Write your name here

Surname	Other names

Edexcel GCE

Centre Number	Candidate Number

Physics

Advanced Subsidiary
Unit 3B: Exploring Physics
International Alternative to Internal Assessment

Wednesday 12 May 2010 – Morning
Time: 1 hour 20 minutes

Paper Reference
6PH07/01

You must have:
Ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 40.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- The list of data, formulae and relationships is printed at the end of this booklet.
- Candidates may use a scientific calculator.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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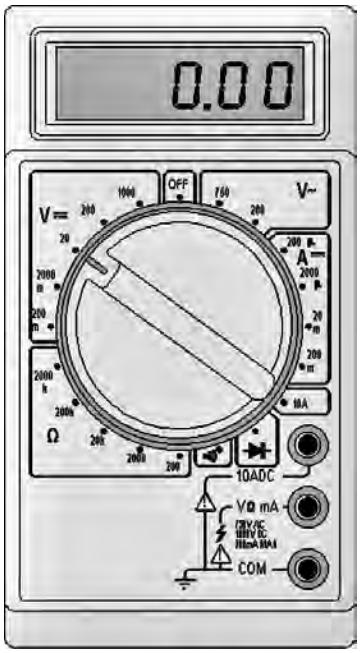
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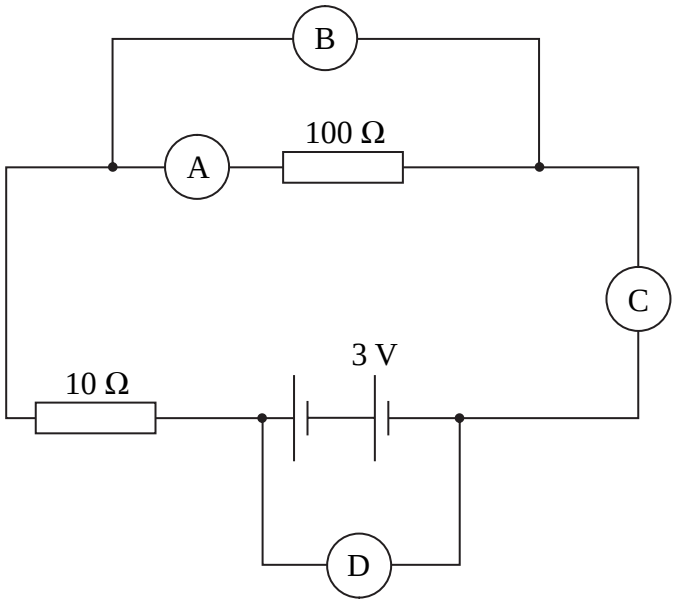
SECTION A

Answer ALL questions.

For questions 1–3, in Section A, select one answer from A to D and put a cross in the box ☒. If you change your mind put a line through the box ☒ and then mark your new answer with a cross ☒.

1 The picture below shows a multimeter similar to those used in many school laboratories.





(a) Which one of the following would be the best setting if you were asked to use the instrument to measure the current in the 100 Ω resistor in the circuit opposite?

(1)

☒ **A** 2000 μ

☒ **B** 20 m

☒ **C** 200 m

☒ **D** 10 A

(b) Places at which meters could be used in the circuit are shown by the letters A to D. Which letter shows the position for the meter when it is used to measure the potential difference for the 100 Ω resistor?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for Question 1 = 2 marks)

2 A student is investigating the variation in the intensity of light with distance by changing the distance from a lamp which is used as a point source. She uses a light dependent resistor (LDR) connected to an ohmmeter as a light detector.

(a) Which one of the following is the measured independent variable?

(1)

- ☒ **A** distance
- ☒ **B** light intensity
- ☒ **C** power of the lamp
- ☒ **D** resistance of the LDR

(b) Which one of the following is the measured dependent variable?

(1)

- ☒ **A** distance
- ☒ **B** light intensity
- ☒ **C** power of the lamp
- ☒ **D** resistance of the LDR

(Total for Question 2 = 2 marks)

3 To determine the Young Modulus of a material from which a wire is made, which one of the following would **not** be needed?

☒ **A** density

☒ **B** diameter

☒ **C** force applied

☒ **D** length

(Total for Question 3 = 1 mark)

TOTAL FOR SECTION A = 5 MARKS

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SECTION B

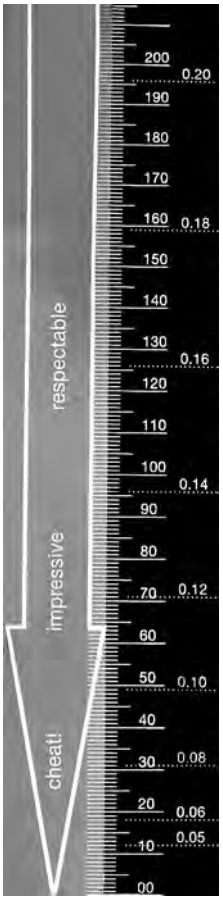
Answer ALL questions in the spaces provided.

4 Two students are discussing an experiment to plot a cooling curve for a liquid. One says that it is always better to use a suitable datalogging device. The other says that using a liquid-in-glass thermometer and stopwatch is better.

Discuss the advantages and disadvantages of each method for an experiment which involves taking the temperature of water in a beaker over a period of 20 minutes and plotting a temperature against time graph.

(Total for Question 4 = 4 marks)

5 As part of its marketing, a physics department designed a small cardboard device, rather like a rule, which can be used to measure reaction time. The timer has been marked with distance in millimetres and a number of corresponding times in seconds.



not to scale

The instructions for use are as follows:

Get a partner to hold the timer at the top. Hold your finger and thumb at the bottom edge – keep them slightly apart so that the timer can fall. When your partner lets go, catch the timer as quickly as you can. Then read your reaction time from the scale.

(a) For one pair of readings for distance and time, use an appropriate equation of motion to show that the values are consistent with each other.

(3)

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(b) State the precautions you would take to ensure that measurements of your reaction time are as accurate as possible.

(3)

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(c) The reaction times for one student are: 0.20, 0.18, 0.19 and 0.08 s.

Calculate the best mean value of his reaction time and state it with a suitable uncertainty.

(2)

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Reaction time = ... s

(Total for Question 5 = 8 marks)

6 In an experiment to find the resistivity ρ of a metal, a student measures the diameter of a wire using a micrometer. She measures it as 0.12 mm.

(a) Calculate the cross-sectional area A of the wire.

(1)

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Area = ...

(b) She varies the length of wire which she measures using a metre rule. For each length l she measures the resistance R using an ohmmeter. The shortest length she uses is 100 mm.
Justify the choice of the metre rule.

(1)

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(c) She then plots a graph of R against l.

(i) Explain why this graph should be a straight line using the equation $R = \rho l/A$.

(2)

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(ii) Her value for the gradient, $\Delta R/\Delta l$, of this graph is 41.9 Ω m^{-1}.

Calculate the resistivity of the wire.

(3)

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Resistivity of wire = ...

(d) Identify **two** main sources of uncertainty in this experiment.

(2)

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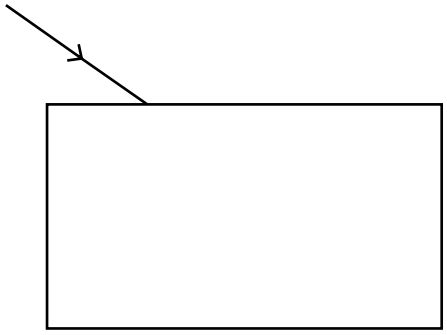
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(Total for Question 6 = 9 marks)

7 When a ray of light is incident on a rectangular glass block it refracts and emerges at the far side. This can be used to find the refractive index from air to glass.



(a) Add lines to the diagram above to show how the ray will pass through the block and emerge at the opposite side. You should show the refraction at both sides. Label the angle of incidence *i* and angle of refraction *r* on the first side where the light enters the block.

(2)

(b) It is possible to do this experiment by placing the block on a sheet of paper and shining a ray of light through the block. Describe how you would draw the path of the ray through the glass block. You may add to the diagram if you wish.

(2)

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(c) The readings opposite were taken from such an experiment. Criticise the set of readings.

(2)

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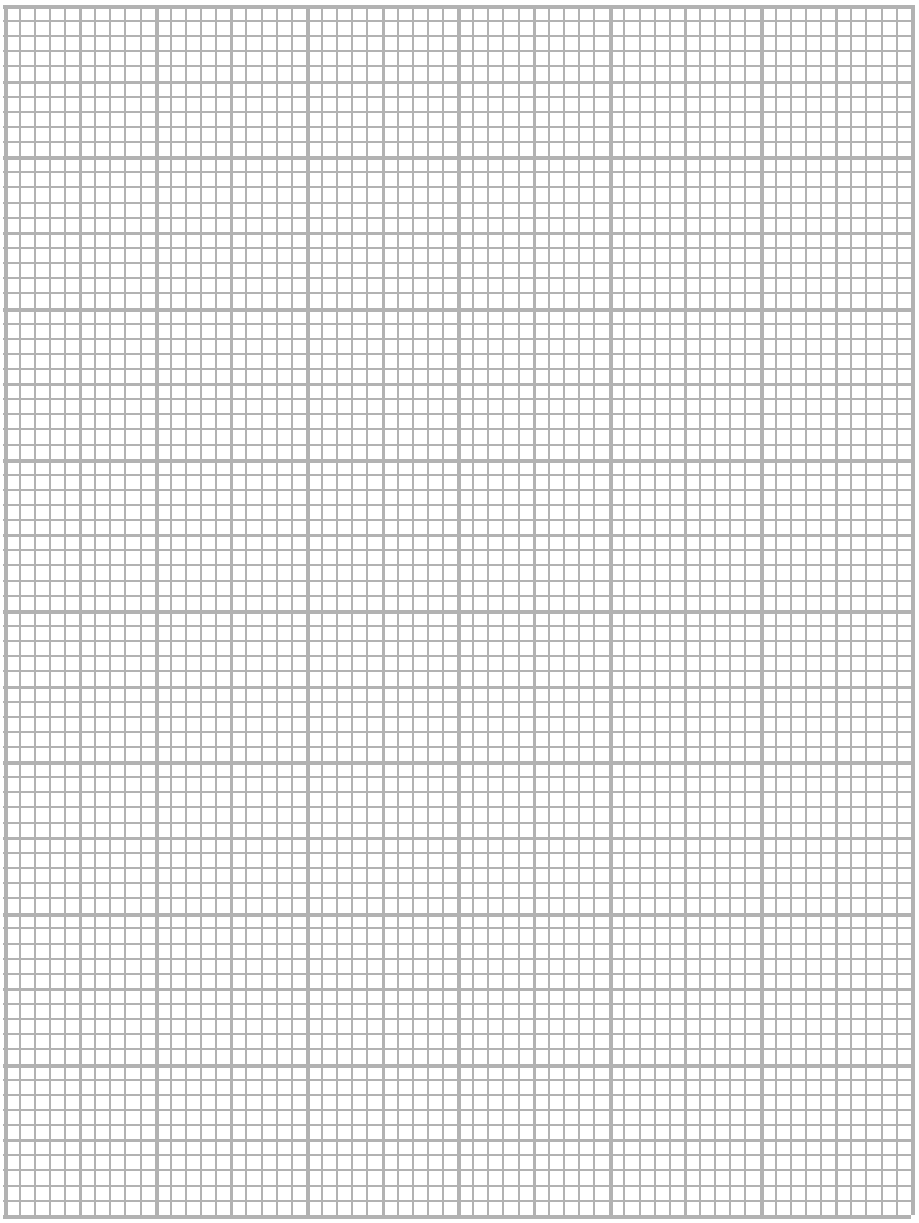
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i/°	20	30	40	50
r/°	15	20	26	32
sin i				
sin r				

(d) Complete the table, then plot the values of sin i on the y axis against sin r on the x axis on the grid below. Start both scales at zero.

(4)



(e) Draw a line of best fit on your graph and explain why you think it should or should not go through the origin.

(2)

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(f) Use your graph to determine the refractive index from air to glass.

(2)

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Refractive index = ...

(Total for Question 7 = 14 marks)

TOTAL FOR SECTION B = 35 MARKS

TOTAL FOR PAPER = 40 MARKS

List of data, formulae and relationships

Acceleration of free fall	$g = 9.81\ \text{m s}^{-2}$	(close to Earth's surface)
Electron charge	$e = -1.60 \times 10^{-19}\ \text{C}$	
Electron mass	$m_e = 9.11 \times 10^{-31}\ \text{kg}$	
Electronvolt	$1\ \text{eV} = 1.60 \times 10^{-19}\ \text{J}$	
Gravitational field strength	$g = 9.81\ \text{N kg}^{-1}$	(close to Earth's surface)
Planck constant	$h = 6.63 \times 10^{-34}\ \text{J s}$	
Speed of light in a vacuum	$c = 3.00 \times 10^{8}\ \text{m s}^{-1}$	

Unit 1

Mechanics

Kinematic equations of motion	$v = u + at$ $s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$
Forces	$\Sigma F = ma$ $g = F/m$ $W = mg$
Work and energy	$\Delta W = F\Delta s$ $E_k = \frac{1}{2}mv^2$ $\Delta E_{grav} = mg\Delta h$

Materials

Stokes' law	$F = 6\pi\eta rv$
Hooke's law	$F = k\Delta x$
Density	$\rho = m/V$
Pressure	$p = F/A$
Young modulus	$E = \sigma/\varepsilon$ where Stress $\sigma = F/A$ Strain $\varepsilon = \Delta x/x$
Elastic strain energy	$E_{el} = \frac{1}{2}F\Delta x$

Unit 2

Waves

Wave speed	$v = f\lambda$
Refractive index	${}_1\mu_2 = \sin i / \sin r = v_1/v_2$

Electricity

Potential difference	$V = W/Q$
Resistance	$R = V/I$
Electrical power, energy and efficiency	$P = VI$ $P = I^2R$ $P = V^2/R$ $W = VIt$ $\%\ \text{efficiency} = \dfrac{\text{useful energy output}}{\text{energy input}} \times 100$ $\%\ \text{efficiency} = \dfrac{\text{useful power output}}{\text{power input}} \times 100$
Resistivity	$R = \rho l/A$
Current	$I = \Delta Q/\Delta t$ $I = nqvA$
Resistors in series	$R = R_1 + R_2 + R_3$
Resistors in parallel	$\dfrac{1}{R} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3}$

Quantum physics

Photon model	$E = hf$
Einstein's photoelectric equation	$hf = \phi + \frac{1}{2}mv^2_{\max}$

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