Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Teacher's Use		
		Mark
Stage 1		
Section A	1	
Section B	2	
	3	
	4	
	5	
TOTAL		

General Certificate of Education
Advanced Level Examination
June 2010

Physics PHY6T/Q10/test

Unit 6 Investigative and Practical Skills in A2 Physics

Investigative Skills Assignment (ISA) Q

Written Test

For this paper you must have:
- a calculator
- a ruler
- a protractor
- your completed documentation from Stage 1.

Time allowed
- 1 hour

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Attach your documentation from Stage 1 to this booklet before handing it to the invigilator at the end of the examination.
- Show all your working.
- Do all rough work in this booklet. Cross through any work you do not want to be marked.

Information
- The marks for the questions are shown in brackets.
- The maximum mark for this paper and the practical task is 41.

Signature of Teacher marking the ISA .... Date ....

Section A

Answer **all** questions in the spaces provided.
You should refer to your documentation from Stage 1 as necessary.

1 (a) Underline the **two** words in the following list that describe the variable n in the investigation in Stage 1.

independent dependent continuous discrete

(1 mark)

1 (b) From the shape of your graph describe qualitatively how R varies with n.

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(1 mark)

1 (c) To show how the thickness of the tracing paper affects the resistance of the LDR under these conditions, the thickness of a single sheet of the paper needs to be determined. Describe how you would determine the thickness of a sheet of tracing paper as accurately as possible. Name the measuring instrument you would use.

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(2 marks)

1 (d) If a tracing paper manufacturer were provided with a graph of LDR resistance against paper thickness, explain how the manufacturer could use this apparatus to check that the thickness of the tracing paper is within acceptable limits.

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(3 marks)

1 (e) The response of an LDR to the light incident upon it is sometimes dependent on the colour (i.e. frequency) of that light.

To investigate whether or not the LDR used in Stage 1 is frequency sensitive, a set of colour filters with known transmission frequencies could be used with the apparatus instead of the tracing paper.

1 (e) (i) What variable other than frequency would be affected by the filters?

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1 (e) (ii) Assuming that this variable could be controlled, how would you use the apparatus to test whether the LDR is frequency sensitive?

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Question 1 continues on the next page

Turn over ▶

1 (e) (iii) How could the results from this experiment be used to suggest the best colour to use in the application referred to in part (d)?

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(4 marks)

11

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Section B

Answer **all** the questions in the spaces provided.

2 In the LDR experiment in **Stage 1** the intensity of the light incident on the LDR was reduced because some of the energy was absorbed as it passed through the tracing paper. It was important to keep the separation of the LDR and the light source constant because an increase in this distance would also decrease the intensity of the incident light. This decrease of intensity with distance is common to all forms of radiant energy.

The table in **Figure 1** shows the measurements taken in an experiment with a weak gamma ray source.

d is the measured distance between the source and the detector.

C_1, C_2 and C_3 are *corrected* repeat readings of the count-rate C as recorded by the detector.

2 (a) Explain why a correction has been made to the values for count-rate recorded by the detector.

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(1 mark)

Figure 1

d / cm	C_1 / min^{-1}	C_2 / min^{-1}	C_3 / min^{-1}	C / min^{-1}	$1/\sqrt{C}$ / min^{½}
2.0	1283	1329	1297	1303	0.0277
4.0	530	501	505	512	0.0442
6.0	306	320	327	318	0.0561
8.0	187	174	164	175	0.0756
10.0	109	127	118	118	0.0921
12.0	100	108	88		
14.0	75	63	72		

2 (b) Why were repeat readings taken at each distance?

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(1 mark)

2 (c) Estimate the uncertainty in C for $d = 14.0$ cm.

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(1 mark)

2 (d) Theory predicts that C is inversely proportional to d^2. The uncertainty in all the measurements of d shown in the table is ± 2 mm.
Estimate the percentage uncertainty in the value of $1/d^2$ when $d = 2.0$ cm.

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(2 marks)

2 (e) Complete the table (**Figure 1**) by calculating the mean value of C and the corresponding values of $1/\sqrt{C}$ for the values of $d = 12.0$ cm and 14.0 cm.

(2 marks)

7

Turn over for the next question

Turn over ▶

3 (a) Complete the graph of $1/\sqrt{C}$ (y-axis) against d and draw the best fit straight line through your points.

(2 marks)

3 (b) The equation for the line you have drawn is $\frac{1}{\sqrt{C}} = k(d + e)$,

where k and e are constants.

3 (b) (i) Measure the gradient of your straight line.

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3 (b) (ii) Find the value of k and state its unit.

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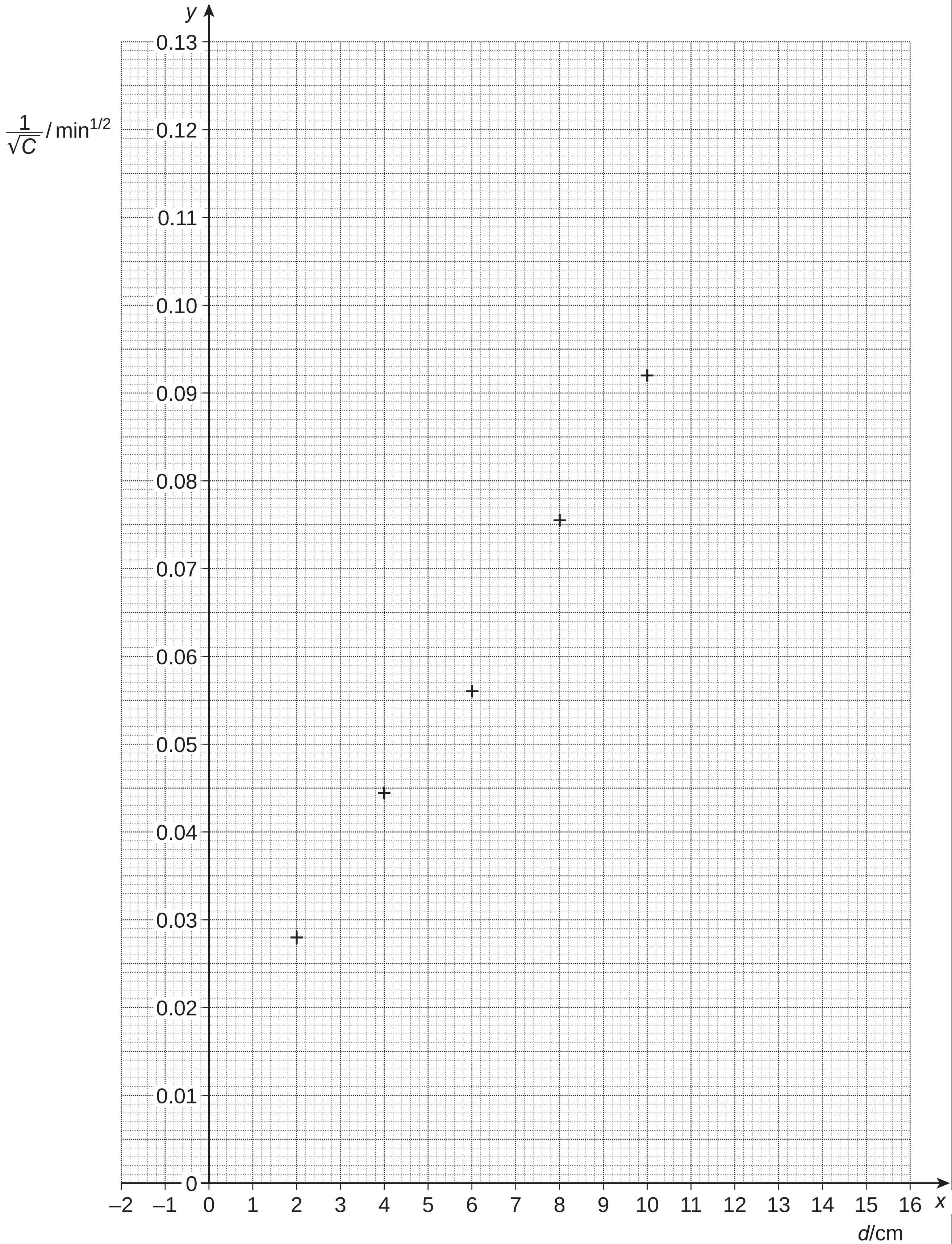
(5 marks)

7

Graph of $\frac{1}{\sqrt{C}}$ against d



Turn over ▶

4 The constant *e* is non-zero because all of the measurements for *d* were consistently too small or too large.

4 (a) What is the name for this type of experimental error?

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(1 mark)

4 (b) Were the measurements of *d* too small or too large? Explain your answer.

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(2 marks)

4 (c) Use your graph to determine a value for *e*.

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(1 mark)

4

5 The equation $\frac{1}{\sqrt{C}} = k(d + e)$ assumes that the gamma radiation spreads out equally in all directions from the source.

5 (a) Discuss whether or not the graph supports this assumption.

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(2 marks)

5 (b) Describe how you would use the apparatus you used in your practical task (Stage 1) to find out if light from a lamp also spreads out equally in all directions.

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(2 marks)

4

END OF QUESTIONS

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