

Write your name here

Surname

Other names

Centre Number

Candidate Number

Edexcel GCE

Physics

Advanced Subsidiary

Unit 3B: Exploring Physics

International Alternative to Internal Assessment

Tuesday 18 January 2011 – 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.*
- Some questions must be answered with a cross in a box (☒).
If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

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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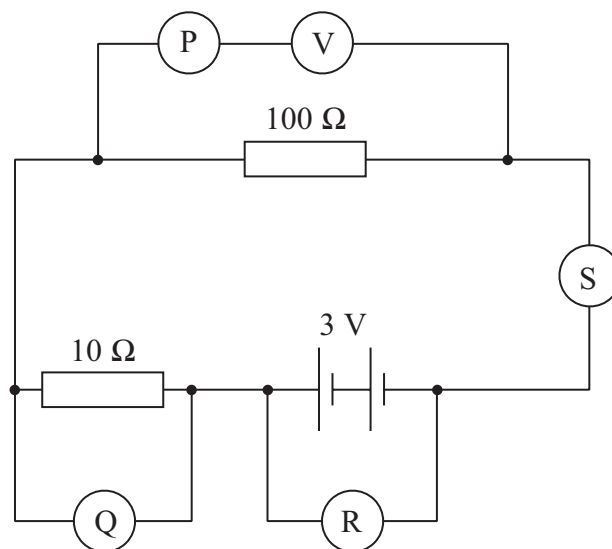
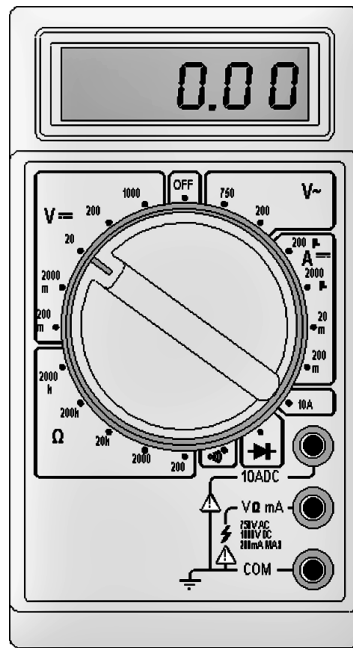
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SECTION A

Answer ALL questions.

For questions 1–5, in Section A, select one answer from A to D and put a cross . If you change your mind put a line through the box and then mark your new answer with a cross .

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



Use the diagrams on page 2 for questions 1 and 2.

- 1 The multimeter is used to measure the potential difference across the $100\ \Omega$ resistor in the circuit.

Which one of the following would be the best setting to use?

- A 200 V
- B 20 V
- C 200 mV
- D 2000 mV

(Total for Question 1 = 1 mark)

- 2 An ammeter is used to measure the current in the $100\ \Omega$ resistor. Which one of the letters P, Q, R or S on the circuit diagram shows the best position for the ammeter?

- A P
- B Q
- C R
- D S

(Total for Question 2 = 1 mark)



Use the information below to answer questions 3 and 4.

A student is investigating the variation in the emf generated by a solar cell with light intensity. She varies the distance between the solar cell and a lamp.

3 Which one of the following is the independent variable?

- A distance
- B emf
- C light intensity
- D power of the lamp

(Total for Question 3 = 1 mark)

4 Which one of the following is the measured dependent variable?

- A distance
- B emf
- C light intensity
- D power of the lamp

(Total for Question 4 = 1 mark)

5 A student takes the following three measurements of the diameter in mm of a ball bearing.

4.21, 4.20, 4.21

Which one of the following should be stated as the average result?

- A 4.2 mm
- B 4.20 mm
- C 4.207 mm
- D 4.21 mm

(Total for Question 5 = 1 mark)

TOTAL FOR SECTION A = 5 MARKS



7 You are to plan an experiment to determine the Young modulus of a material in the form of a long wire. You are to use a graphical method. Assume that standard laboratory apparatus is available.

Your answer should include:

- (a) a labelled diagram of the apparatus to be used, (1)
- (b) a list of any additional apparatus required that is not shown in the diagram, (1)
- (c) the quantities to be measured, (1)
- (d) an explanation of your choice of measuring instrument for two of these quantities, (4)
- (e) which is the independent and which is the dependent variable, (1)
- (f) how the data collected will be used to determine the Young modulus, (2)
- (g) the main source of uncertainty and/or systematic error, (1)
- (h) a comment on safety. (1)

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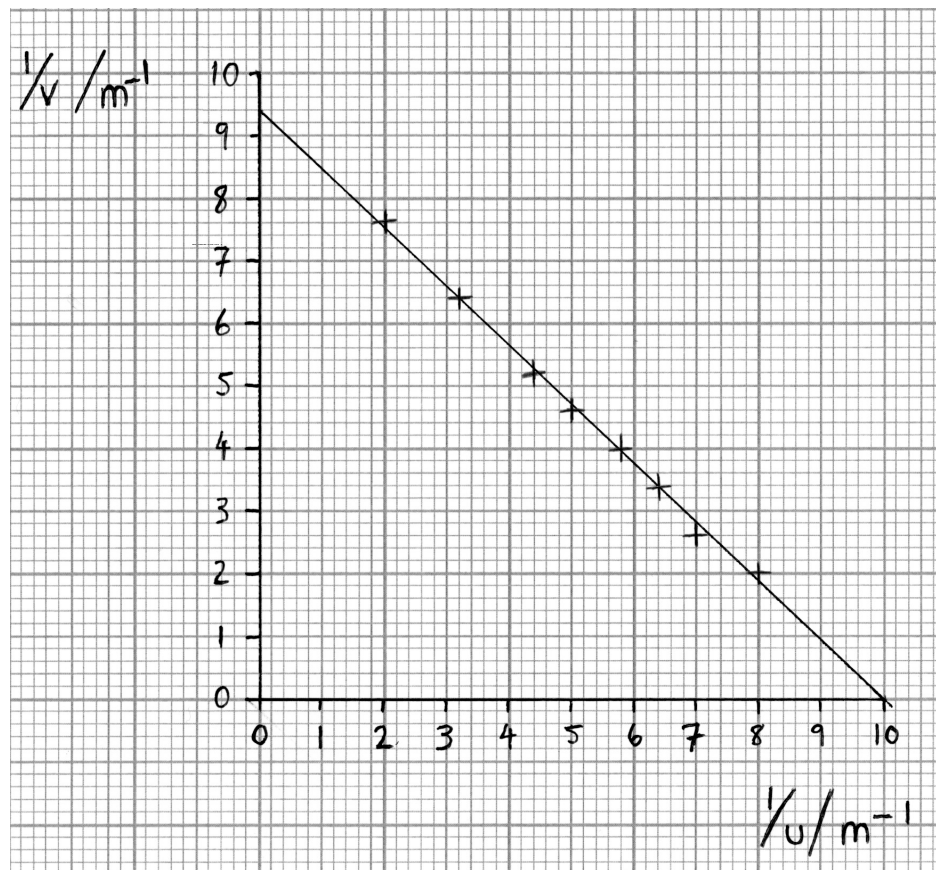
Handwriting practice area with 25 horizontal dotted lines.

(Total for Question 7 = 12 marks)



- 8 A student does an experiment to find the focal length f of a lens. He measures the distance u from an object to the lens and the corresponding distance v from the lens to the focused image. He repeats this for various values of u and v .

The graph plotted by the student is shown below.



- (a) Mark with a cross (☒) the answer **A**, **B**, **C** or **D** which best completes the following sentence.

(1)

The line on the graph shows that $1/v$ and $1/u$

- A** are directly proportional.
- B** are inversely proportional.
- C** have a linear relationship.
- D** have a positive correlation.



(b) The equation relating f , u and v is

$$1/f = 1/u + 1/v$$

Rearrange this equation to show that:

- the gradient of the graph should be -1
- the intercept with the y axis is $1/f$.

(3)

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(c) Use the intercept on the y axis to determine a value for f .

(3)

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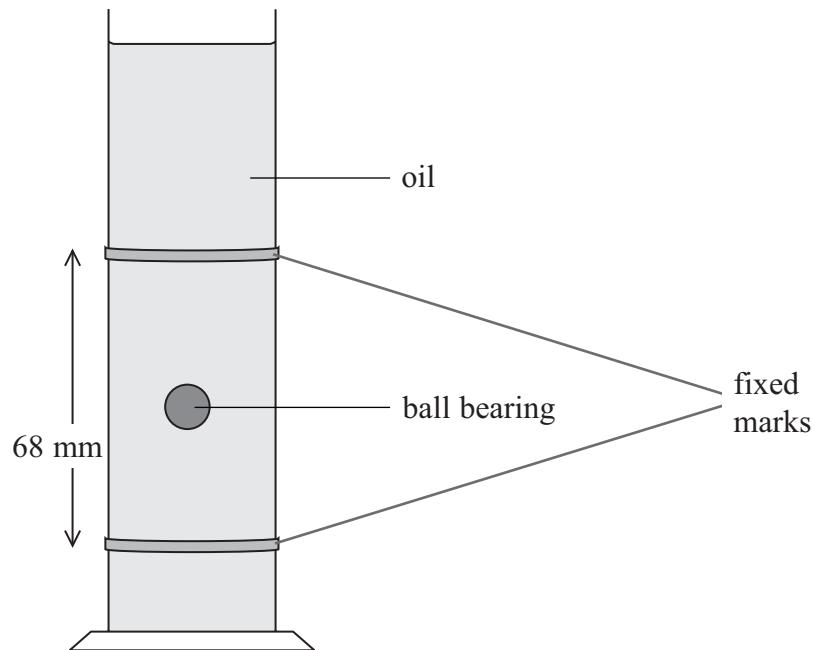
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$$f = \dots\dots\dots$$

(Total for Question 8 = 7 marks)



- 9 A student does an experiment to determine the viscosity of an oil. She drops ball bearings of different diameters into a tube of the oil. She timed the ball bearings between two fixed marks.



She planned to plot a graph to determine the viscosity of the oil. All her results are shown in the table below.

Diameter/mm	Time/s	Time/s	Time/s	Average time/s
3	27.97	29.91	26.12	28
4	8.75	7.97	7.53	8.08
6.01	4.22	4.37	4.16	4.25
12.03	2.19	2.40	2.37	2.32

(a) Criticise the set of results.

(2)

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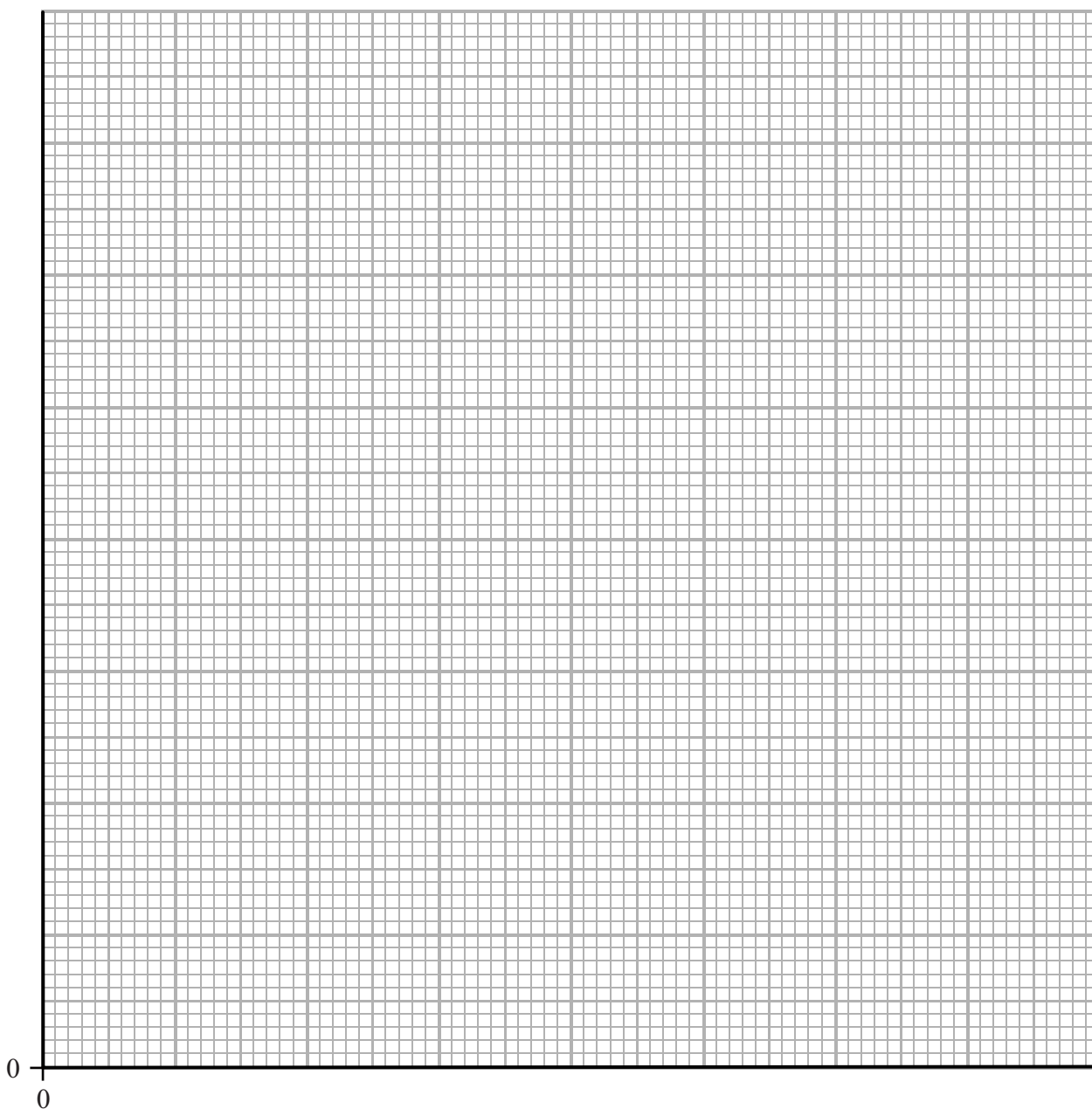
(b) The ball bearings were timed falling a distance of 68 mm. Complete the table below.

(4)

Diameter/mm	Radius/mm	Radius ² /mm ²	Average time/s	Velocity/
3	1.5	2.3	28	2.4
4	2.0	4.0	8.08	8.4
6.01			4.25	
12.03	6.0	36.0	2.32	29.3

(c) Use your values to plot a graph of velocity against radius squared on the grid below.

(5)



(d) The student expected to obtain a straight line graph.

Suggest **one** possible reason for the apparent error in her measurements.

(1)

(Total for Question 9 = 12 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	$\Delta W = F\Delta s$ $E_k = \frac{1}{2}mv^2$ $\Delta E_{\text{grav}} = mg\Delta h$

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	$E = \sigma/\varepsilon \text{ where}$ $\text{Stress } \sigma = F/A$ $\text{Strain } \varepsilon = \Delta x/x$
Elastic strain energy	$E_{\text{el}} = \frac{1}{2}F\Delta x$



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

$$P = VI$$
$$P = I^2R$$
$$P = V^2/R$$
$$W = VI t$$

$$\% \text{ efficiency} = \frac{\text{useful energy output}}{\text{energy input}} \times 100$$

$$\% \text{ efficiency} = \frac{\text{useful power output}}{\text{power input}} \times 100$$

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 $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

Quantum physics

Photon model $E = hf$

Einstein's photoelectric equation $hf = \phi + \frac{1}{2}mv_{\max}^2$



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