Write your name here

| Surname | Other names |
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**Edexcel GCE**

| Centre Number | Candidate Number |
|---|---|
| | |

# 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**

**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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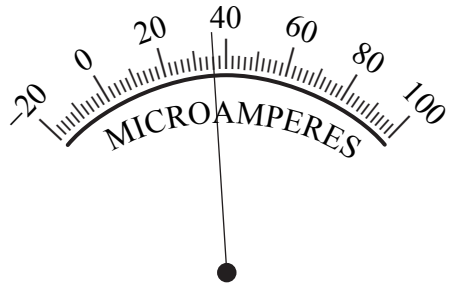
## SECTION A

**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** $28 \times 10^{-6}$ A

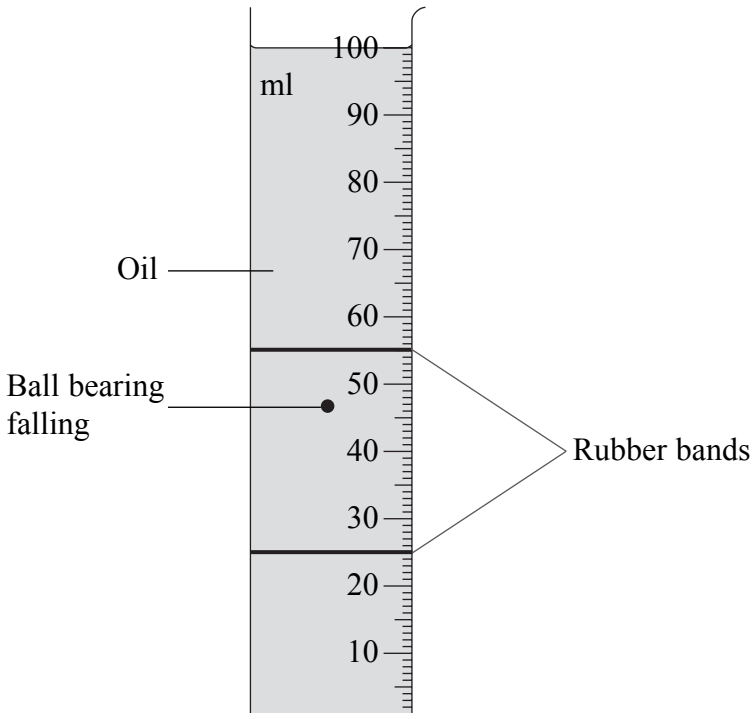
☒ **B** $28 \times 10^{-3}$ A

☒ **C** $36 \times 10^{-6}$ A

☒ **D** $36 \times 10^{-3}$ 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.

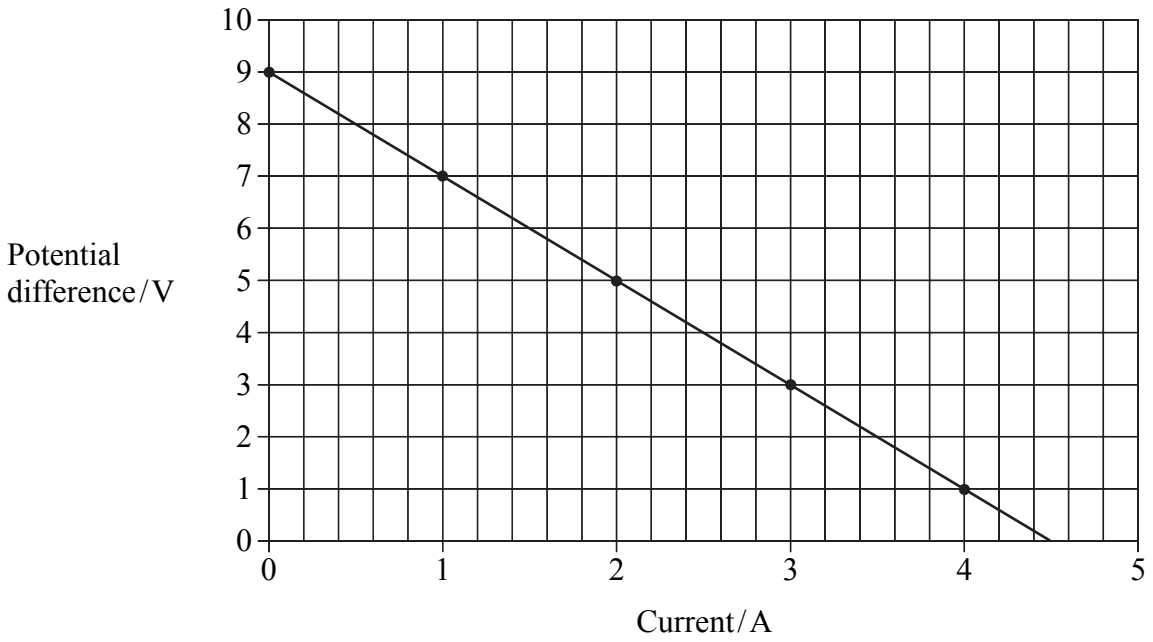
☒ **B** Use a metre rule rather than the scale on the measuring cylinder.

☒ **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**

## SECTION B

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

**4** A student wants to determine the percentage loss of kinetic energy after a ball dropped from a fixed height has bounced once on a hard surface. The student makes the assumption that the initial gravitational potential energy of the ball will all be converted to kinetic energy just before the ball hits the hard surface.

Describe an experiment which could be carried out to achieve this. State one precaution the student should take to improve the accuracy of the results.

**(Total for Question 4 = 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.

.....

.....

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

**(2)**

.....

.....

.....

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

**(2)**

(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)**

**(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)**

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

**(1)**

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

**(2)**

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

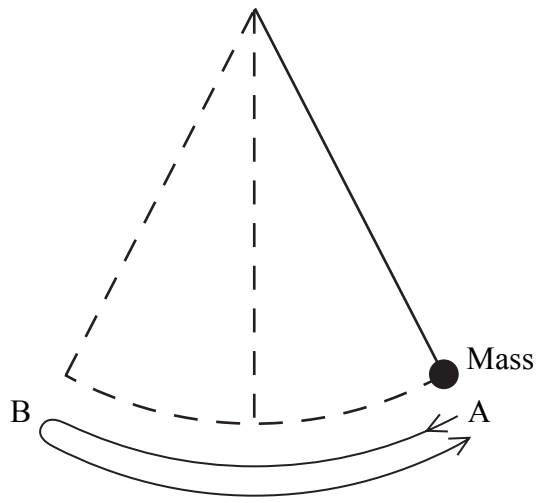
Explain why knowing a value for $k$ may be useful.

**(1)**

**(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.

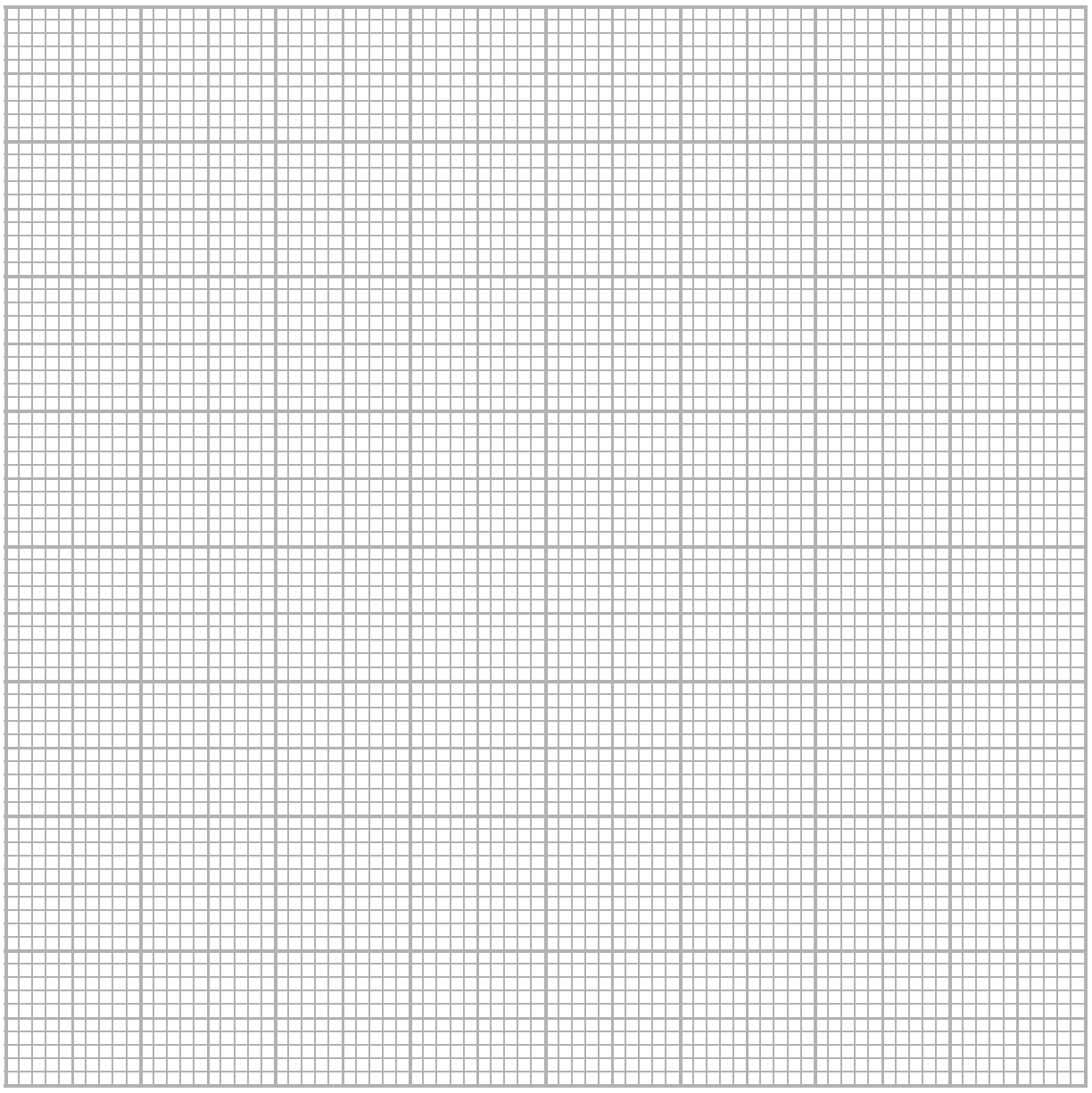
| **Length, $l$ / m** | **Time for 10 complete swings / s** | **Period, $T$ / s** | |
|---|---|---|---|
| 1.0 | 20 | 2 | |
| 1.2 | 22.1 | 2.21 | |
| 1.4 | 23.8 | 2.38 | |
| 1.6 | 25.4 | 2.54 | |
| 1.8 | 27 | 2.7 | |

Criticise this set of measurements.

**(3)**

(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)**

.....

.....

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

**(3)**

(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)**

**(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's 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 | $P = VI$<br>$P = I^2R$<br>$P = V^2/R$<br>$W = VIt$<br>$\%\ \text{efficiency} = \frac{\text{useful energy output}}{\text{energy input}} \times 100$<br>$\%\ \text{efficiency} = \frac{\text{useful power output}}{\text{power input}} \times 100$ |
| Resistivity | $R = \rho l/A$ |
| Current | $I = \Delta Q/\Delta t$<br>$I = nqvA$ |
| 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 | $hf = \phi + \frac{1}{2}mv^2_{max}$ |

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