

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

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General Certificate of Education
June 2009
Advanced Subsidiary Examination



Physics
Unit 3 Investigative and Practical Skills in AS Physics

PHY3T/P09/test

Investigative Skills Assignment (ISA) P
Written Test

- For this paper you must have:**
- a calculator
 - a ruler
 - a protractor
 - your completed documentation from Stage 1.

Time allowed

- 1 hour

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided. Attach your documentation from Stage 1 to this booklet before handing it to the invigilator at the end of the examination.
- Show all your working.
- Do all rough work in this booklet. Cross through any work that you do not want to be marked.

Information

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

For Teacher's Use		
		Mark
Stage 1		
Section A	1	
Section B	2	
	3	
	4	
TOTAL		

SECTION A

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

- 1 (a) State the precision of the instruments used to measure current and terminal pd.

Current reading:

Voltage reading:

(1 mark)

- 1 (b) Using the instrument precision, calculate the percentage uncertainty in your smallest ammeter reading and smallest voltmeter reading.

Ammeter reading:

Answer %

Voltmeter reading:

Answer %

(2 marks)

- 1 (c) By reference to part (b), state and justify which meter is the source of greater uncertainty.

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(1 mark)

- 1 (d) Explain why using resistors with very high values would be unsuitable in this experiment.

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(2 marks)

- 1 (e) Why do you think you were instructed to switch off or disconnect the cell between readings?

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(1 mark)

- 1 (f) Do you think your readings are reliable? Give a reason for your answer.

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(1 mark)

- 1 (g) The equation relating terminal pd, V , and current, I , is

$$V = \varepsilon - Ir$$

where ε is the emf of the supply and r is the internal resistance of the supply.

By reference to the equation of a straight line $y = mx + c$,

- 1 (g) (i) what physical quantity is represented by the intercept on the pd axis?

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- 1 (g) (ii) what physical quantity is represented by the gradient of the graph?

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(2 marks)

10

Turn over for the next question

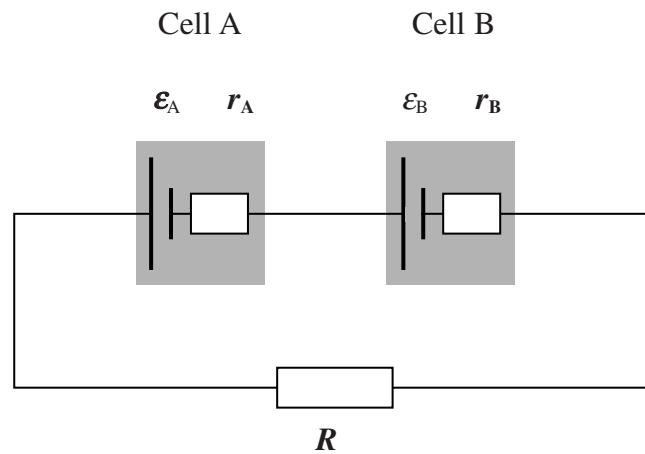
Turn over ►

SECTION B

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

- 2 In an experiment on cells, cell A, of emf \mathcal{E}_A and internal resistance r_A , is connected in series with cell B, of emf \mathcal{E}_B and internal resistance r_B . The emfs of the cells are different. The cells are connected so that the emfs add together. A resistor, R , is connected across the cell combination as shown in **Figure 1**.

Figure 1 Cell combination (A + B) with emf, $\mathcal{E}_{(A+B)}$



Readings of the current, I , through the resistor and the pd, V , across the resistor were taken with different resistors, R , connected across the cells. A graph has been drawn on the next page, showing the pd against current for these readings.

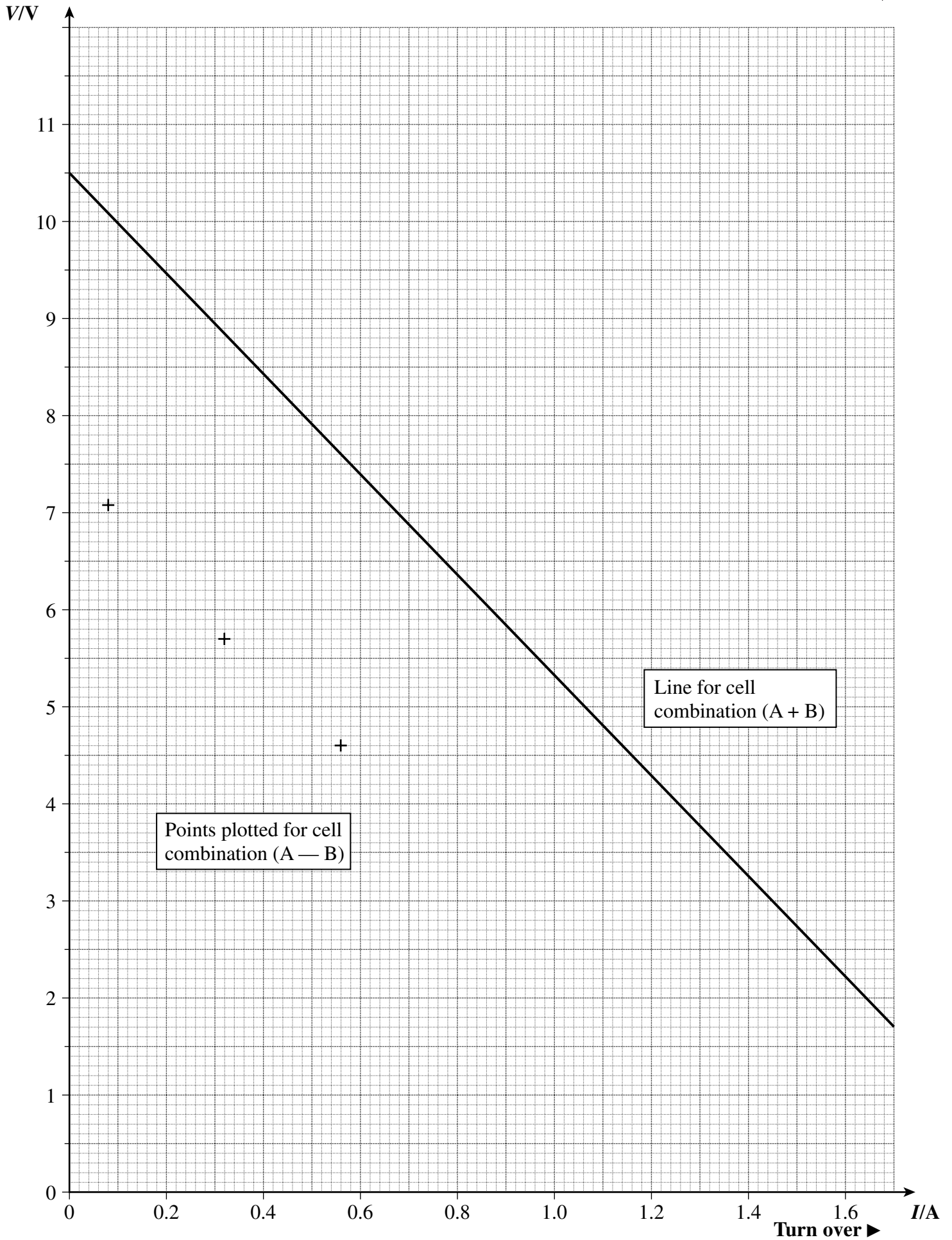
- 2 (a) (i) Calculate the gradient of the line already drawn, showing clearly your working.

Answer

- 2 (a) (ii) State what the gradient of the graph represents in relation to cell A and cell B.

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(5 marks)

Graph showing pd versus current
for cell combination (A + B) and cell combination (A - B)



- 2 In a second experiment, cell B is now reversed but still connected in series with cell A and the experiment is repeated. This is referred to as cell combination (A – B). The table below shows the results for this experiment. Three results have been plotted on the graph, on the previous page, and three further results are shown below.

R/Ω	V/V	I/A	
1.0	1.20	1.18	
2.7	2.55	0.96	
4.7	3.54	0.72	
8.2	4.60	0.56	Already plotted
18.0	5.70	0.32	Already plotted
82.0	7.08	0.08	Already plotted

- 2 (b) (i) Complete the graph for cell combination (A – B) by plotting the three remaining points.

- 2 (b) (ii) Draw a line of best fit through these six points.

(3 marks)

- 2 (c) Explain why the gradient of this line is the same as the gradient of the line already drawn for cell combination (A + B).

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(1 mark)

- 2 (d) Using information from the graphs, determine the emf, $\mathcal{E}_{(A-B)}$, for the cell combination (A – B), and the emf of cell A, \mathcal{E}_A .

$\mathcal{E}_{(A-B)}$

Answer

\mathcal{E}_A

Answer

(3 marks)

- 3 (a) The manufacturer quotes the resistors used as having an uncertainty (the manufacturer's 'tolerance') of 5%. Calculate the **maximum** possible value of the $18.0\ \Omega$ resistor used in this experiment.

Answer Ω
(1 mark)

- 3 (b) Explain why it would not have made any difference to the value of ε_A obtained in the experiment if resistors with a tolerance of only 2% had been used instead.

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(1 mark)

- 3 (c) The voltmeter used in the above experiment was found to have a calibration error whereby **every** reading was 0.22 V too high.

- 3 (c) (i) What is the name given to this type of error?

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- 3 (c) (ii) How, if at all, would this have affected the value obtained for the emf ε_A ?

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- 3 (c) (iii) How, if at all, would this have affected the value for the gradient of the graph?

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(3 marks)

Turn over for the next question

Turn over ►

- 4 It is suggested that the power supplied to an external resistor, R , is maximum when its resistance is equal to the internal resistance of the supply. Describe how this hypothesis could be tested experimentally.

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(4 marks)

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END OF QUESTIONS