Centre Number						Candidate Number				
Surname						Other Names				

Notice to Candidate. The work you submit for assessment must be your own. If you copy from someone else or allow another candidate to copy from you, or if you cheat in any other way, you may be disqualified.

Candidate Declaration. I have read and understood the Notice to Candidate and can confirm that I have produced the attached work without assistance other than that which is acceptable under the scheme of assessment.

Candidate Signature		Date	

For Teacher's Use	
Section	Mark
PSA	
Stage 1	
Section A	
Section B	
TOTAL (max 50)	

General Certificate of Education
Advanced Subsidiary Examination
June 2011

Physics (Specification A & B) PHY3T/Q11/test

Unit 3T AS Investigative Skills Assignment (ISA) Q

For submission by 15 May 2011

For this paper you must have:	**Time allowed**
• your documentation from Stage 1 • a ruler with millimetre measurement • a calculator.	• 1 hour
Instructions:	**Information**
• 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 space provided. Do not write outside the box around each page or on blank pages. • Do all rough work in this book. Cross through any work you do not want to be marked.	• The marks for questions are shown in brackets. • The maximum mark for this paper and Stage 1 is 41.

Details of additional assistance (if any). Did the candidate receive any help or information in the production of this work? If you answer yes give the details below or on a separate page.

Yes ☐ No ☐

Teacher Declaration:
I confirm that the candidate's work was conducted under the conditions laid out by the specification. I have authenticated the candidate's work and am satisfied that to the best of my knowledge the work produced is solely that of the candidate.

Signature of teacher ..... Date .....

Do not write outside the box

Section A

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

You should refer to your documentation from Stage 1 as necessary.

1 (a) Theory predicts that, for the wire you investigated in Stage 1, its resistance is directly proportional to its length. State and explain whether or not your graph shows this.

.....

.....

.....

(2 marks)

1 (b) Estimate the uncertainty in your measurements of length L and explain how you arrived at this estimate.

.....

.....

.....

(2 marks)

1 (c) (i) Using the value you stated for the precision of the ammeter, determine the percentage uncertainty in the measurement of the 0.50 A current.

.....

.....

1 (c) (ii) Using the value you stated for the precision of the voltmeter, find the percentage uncertainty in your smallest measured pd.

.....

.....

1 (c) (iii) Use your answers to part **(c)(i)** and part **(c)(ii)** to find the percentage uncertainty in your smallest calculated value of resistance.

.....

.....

.....

(3 marks)

Do not write outside the box

1 (d) The resistance R of a metal wire of length L is given by the formula $R = \rho L/A$, where A is the area of cross-section of the wire and ρ is the resistivity of the metal.

Explain how ρ could be calculated using your graph, stating a further measurement which needs to be made. Suggest a suitable instrument for making this measurement.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4 marks)

11

Turn over for the next question

Do not write outside the box

Section B

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

2 In an experiment, the resistance and diameter of seven different wires were measured. Each wire was made of the same metal and was 1.100 m in length. The resistance was measured using a multimeter and the diameter measurement was made at three different positions along each wire. The results from the experiment are shown in the following table.

wire diameter d / mm				area A of cross-section / mm^2	$1/A$ / mm^{-2}	resistance R / Ω
first reading	second reading	third reading	mean value			
0.276	0.277	0.274	0.276	0.060	16.7	8.29
0.297	0.297	0.300	0.298	0.070	14.3	6.95
0.324	0.325	0.325	0.325	0.083	12.1	5.91
0.352	0.352	0.351	0.352	0.097	10.3	5.06
0.401	0.398	0.402	0.400	0.126	7.9	3.88
0.450	0.448	0.449				3.09
0.501	0.497	0.500				2.42

2 (a) Complete the table by filling in the missing values of d, A and $1/A$.

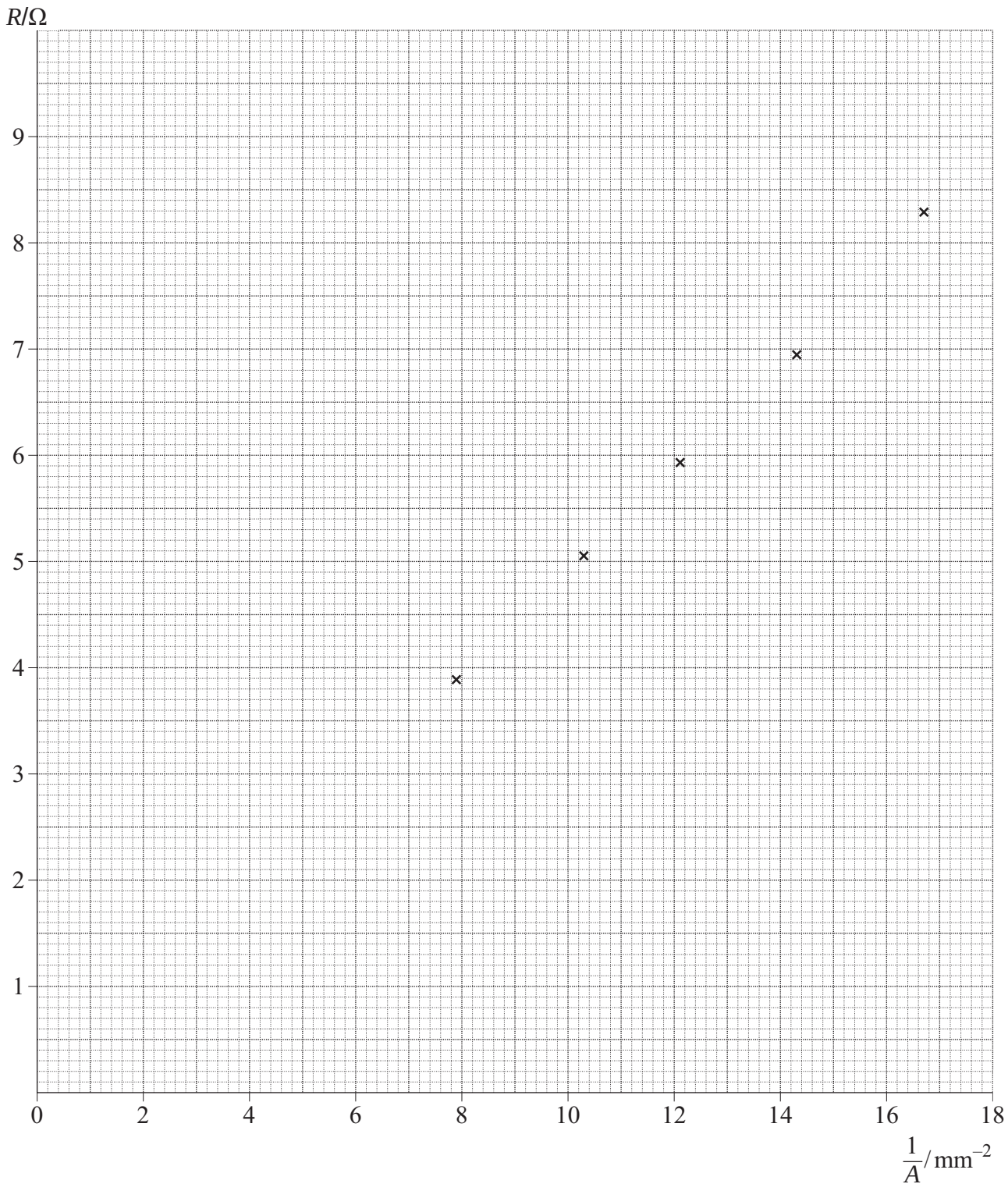
(2 marks)

2 (b) Complete the graph of R against $1/A$ on **page 5** by plotting the **two** missing points and drawing a straight line of best fit.

(2 marks)

Do not write outside the box

Graph of R against $\frac{1}{A}$



Question 2 continues on the next page

Do not write outside the box

2 (c) (i) Determine the gradient of the graph of R against $\frac{1}{A}$.

.....

.....

.....

2 (c) (ii) State the unit of the quantity represented by the gradient you measured in part **(c)(i)**.

.....

2 (c) (iii) Use the gradient and the formula $\rho = RA/L$ to show that the resistivity of the metal was about $4 \times 10^{-7}\,\Omega\,\text{m}$.

.....

.....

.....

.....

(7 marks)

2 (d) (i) Use data from the table on **page 4** to estimate the uncertainty in the mean value of $d = 0.400\,\text{mm}$.

.....

.....

2 (d) (ii) Is the uncertainty you estimated in part **(d)(i)** more or less significant than the uncertainty for L you estimated in Question **1** part **(b)**? Justify your answer with suitable calculations.

.....

.....

.....

(3 marks)

14

Do not write outside the box

3 Overhead power cables are made from aluminium with a steel core to combine tensile strength with low resistivity. These properties are necessary because the cables are very long and have to be stretched between support towers.

Suppose you are required to investigate how the resistance of a vertical wire, two metres in length, varies when it is stretched by attaching weights to its lower end. Assume you are provided with a secure means of hanging the wire from the ceiling, a multimeter with ranges to measure mΩ, Ω and kΩ, a set of weights to hang from the wire, long connecting leads and crocodile clips.

Describe how you would use the apparatus provided to investigate how the resistance of the wire varies with the stretching force. You should consider safety issues and the reduction of systematic errors in this experiment.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(5 marks)

END OF QUESTIONS

5

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED