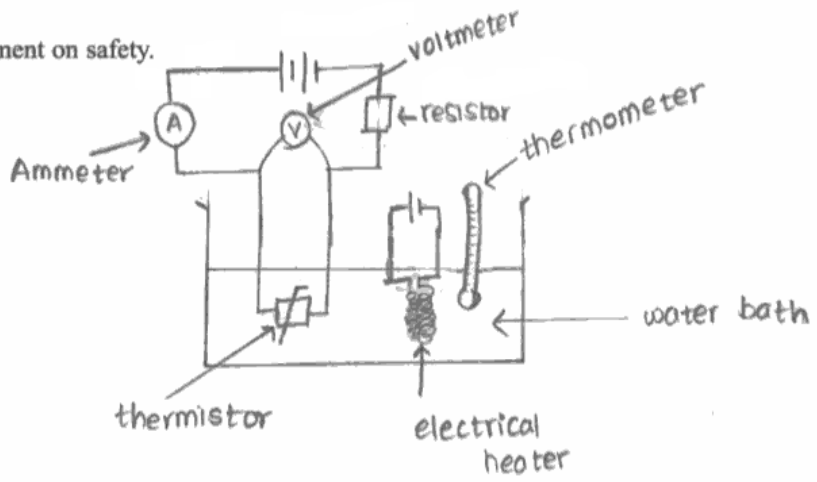
(g) the main source of uncertainty and/or systematic error,

(1)

(h) a comment on safety.

(1)

(a)



(b) ~~Stop watch~~

(c) ~~voltage~~, current, ~~thermometer~~ temperature, voltage

(d) To measure the voltage a voltmeter would be used which is set to a base of about 200mV as only a small voltage

would pass through the circuit. To measure the current an ammeter would be used with the base setting to about 20mA. By using this base setting ø even a very small reading for the current could be obtained.

f) The corresponding voltage values and the current values are recorded docon for each temperature. A graph is drawn for voltage against ~~time.~~ current. The gradient of the graph for different points are obtained which shows the variation of the resistance

h) Do not spill the hot water and wear gloves to prevent the hand being burnt.

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Examiner Comments

The parts shown are well organised and explain clearly how the graph wil be used.

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Examiner Tip

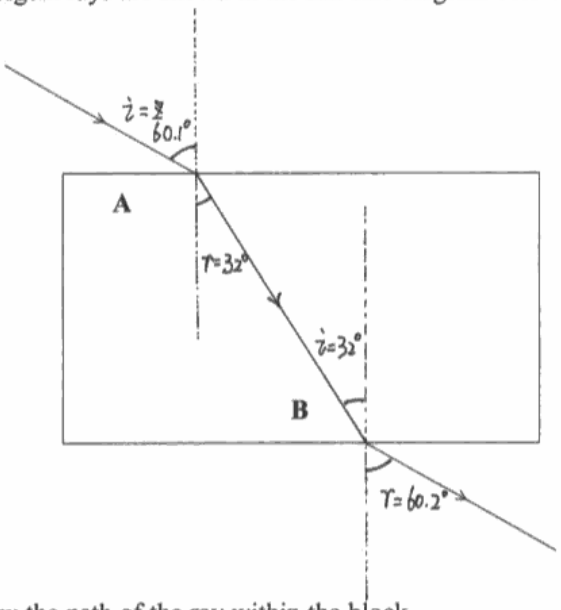
Structure your answer using the headings in the question.

Question 8 (a)

This question required candidates to draw lines and measure angles. Use of a protractor was expected but some candidates calclulated angles using trigonometry.

8 A student does an experiment to measure the refractive index μ for light travelling from air into a transparent material.

The student shines a ray of light through a rectangular block of the material. The paths of the incident and emergent rays are shown in the full size diagram below.



(a) On the diagram draw the path of the ray within the block.

(1)

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Examiner Comments

This is a clear neat line.

Question 8 (b) (c)

Most candidates seemed familiar with this type of experiment. Some did not measure angles at both A and B. As an average was requested, it was important that those who measured the same size of angles at A and B commented on this.

As shown in the mark scheme, in part (b) (ii) candidates were expected to state the uncertainty in angle measurements and then recalculate the refractive index taking this into account, or to use the difference ion their answers to part (i).

Any answer which was a good match to the refractive index calculated in (b) (i) was credited.

(b) (i) By measuring appropriate angles at A and B determine an average value of μ. (1)

You should show any construction lines and your measurements on the diagram.

Give your final answer to an appropriate number of significant figures.

(7)

$I_1 = 61^\circ$ $\mu_1 = \frac{\sin I_1}{\sin R_1} = \frac{\sin 60^\circ}{\sin 32.5^\circ}$

$I_1 = 60^\circ$

$R_1 = 32.5^\circ$ $= 1.61$

$I_2 = 33^\circ$ $\frac{1}{\mu_2} = \frac{\sin I_2}{\sin R_2}$ $\mu_2 = \frac{\sin R_2}{\sin I_2} = \frac{\sin 60^\circ}{\sin 33^\circ}$

$R_2 = 60^\circ$

$= 1.59$ //

$\mu = \frac{\mu_1 + \mu_2}{2} = 1.60$ //

$\mu = 1.60$

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Examiner Comments

This is a good aswer which clearly shows two sets of measurements, averaging and a sensible number of significant figures.

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Examiner Tip

Show all your working clearly.

Question 8 (d)

Most candidates gave good answers to this part: those who did not, often tried to explain why graphs are a good idea rather than how to obtain one in this case.

This explains clearly how a graph will be obtained and how it will be used.

(d) The student's teacher suggests that a graphical method could be used to increase the accuracy of the value of μ.

Describe how this could be done.

(2)

Vary the angle of incidence, and hence, the angle of refraction. Measure the angles and plot a graph of sin i (y-axis) against sin r (x-axis). Draw a line of best fit (and find gradient to get μ).

(Total for Question 8 = 13 marks)

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Examiner Comments

A good clear answer.

Paper Summary

The space given for questions is more than we would expect any answer to take, and relevance rather than length is the key to high marks. Centres should also ensure that candidates have access to rulers, pencils and protractors. The use of a scientific calculator is expected.

Many centres had prepared their candidates well for this paper which was relected in the good responses from many canddidates.

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