Surname		Other Names	
Centre Number			Candidate Number	
Candidate Signature			

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General Certificate of Education
June 2009
Advanced Subsidiary Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

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.

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

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.

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?

.....

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

.....

(2 marks)

10

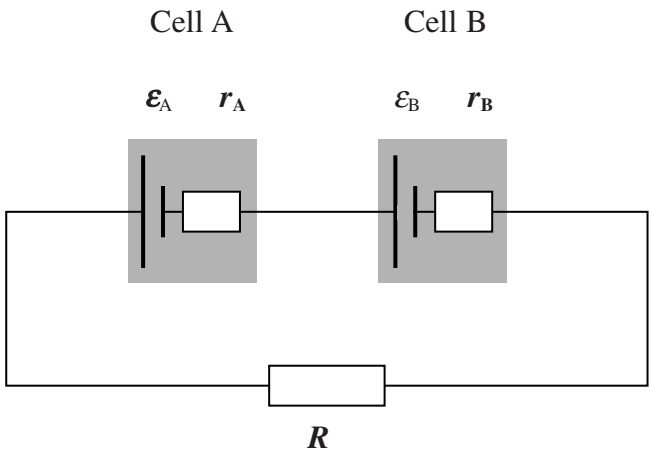
Turn over for the next question

SECTION B

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

2 In an experiment on cells, cell A, of emf ε_A and internal resistance r_A, is connected in series with cell B, of emf ε_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, $\varepsilon_{(A+B)}$



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.

.....

(5 marks)

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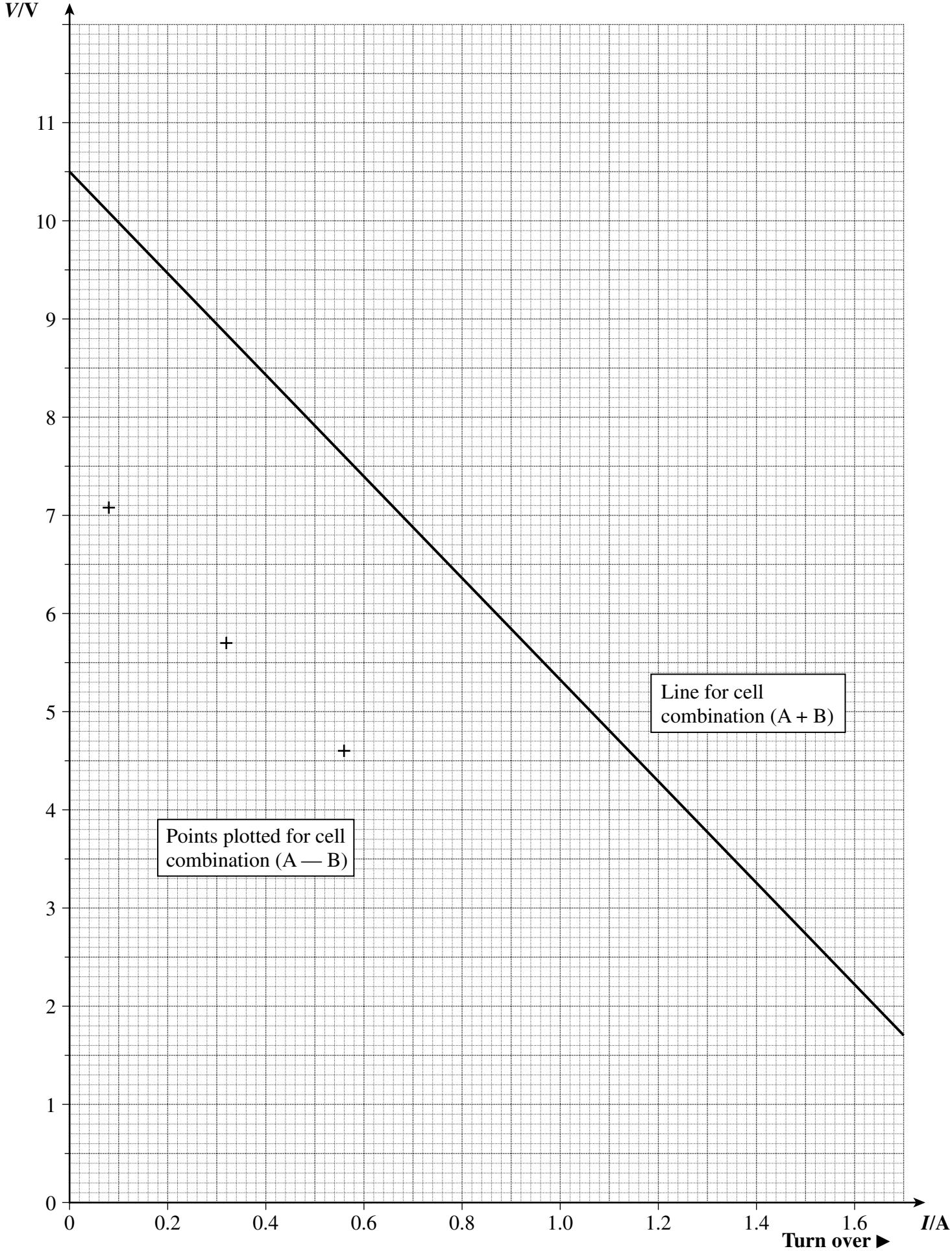
Graph showing pd versus current for cell combination (A + B) and cell combination (A – B)



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, $\varepsilon_{(A-B)}$, for the cell combination (A — B), and the emf of cell A, ε_A.

$\varepsilon_{(A-B)}$

Answer .....

ε_A

Answer .....

(3 marks)

12

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 Ω 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?

.....

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

.....

.....

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

.....

(3 marks)

5

Turn over for the next question

LEAVE MARGIN BLANK

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)

4

END OF QUESTIONS