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)	

AQA

General Certificate of Education
Advanced Subsidiary Examination
June 2014

Physics (Specification A & B) PHY3T/P14/test

Unit 3T AS Investigative Skills Assignment (ISA) P

For submission by 15 May 2014

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. • Show all your working.	• 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) State the dependent variable in your experiment.

[1 mark]

.....

1 (b) (i) State the uncertainty in your readings of V and the uncertainty in your readings of I.

[1 mark]

Uncertainty in V .....

Uncertainty in I .....

1 (b) (ii) State which of the results for V and I in your table, from stage 1, would give the smallest percentage uncertainty in the resistance of R_A.

[1 mark]

.....

.....

1 (b) (iii) Use your answers to parts (b)(i) and (b)(ii) to determine the smallest percentage uncertainty in the resistance of R_A.

[2 marks]

.....

.....

.....

.....

.....

.....

.....

.....

Do not write outside the box

1 (c) (i) Read a point off each of the lines for R_A and R_B to determine the resistance of R_A and the resistance of R_B. You should take account of the need to reduce percentage uncertainty in your calculation.

[2 marks]

R_A .....

.....

.....

R_B .....

.....

.....

1 (c) (ii) The resistance, R, of R_A and R_B in parallel is given by

$$R = \frac{(\text{resistance of } R_A) \times (\text{resistance of } R_B)}{(\text{resistance of } R_A) + (\text{resistance of } R_B)}$$

Use this equation to calculate R.

[1 mark]

.....

.....

.....

1 (c) (iii) Use the 'parallel resistance' line to determine the resistance R.

[1 mark]

.....

.....

1 (c) (iv) If all the measurements of resistance were accurate to 5% explain which of the two results for the value of R in parts (c)(ii) and (c)(iii) is more reliable.

[1 mark]

.....

.....

.....

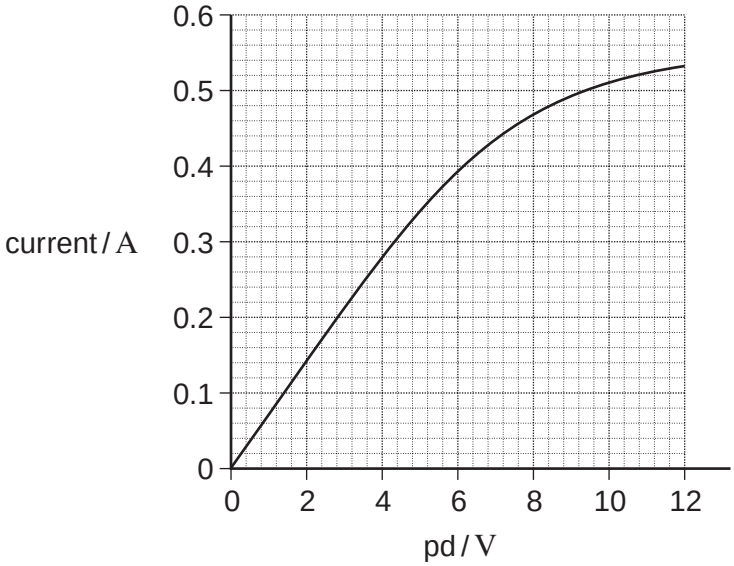
.....

.....

Do not write outside the box

1 (d) A student plots the current – pd characteristics of a tungsten filament lamp. The results are shown in **Figure 1**.

Figure 1



Describe how you would use this graph to show the variation of the resistance of the filament with the current through it. Indicate the outcome you would expect.

[2 marks]

.....

.....

.....

.....

.....

.....

.....

12

Do not write outside the box

Section B

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

2 An experiment was performed to investigate how the resistance of a length of constantan wire varies with the diameter of the wire.
$1.000\,\text{m}$ lengths of constantan wire of different diameters, d, were used.
The results are shown in **Table 1**.

Table 1

d / mm	$\frac{1}{d^2}$ / mm^{-2}	1st reading resistance R_1 / Ω	2nd reading resistance R_2 / Ω	mean resistance R / Ω
0.91	1.21	0.80	0.84	0.82
0.71	1.98	1.30	1.35	1.33
0.56	3.19	2.08	2.10	2.09
0.51	3.84	2.49	2.53	2.51
0.46		3.11	3.14	
0.38		4.56	4.53	

2 (a) Complete **Table 1**.

[1 mark]

2 (b) Complete **Figure 2** on page 6 by plotting the two remaining points and draw a best fit straight line.

[2 marks]

2 (c) Determine the gradient of the graph, **Figure 2**.

[3 marks]

.....

.....

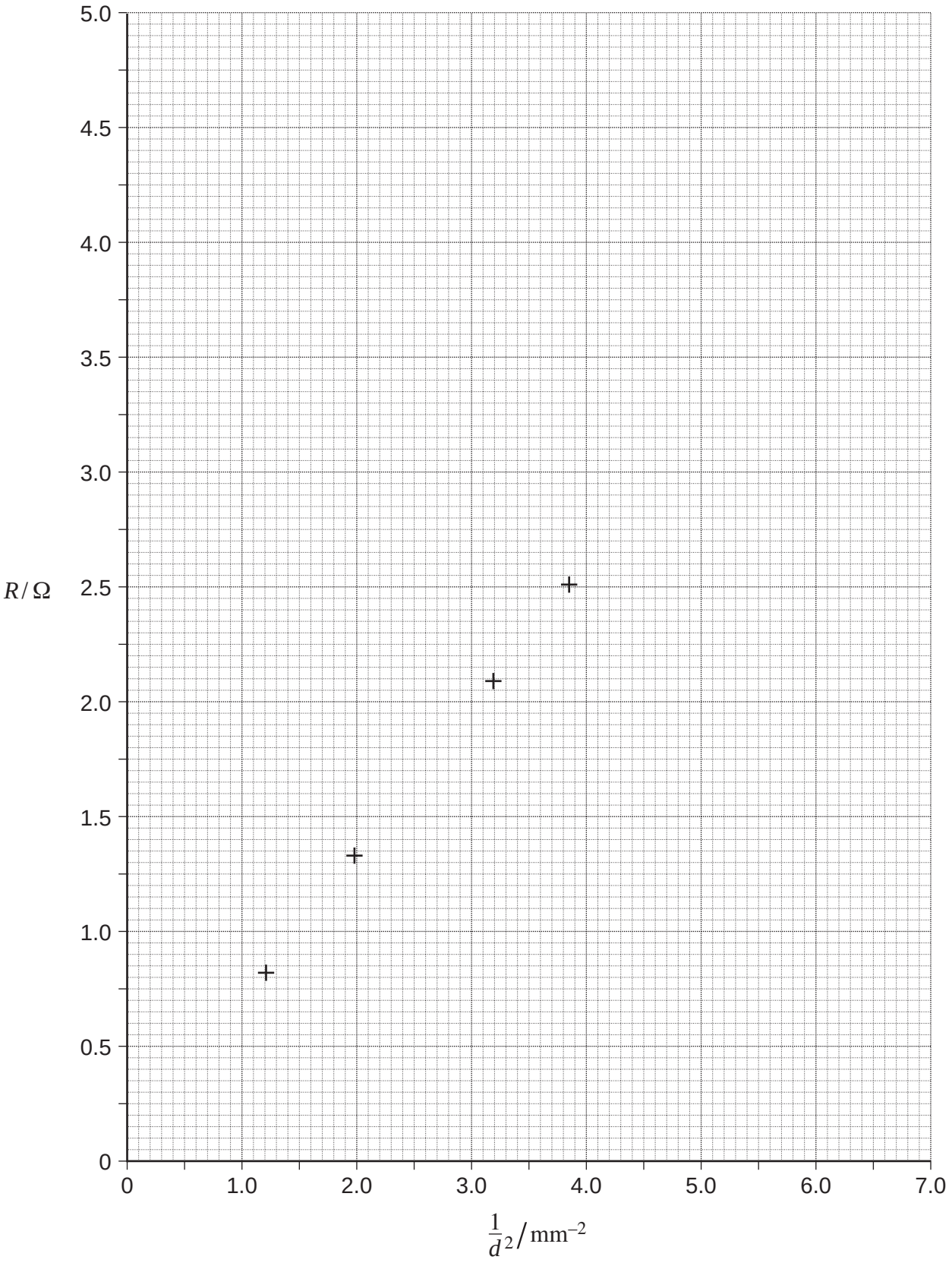
.....

.....

Turn over ▶

Do not write outside the box

Figure 2



Do not write outside the box

2 (d) Resistance R of the wire is related to the resistivity ρ of the material by the equation

$$R = \frac{\rho l}{A}$$

where l is the length of the wire and A is the cross-sectional area.

2 (d) (i) Explain how this relationship is supported by the graph (**Figure 2**).

[2 marks]

.....

.....

.....

.....

2 (d) (ii) Use the value for the gradient of the graph (**Figure 2**) found in part (c) to determine the resistivity ρ of constantan.

[2 marks]

.....

.....

.....

.....

.....

.....

2 (e) (i) Describe **in detail** how you would measure the diameter of a wire in this experiment.

[2 marks]

.....

.....

.....

.....

.....

Do not write outside the box

2 (e) (ii) State **one** possible source of systematic error in this measurement and explain how you would eliminate it.

[2 marks]

.....

.....

.....

.....

2 (f) For the results in this experiment you may assume that the length was measured to ± 0.5%, the diameter to ± 2% and the resistance to ± 3%.

2 (f) (i) Discuss which measurement contributes most to the uncertainty in the value of ρ.

[1 mark]

.....

.....

.....

2 (f) (ii) Estimate the uncertainty in your value for ρ from part (d)(ii).

[2 marks]

.....

.....

.....

.....

.....

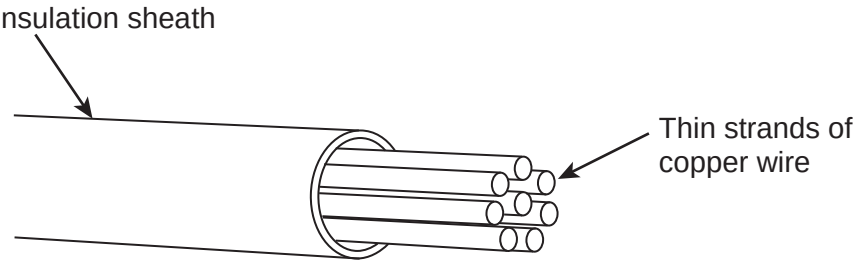
.....

17

Do not write outside the box

3 Electrical cables are usually made from identical thin strands of copper wire enclosed in an insulation sheath as shown in **Figure 3**.

Figure 3



3 (a) State and explain how you would expect the resistance of a fixed length of cable to vary as n, the number of strands in the cable, increases.

[1 mark]

.....

.....

.....

3 (b) Describe how you would investigate the way in which the resistance of a cable depends on the number of strands of wire in the cable.
You may assume that you have been provided with an ohm-meter, a reel of thin wire of resistance per unit length about $1\ \Omega\text{m}^{-1}$ and any other laboratory equipment that you may need.

[4 marks]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Turn over ▶

.....

.....

.....

.....

5

END OF QUESTIONS