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



General Certificate of Education
Advanced Subsidiary Examination
June 2012

Physics (Specification A & B) PHY3T/P12/test

Unit 3T AS Investigative Skills Assignment (ISA) P

For submission by 15 May 2012

For this paper you must have: <ul style="list-style-type: none"> ● your documentation from Stage 1 ● a ruler with millimetre measurement ● a calculator. 	Time allowed <ul style="list-style-type: none"> ● 1 hour
Instructions: <ul style="list-style-type: none"> ● 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. 	Information <ul style="list-style-type: none"> ● 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 <input type="checkbox"/> No <input type="checkbox"/>	

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

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Section A

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

1 (a) State the independent variable in your experiment.

.....
(1 mark)

1 (b) Calculate the percentage uncertainty in your largest mean current reading.

.....
.....
.....
(1 mark)

1 (c) If the resistors used in your experiment had a tolerance quoted as 5%, calculate the maximum and minimum resistance values of the largest value resistor, R , which you used.

Maximum value of resistor

Minimum value of resistor

(1 mark)

1 (d) (i) What would be the effect of contact resistance between resistor R and the connecting clips or plugs on the values of current I ?

.....
.....
.....

1 (d) (ii) State and explain the type of error introduced by contact resistance.

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.....
.....
(2 marks)

1 (e) State and explain what your graph indicates about the relationship between I_{mean} and $1/R$.

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(2 marks)

1 (f) Assess the *reliability* of your experiment.

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(1 mark)

8

Turn over for the next question

Turn over ►

Section B

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

- 2 An experiment was performed to investigate how the resistance of a nickel alloy wire varied with temperature. The resistance was measured using an ohm-meter. The results are shown in the table below.

temperature/ $\theta/^\circ\text{C}$	1 st reading resistance R_1/Ω	2 nd reading resistance R_2/Ω	3 rd reading resistance R_3/Ω	Mean resistance R/Ω
10	3.15	3.10	3.13	3.13
20	3.34	3.31	3.28	3.31
30	3.50	3.52	3.46	3.49
40	3.66	3.59	3.62	3.62
50	3.77	3.79	3.83	
60	3.90	3.95	3.88	
70	4.05	4.11	4.12	

- 2 (a) Complete the table by calculating the mean resistance, R , for the last three temperature values.
(1 mark)
- 2 (b) Complete the graph on page 5 by plotting the three remaining points and draw a best fit straight line.
(2 marks)
- 2 (c) Determine the gradient of the graph.

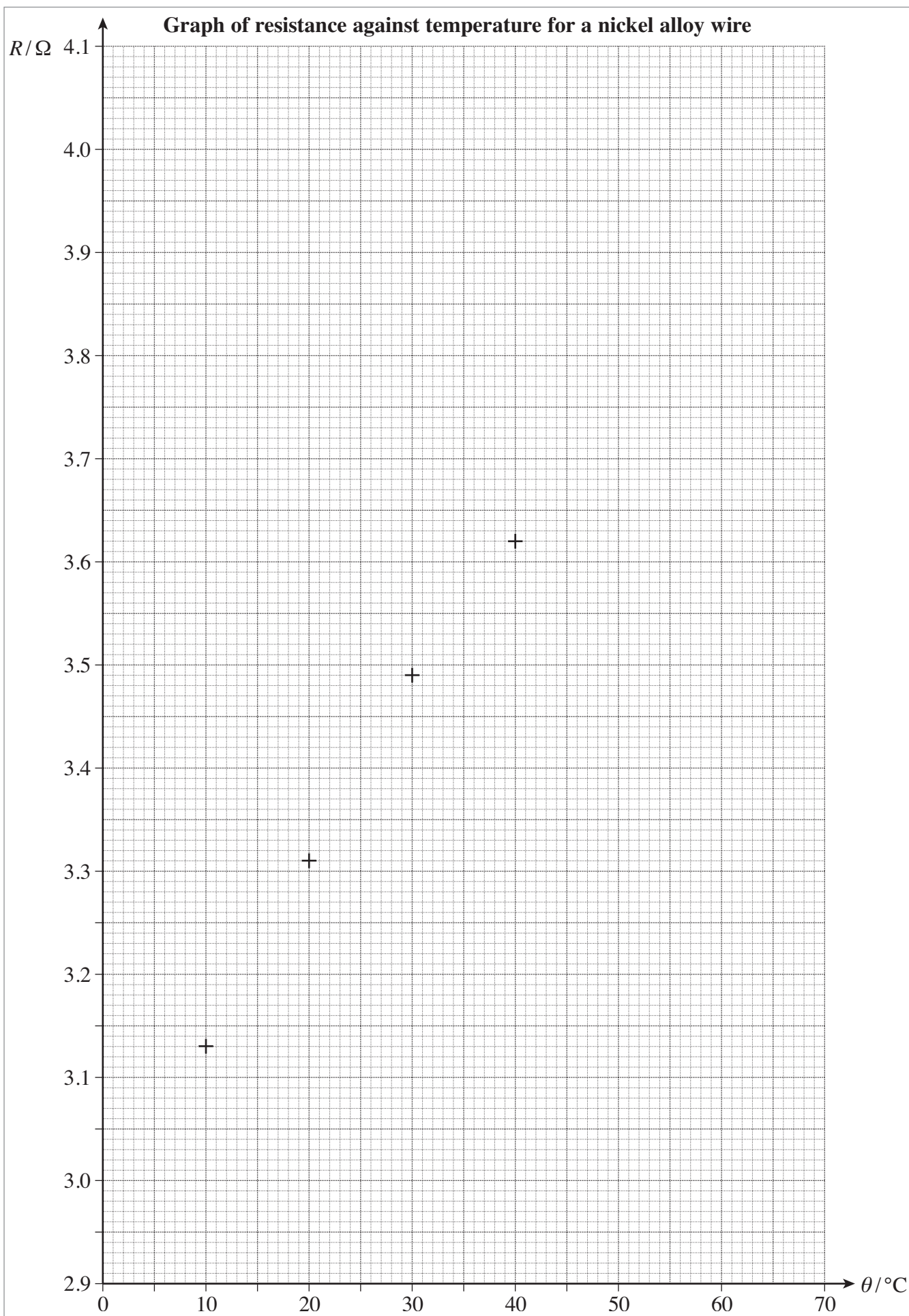
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(3 marks)



Turn over ►

2 (d) It is suggested that the relationship shown by the graph is of the form

$$R = R_0 + k\theta$$

where R is the resistance of the wire at temperature θ
 R_0 is the resistance of the wire at 0°C
and k is a constant

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

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.....

2 (d) (ii) Determine the value of the constant k .

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.....

2 (d) (iii) Use the graph to determine the value of R_0 .

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.....

(4 marks)

2 (e) Would an ohm-meter with a zero error affect the values of k and R_0 if it was used instead?
Explain your answer.

.....
.....
.....
.....

(3 marks)

3 (a) A student performed the experiment outlined in Question 2 with an identical piece of nickel alloy wire. The student decided to use an ammeter and voltmeter to determine the resistance of the metal wire at 10°C .
The ammeter used had a precision $\pm 0.01\text{ A}$, and the voltmeter a precision of $\pm 0.02\text{ V}$.
The current used was 0.20 A , and the measured potential difference (pd) was 0.62 V .

3 (a) (i) Calculate the percentage uncertainty in the current.

.....

3 (a) (ii) Calculate the percentage uncertainty in the pd.

.....

3 (a) (iii) Calculate the percentage uncertainty in the resistance measurement at 10°C .

.....

(3 marks)

3 (b) Explain whether the equipment used by the student in part (a) would have been suitable for measuring the variation of resistance of the metal wire at 10°C intervals.

.....

(2 marks)

5

Turn over for the next question

Turn over ►

- 4 (b)** Choose the most suitable ammeter to use in the experiment in part (a) from the selection below by ticking the appropriate box. Justify your choice with a suitable calculation.

Range 0 – 10 mA	precision ± 0.1 mA	<input type="checkbox"/>
Range 0 – 100 mA	precision ± 1 mA	<input type="checkbox"/>
Range 0 – 1.0 A	precision ± 0.01 A	<input type="checkbox"/>
Range 0 – 10 A	precision ± 0.1 A	<input type="checkbox"/>

(2 marks)

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END OF QUESTIONS