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 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:	**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 .....

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.

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(1 mark)

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

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(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?

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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

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/ θ/°C	**1st reading resistance R_1/Ω**	**2nd reading resistance R_2/Ω**	**3rd 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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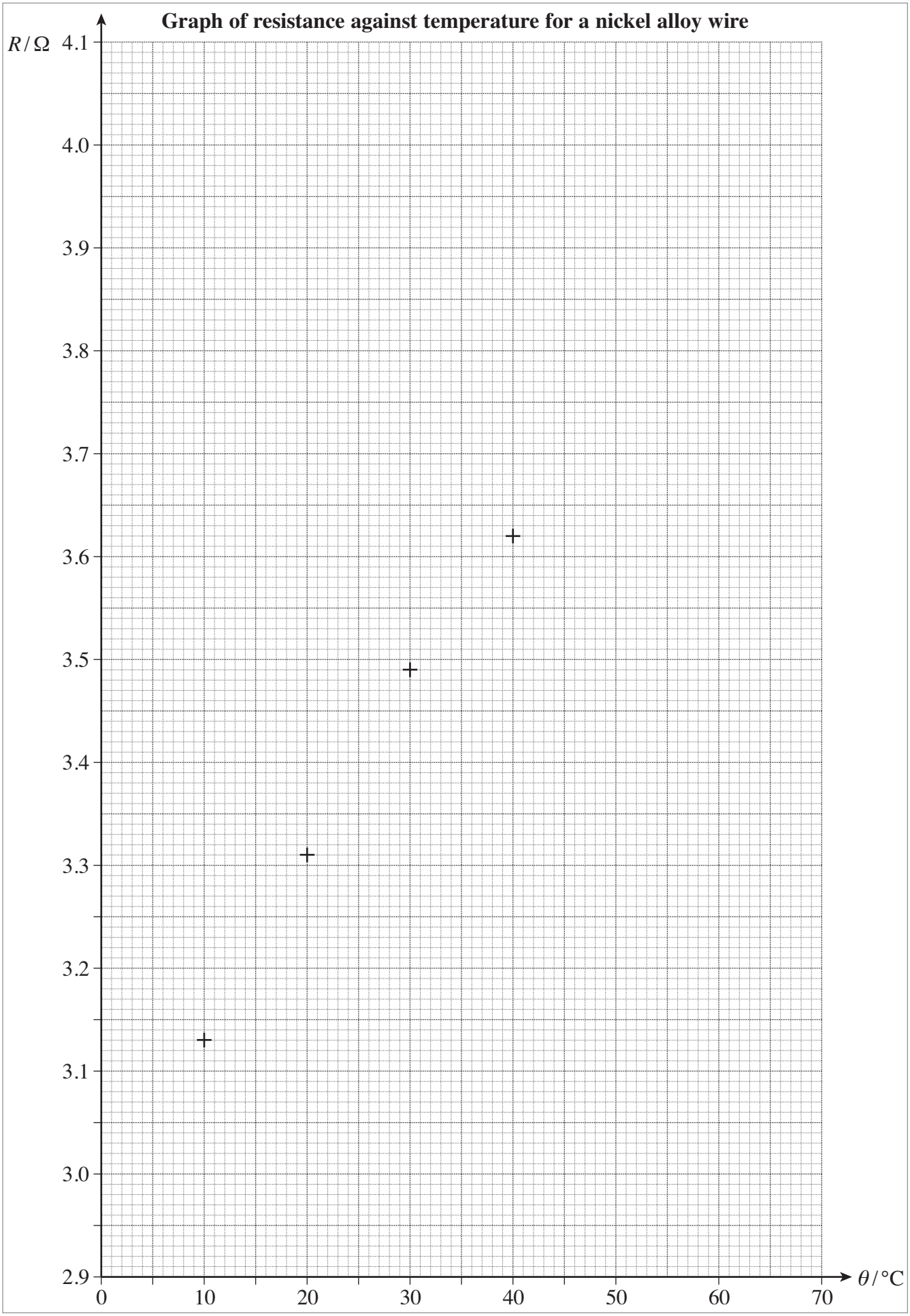
(3 marks)

Graph of resistance against temperature for a nickel alloy wire



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.

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(3 marks)

13

3 (a) A student perfomed 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 ± 0.01 A, and the voltmeter a precision of ± 0.02 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.

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

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

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(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.

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(2 marks)

5

Turn over for the next question

4 (a) It is suggested that when identical resistors are connected in parallel the total resistance is inversely proportional to the number of resistors. Describe how you could test this experimentally using two 1.5 V cells and six identical 20 Ω resistors and a suitable ammeter and voltmeter.

You should include a circuit diagram showing the arrangement when three resistors are used.

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(4 marks)

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	☐
Range 0 – 100 mA	precision ± 1 mA	☐
Range 0 – 1.0 A	precision ± 0.01 A	☐
Range 0 – 10 A	precision ± 0.1 A	☐

(2 marks)

6

END OF QUESTIONS