

Write your name here

Surname	Other names
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Centre Number

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Candidate Number

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Edexcel GCE

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

Friday 15 January 2010 – Morning Time: 1 hour 20 minutes	Paper Reference 6PH07/01
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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.

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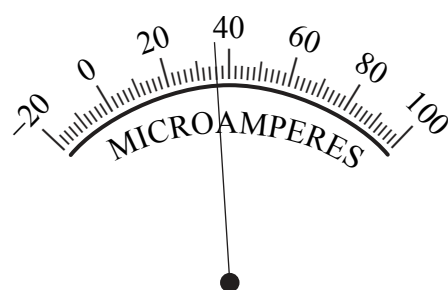
SECTION A

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 diagram shows the scale on a microammeter.

(1)



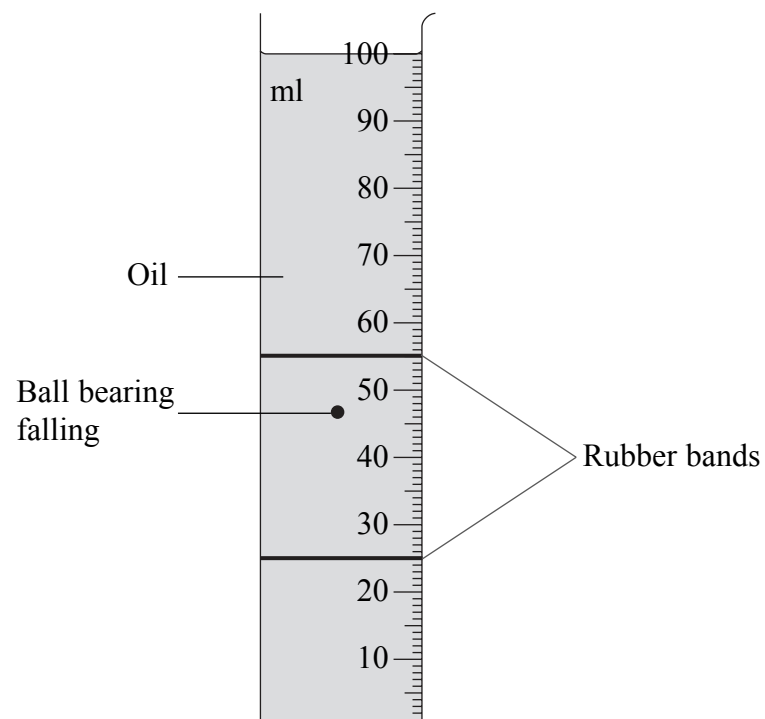
Which of the following is the correct reading?

- A 28×10^{-6} A
- B 28×10^{-3} A
- C 36×10^{-6} A
- D 36×10^{-3} A

(Total for Question 1 = 1 mark)



- 2 In an experiment to measure viscosity of oil, ball bearings are dropped into a long measuring cylinder full of oil.



- (a) For one ball bearing, three measurements of its ball diameter are:

2.55 mm, 2.56 mm, 2.59 mm

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

(1)

- A 2.56 mm
- B 2.566 mm
- C 2.567 mm
- D 2.57 mm

- (b) Which of the following should be used to measure the diameter of the ball bearings?

(1)

- A metre rule
- B micrometer
- C scale on the measuring cylinder
- D tape measure



(c) Which of the following would minimise **parallax** error when timing the ball bearing as it falls through a fixed distance in the oil?

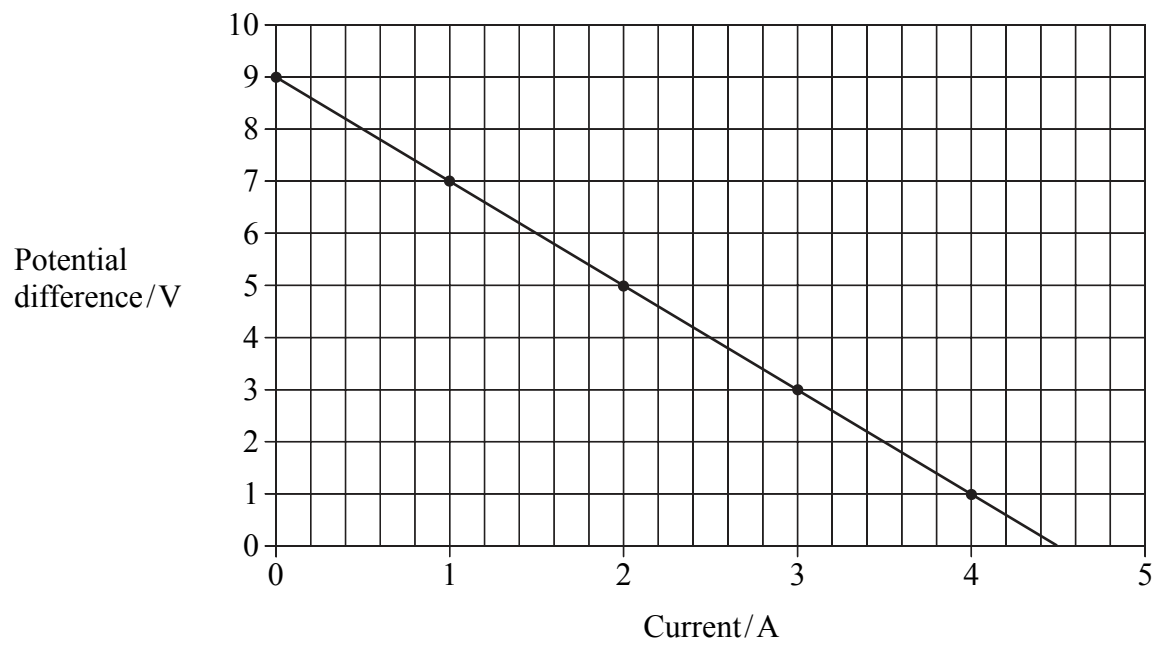
(1)

- A** Ensure that the observer is at eye level with the ball bearing.
- B** Use a metre rule rather than the scale on the measuring cylinder.
- C** Use two parallel rubber bands around the measuring cylinder to indicate the fixed distance.
- D** Start and stop the clock as the middle of the ball bearing passes through the start and finish points.

(Total for Question 2 = 3 marks)



3 In an experiment to measure the e.m.f. of a battery, a graph similar to the one below was drawn.



Which of the following gives the e.m.f. of the battery?

- A area under the graph
- B gradient
- C intercept with the current axis
- D intercept with the potential difference axis

(Total for Question 3 = 1 mark)

TOTAL FOR SECTION A = 5 MARKS



5 A student is doing an experiment to find the resistivity of constantan. His apparatus includes a length of constantan wire, an ammeter, a voltmeter, a variable resistor and a micrometer.

(a) Draw a circuit diagram to show the circuit he should use to find the resistance of a fixed length of constantan wire.

(2)

(b) The student has been told to use a range of current values to plot a graph of p.d. against current.

(i) State how he should use the graph to determine a value for the resistance R of the length of wire.

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(ii) Explain how plotting a graph should improve his result.

(2)

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(c) State and explain what additional instrument he should use to measure the length l of the wire.

(2)

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(d) (i) State what further measurement the student would need to take to determine the resistivity of the wire.

(ii) Show how the student should use his measurements to calculate a value for the resistivity of constantan.

(3)

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(Total for Question 5 = 9 marks)



6 A group of students is asked to design an experiment to compare the behaviour of two wires when forces are applied to them. They decide to find the constant k in the equation $F = k\Delta x$ for each wire.

(a) Briefly outline a simple experiment which they could do.

(3)

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(b) State **one** variable which would have to be kept constant to make this a fair test.

(1)

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(c) State and explain **one** safety precaution they would need to take.

(2)

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(d) The wires are going to be used to hang pictures on a wall in an art exhibition.

Explain why knowing a value for k may be useful.

(1)

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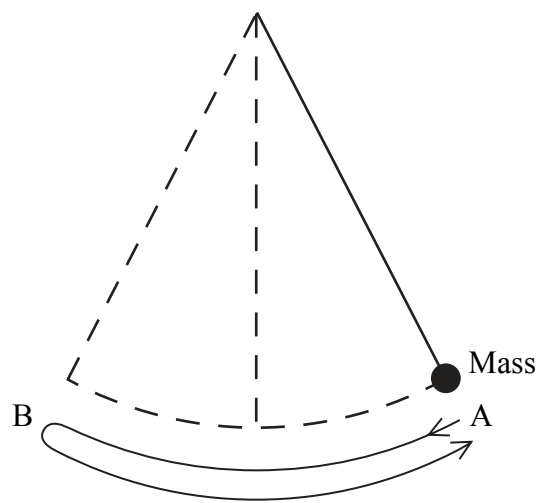
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(Total for Question 6 = 7 marks)



- 7 A student is asked to determine the acceleration of free fall, g , by timing the swings of a mass hanging on the end of a string.

The equation she is given is $T = 2\pi\sqrt{\frac{l}{g}}$, where T is the period taken for the mass to make one complete swing from A to B and back to A, and l is the length of the string.



- (a) Her results are shown in the table below.

Length, l / m	Time for 10 complete swings / s	Period, T / s	
1.0	20	2	
1.2	22.1	2.21	
1.4	23.8	2.38	
1.6	25.4	2.54	
1.8	27	2.7	

Criticise this set of measurements.

(3)

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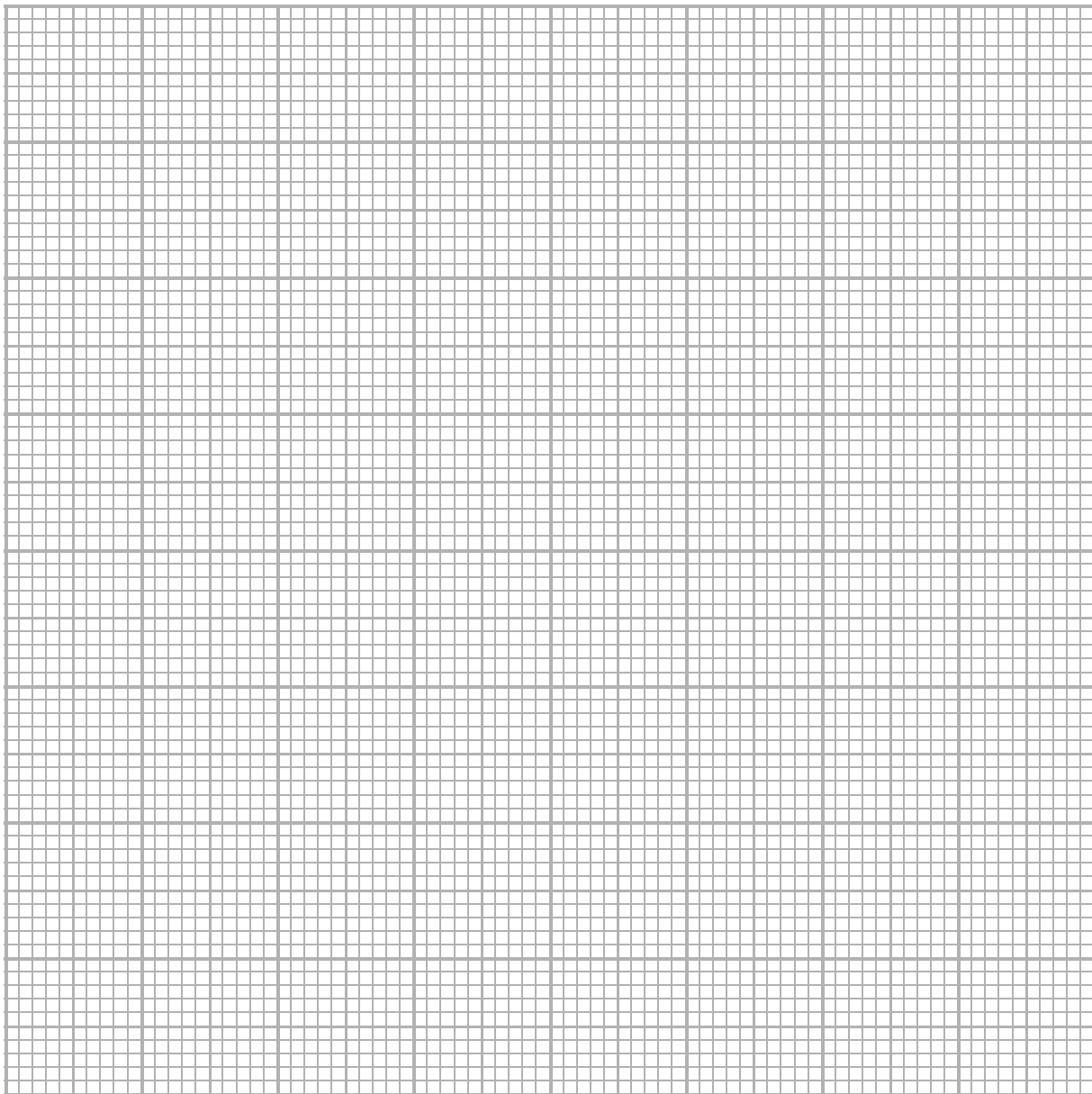
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(b) Plot a graph of T^2 against l . Use the extra column in the table for your values of T^2 . (6)



(c) Use the equation to show why the graph is a straight line. (1)

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(d) Use your graph to determine a value for g .

(3)

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(e) The accepted value for g is 9.81 m s^{-2} . Calculate the percentage difference between the value you have determined and the accepted value.

(1)

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

Materials

Stokes' law	$F = 6\pi\eta r v$
Hooke's law	$F = k\Delta x$
Density	$\rho = m/V$
Pressure	$p = F/A$
Young's modulus	$E = \sigma/\epsilon$ where Stress $\sigma = F/A$ Strain $\epsilon = \Delta x/x$
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
 $P = VI$
 $P = I^2R$
 $P = V^2/R$
 $W = VIt$

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

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

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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