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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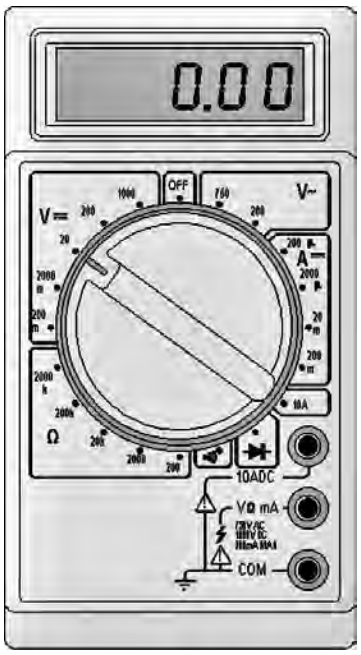
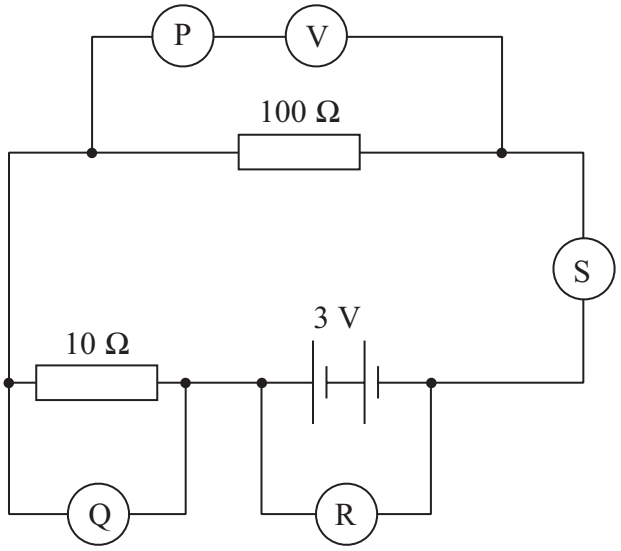
SECTION A

Answer ALL questions.

For questions 1–5, 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 ☒.

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 Ω 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 Ω 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

SECTION B

Answer ALL questions in the spaces provided.

6 An experiment involves measuring the time taken for a ball to fall through different distances. The maximum distance is 1.5 m.

One student says that it is better to use light gates or sensors and a datalogger. Another student says that just using a stopwatch is better.

Discuss the advantages and disadvantages of each method.

(Total for Question 6 = 4 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)**

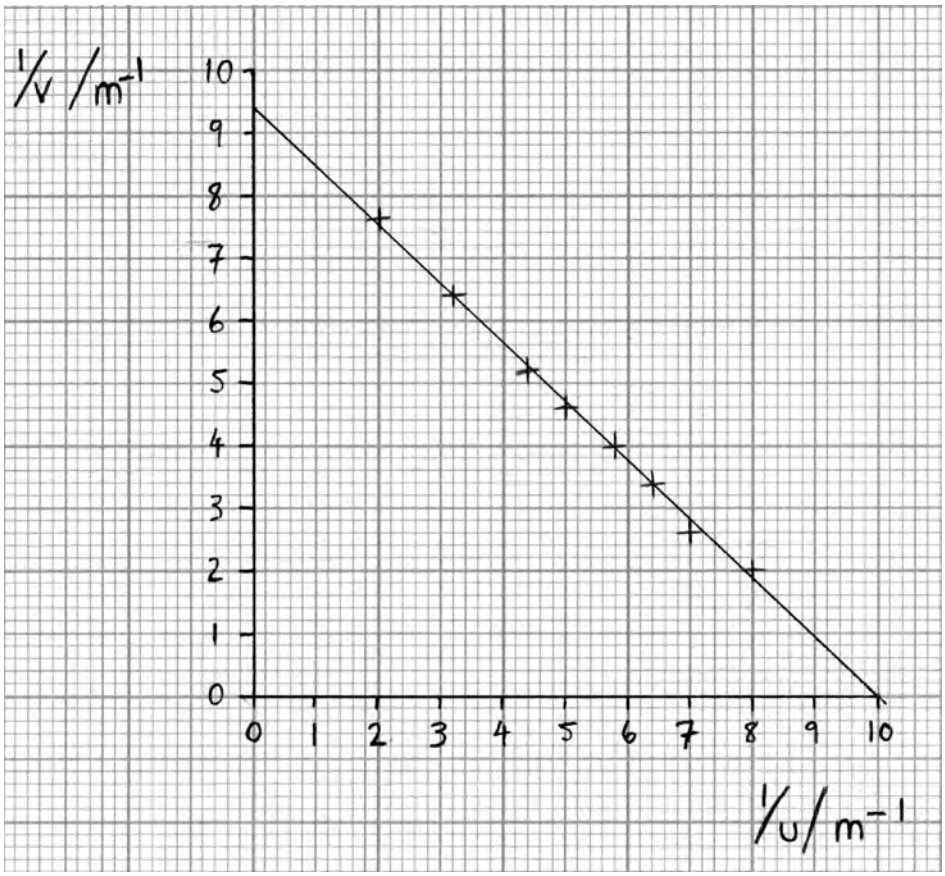
(g) the main source of uncertainty and/or systematic error, **(1)**

(h) a comment on safety. **(1)**

(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)

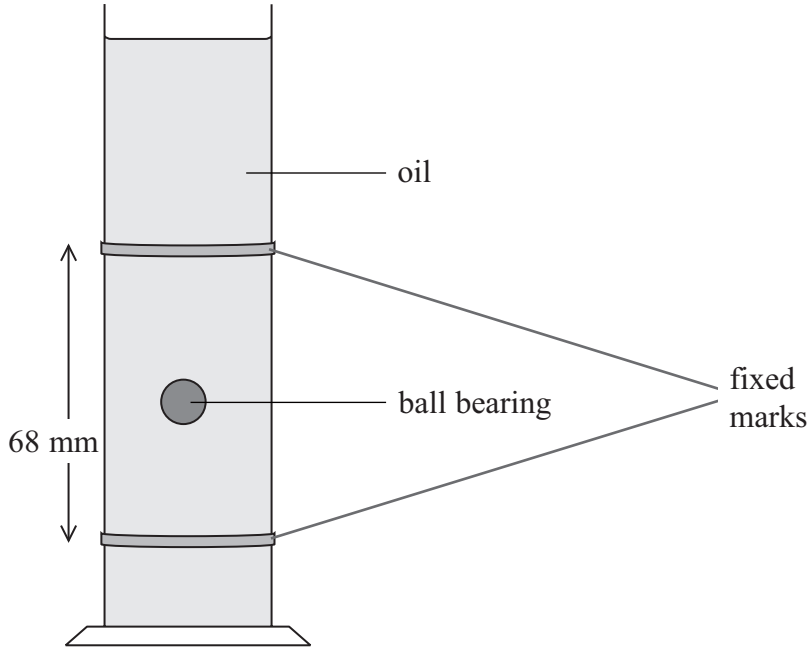
(c) Use the intercept on the y axis to determine a value for f.

(3)

$f =$ .....

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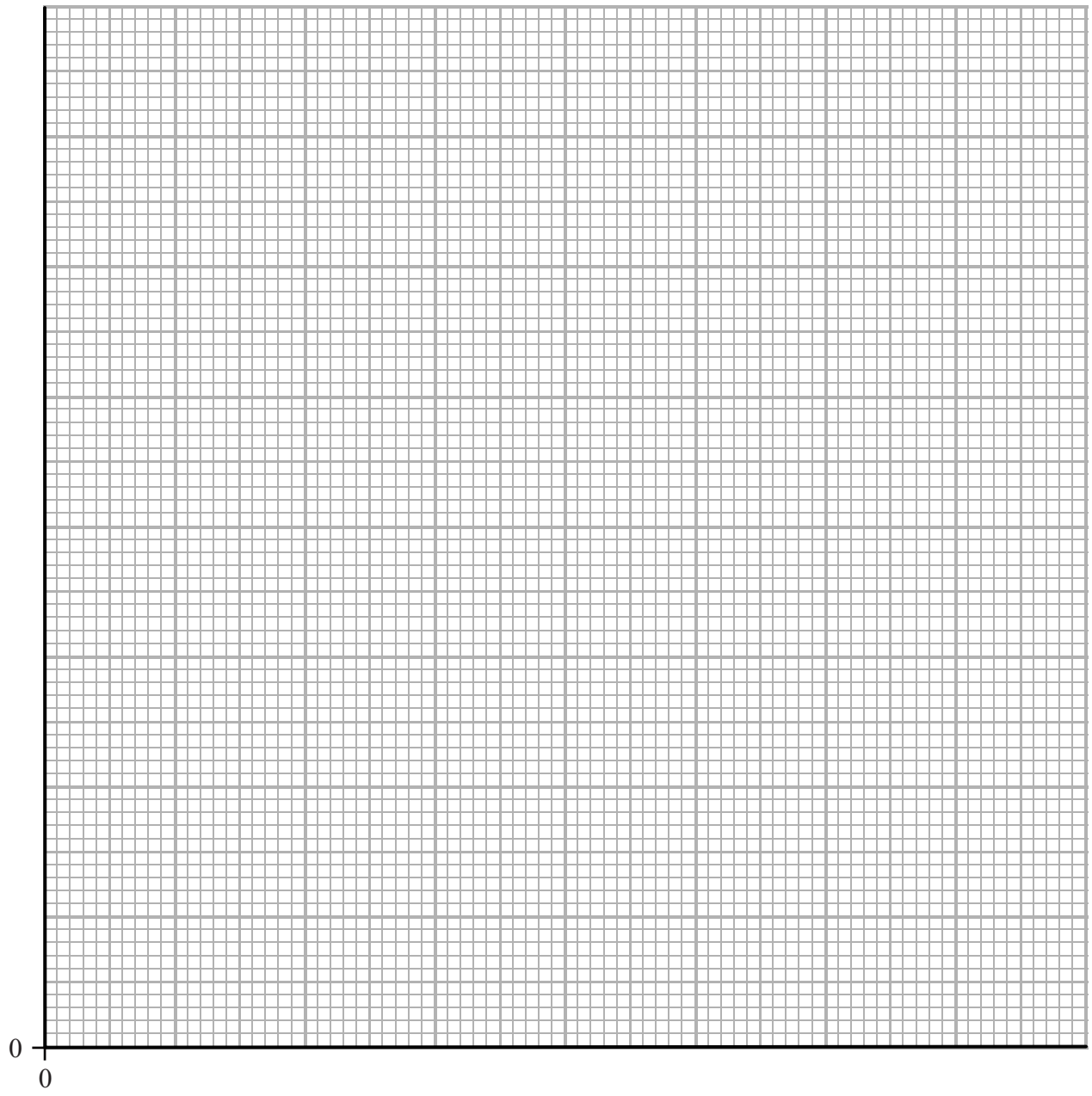
(b) The ball bearings were timed falling a distance of 68 mm. Complete the table below.

(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	$\Delta W = F\Delta s$ $E_k = \frac{1}{2}mv^2$ $\Delta E_{grav} = mg\Delta h$

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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