

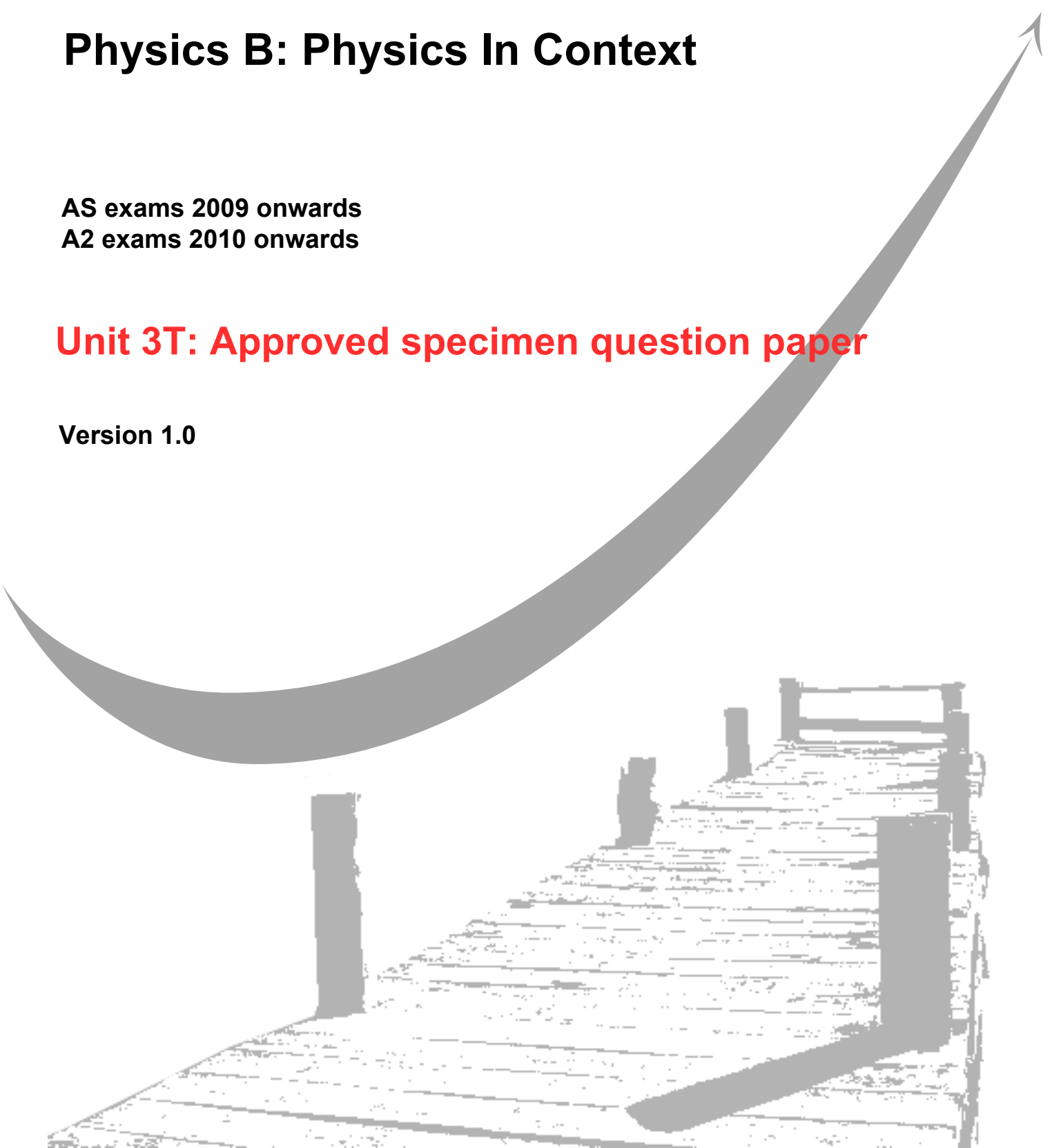
**GCE**  
**AS and A Level**

# **Physics B: Physics In Context**

**AS exams 2009 onwards**  
**A2 exams 2010 onwards**

**Unit 3T: Approved specimen question paper**

**Version 1.0**



|                     |  |  |  |  |                  |  |  |  |  |
|---------------------|--|--|--|--|------------------|--|--|--|--|
| Surname             |  |  |  |  | Other Names      |  |  |  |  |
| Centre Number       |  |  |  |  | Candidate Number |  |  |  |  |
| Candidate Signature |  |  |  |  |                  |  |  |  |  |

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General Certificate of Education  
2009  
Advanced Subsidiary Examination



version 1.0

**PHYSICS**  
**Investigative and Practical Skills in AS Physics**  
**Unit 3 ISA**

**PHB3T**

SPECIMEN PAPER

|  |
|--|
| <p><b>For this paper you must have:</b></p> <ul style="list-style-type: none"> <li>• a calculator</li> <li>• a ruler</li> <li>• a protractor</li> <li>• your completed documentation from stage 1</li> </ul> |
|--|

| For Examiner's Use  |      |       |      |
|---------------------|------|-------|------|
| Sec A               | Mark | Sec B | Mark |
| 1                   |      | 1     |      |
|                     |      | 2     |      |
|                     |      | 3     |      |
|                     |      | 4     |      |
|                     |      |       |      |
| Total (Sec A)       |      |       |      |
| Total (Sec B)       |      |       |      |
| TOTAL               |      |       |      |
| Examiner's Initials |      |       |      |

Time allowed: 1 hour

**Instructions**

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided. A separate sheet of graph paper is required. Attach your graph to this book before handing it to the invigilator at the end of the examination.
- Show all your working.
- Do all rough work in this book. Cross through any work you do not want to be marked.

**Information**

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

**SECTION A**

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

**1**

- (a) What was the **independent variable** in your experiment?

.....  
(1 mark)

- (b) Explain what factors you considered in deciding on the **range** of the readings that you took.

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

- (c) State the **sensitivity** of the instruments you used to measure current and voltage.

.....  
(1 mark)

- (d) Based on the instrument sensitivity, calculate the percentage error in your **largest** voltage reading.

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

- (e) Describe what your graph suggests about the resistance of the device:

.....  
.....  
.....  
.....  
(3 marks)

- (f) What do your results suggest is in the sealed box?

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

**SECTION B**

Answer all questions in the spaces provided.

- 1 A student performs an experiment to investigate the current-voltage characteristics of a length of metal wire used to make heating elements. Five of the results have been plotted on the graph (on the next page). The remaining three results are shown in the table below.

| V /V | I <sub>1</sub> /A | I <sub>2</sub> /A | I <sub>3</sub> /A | I <sub>average</sub> /A | resistance /ohms |
|------|-------------------|-------------------|-------------------|-------------------------|------------------|
| 6.00 | 0.254             | 0.264             | 0.256             |                         |                  |
| 7.00 | 0.272             | 0.283             | 0.282             |                         |                  |
| 8.00 | 0.285             | 0.296             | 0.289             |                         |                  |

Results I<sub>1</sub>, I<sub>2</sub> and I<sub>3</sub> are repeat readings of the current. The student used a new piece of wire from the same reel for each repeat reading.

- (a) What must be kept constant in this experiment to ensure that the repeat readings were valid?

.....  
(1 mark)

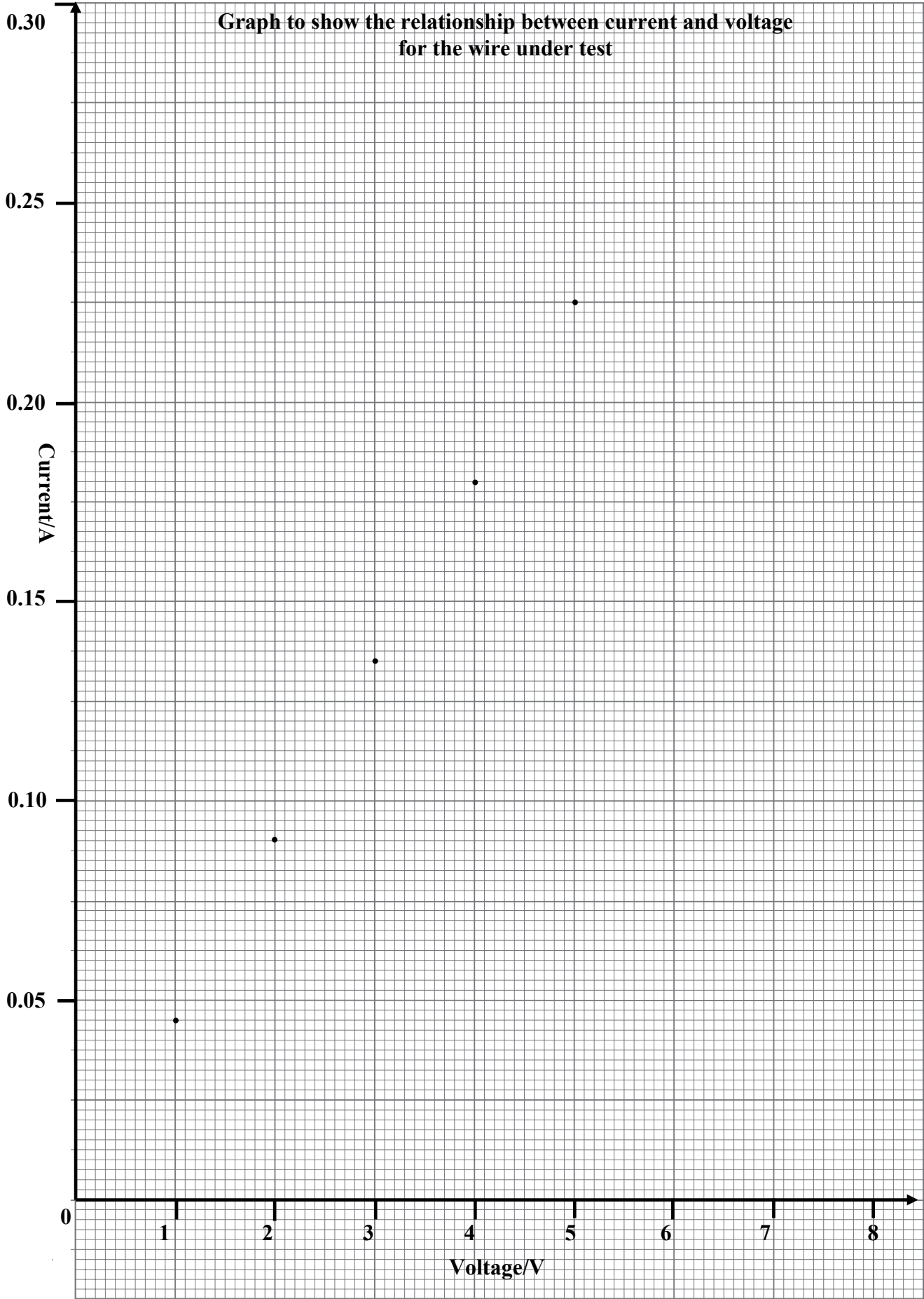
- (b) Complete the table by entering the average current and resistance values. (2 marks)

- (c) Plot the final three points on the graph and draw an appropriate line or curve. (3 marks)

- (d) Calculate the gradient of the first linear section of the graph.  
.....  
.....  
.....  
.....  
(3 marks)

- (e) Use your value for the gradient to determine the resistance of the wire over this section of the graph.  
.....  
.....  
.....  
(2 marks)

**Graph to show the relationship between current and voltage  
for the wire under test**



2 Look at the repeat current readings in the table of results. The ammeter has a sensitivity of  $\pm 0.001$  A.

(a) For a typical current reading, a student states the error in the average current as  $0.258 \pm 0.001$  A.

Why is this **not** an accurate estimate of the error (or uncertainty) in the current readings?

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

(b) Suggest a more realistic  $\pm$  error for the average current reading of 0.258A in the table.

.....  
(1 mark)

(c) What is the general name given to the **type** of error which accounts for the variation in repeated current readings in this experiment?

.....  
(1 mark)

(d) By inspection of the table and graph, comment on the **reliability** of the results.

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

3 (a) What can you say about the relationship between current and voltage over the first section of the graph?

.....  
(1 mark)

(b) By inspection of the table and/or graph, what do your results suggests about the resistance of the wire at higher voltages?

.....  
(1 mark)

4 A student suggests that the change in resistance is due to a change in temperature of the wire. Describe briefly how this hypothesis could be tested experimentally.

.....

.....

.....

.....

.....

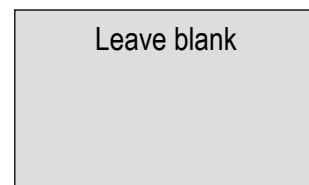
.....

.....

.....

*(3 marks)*

|                     |  |  |  |  |                  |  |  |  |  |
|---------------------|--|--|--|--|------------------|--|--|--|--|
| Surname             |  |  |  |  | Other Names      |  |  |  |  |
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**PHYSICS B** **PHB3T**  
**Unit 3: Practical and Investigative Skills in AS Physics**

**Specimen ISA**

Centre Instructions for the Investigation



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**SPECIMEN ISA****'COMPONENT IN A BOX'****PHB3T****Centre instructions for the Investigation**

In this ISA, candidates will be investigating the current-voltage characteristics of a semi-conductor diode in series with a fixed resistor.

The components should be enclosed in a sealed box/packet with terminals labelled **A** and **B**. Terminal **A** should correspond to the positive diode terminal. The fixed resistor should be chosen so that, with the dc supplies available in the centre, candidates cannot exceed the current rating of the diode. (e.g. A 12V dc supply with a resistor 15 ohms or greater and a 1A diode).

**Information for Centres**

Candidates can be told approximately one week before undertaking Stage 1 of the ISA that the investigation will be about I-V characteristics and resistance.

Stage 2 of the ISA, (the written tests; Section A & B) should be given as soon as possible after the practical investigation.

**SPECIMEN ISA**

**'COMPONENT IN A BOX'**

**PHB3T**

## **Task Sheet**

### **Stage 1: Investigation**

You are going to investigate the current-voltage characteristics of the sealed box with terminals labelled **A** and **B**.

- Set up a suitable circuit. You should draw a circuit diagram of the circuit you used. This should include a dc supply, meters with appropriate range and a method of varying the voltage and current.
- Take a range of voltage and current readings for both positive and negative voltages. You should take repeat readings if you feel this is appropriate.
- Present your results in a table.
- Calculate the resistance for each current and voltage reading, and include this in your table.
- Plot an I – V graph of your results.
- Write down the sensitivity of the meters (ammeter, voltmeter) you have used.

At the end of the investigation, please hand the following in to your teacher.

- Your completed answer sheet(s) which should include a circuit diagram, results table and information on the sensitivity of the meters.
- A piece of graph paper with your I-V graph.

This documentation will be required for Stage 2 of the ISA. Please ensure you have entered your centre details, candidate number and name on all the sheets you have completed.