Diploma Programme
Programme du diplôme
Programa del Diploma

Physics
Standard level
Paper 2

6 November 2025

Zone A morning | **Zone B** morning | **Zone C** morning

Candidate session number

1 hour 30 minutes

Instructions to candidates

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all questions.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- A clean copy of the **physics data booklet** is required for this paper.
- The maximum mark for this examination paper is **[50 marks]**.

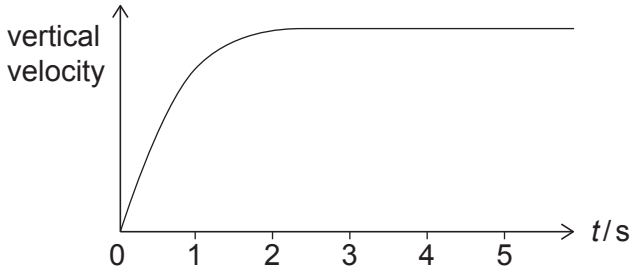
8825–6712

13 pages

Answer **all** questions. Answers must be written within the answer boxes provided.

1. A spherical oil droplet is released from rest at the bottom of a column of water.

The graph shows the variation with time t of the vertical velocity of the oil droplet.



(a) The following data are available:

radius of the oil droplet $= 3.5\,\text{mm}$

weight of the oil droplet $= 1.6 \times 10^{-3}\,\text{N}$

density of the water $= 1000\,\text{kg m}^{-3}$

viscosity of the water $= 1.1 \times 10^{-3}\,\text{Pa s}$

(i) Show that the volume of the oil droplet is about $2 \times 10^{-7}\,\text{m}^3$. [1]

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(ii) Calculate the initial acceleration of the oil droplet. [3]

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(This question continues on the following page)

(Question 1 continued)

(b) Describe why the acceleration of the oil droplet changes. [2]

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(c) (i) Explain why the velocity of the oil droplet is constant for $t > 3\,s$. [2]

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(ii) Deduce the velocity of the oil droplet for $t > 3\,s$. [2]

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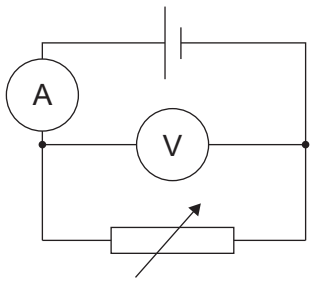
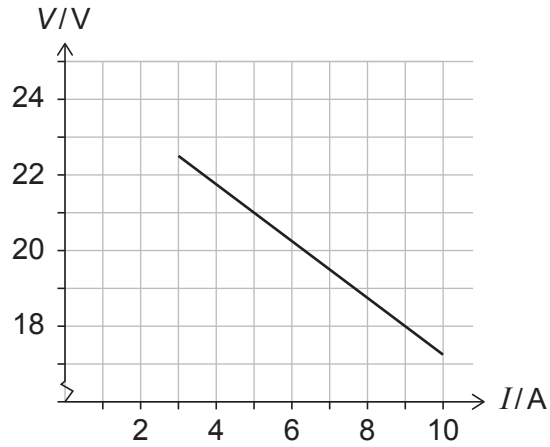
2. A student is investigating the emf and internal resistance of a cell, using the circuit shown. The ammeter and the voltmeter are ideal.



The graph shows the variation of the voltmeter reading V with the ammeter reading I.



(a) Explain why V changes when the resistance of the variable resistor is changed. [2]

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(b) Show that the internal resistance of the cell is about $0.8\,\Omega$. [2]

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(Question 2 continued)

(c) Determine the emf of the cell. [2]

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3. A student investigates simple harmonic motion with a mass–spring system that oscillates horizontally on a frictionless surface. In a first trial, the spring is compressed and the mass is released from rest at time $t = 0$. The mass oscillates with a period T.

(a) State the energy changes that take place:

(i) between $t = 0$ and $t = \frac{T}{4}$; [1]

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(ii) between $t = \frac{T}{4}$ and $t = \frac{T}{2}$. [1]

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(b) In a second trial, the mass is tripled without changing the spring.

Determine the ratio $\frac{\text{frequency of oscillation in the first trial}}{\text{frequency of oscillation in the second trial}}$. [2]

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(c) Describe what property the spring must have for the motion of the system to be simple harmonic. [1]

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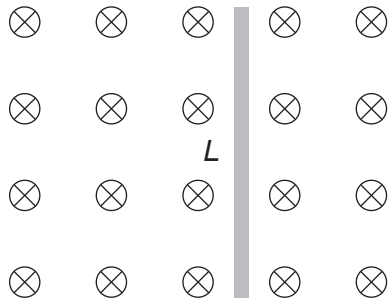
4. A metal conducting wire is in a region of uniform magnetic field $B = 1.2\,\text{T}$ directed into the page. There is current in the wire and the piece of wire has a length $L = 0.60\,\text{m}$.



(a) The wire experiences a magnetic force of 0.084 N toward the right.

(i) Show that the current in the wire is about 0.12 A. [1]

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(ii) State the direction of the current through the wire. [1]

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(iii) Outline how current in the wire causes the magnitude of the magnetic field to be different on the left side and right side of the wire. [3]

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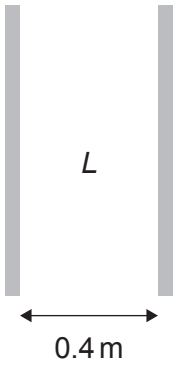
(Question 4 continued)

(b) The wire is now removed from the magnetic field and placed at a distance of 0.4 m from another similar conducting wire. Both wires have the same current as before, in the same direction.



(i) State the direction of the force on each wire. [1]

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(ii) Determine the force per unit length between the two wires. Give an appropriate SI unit for your answer. [3]

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5. Star A is a main sequence star.

The data for Star A and the Sun are given in a table.

	Value
Surface temperature of Star A	5200 K
Surface temperature of the Sun	5800 K
Parallax angle	0.74 arcsec
Radius of Star A	$0.9 R_{\odot}$
Radius of the Sun	$R_{\odot}$
Luminosity of the Sun	$L_{\odot}$

(a) (i) State how physical stability is maintained in main sequence stars. [1]

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(ii) Explain why nuclear fusion in the core of the star occurs when the temperature and density exceed threshold values. [2]

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(iii) Outline why regions of convection form in Star A. [2]

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(Question 5 continued)

(b) (i) Calculate, in m, the distance to Star A from Earth. [1]

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(ii) Show that the luminosity of Star A is about half that of the Sun. [1]

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(iii) Deduce the apparent brightness of Star A compared to the apparent brightness of the Sun [3]

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(Question 5 continued)

(c) (i) Show that the peak wavelength emitted from Star A is about 560 nm. [1]

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(ii) Calculate the energy of a photon of light emitted at this peak wavelength. [2]

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(iii) The peak wavelength of the radiation from Star A is measured by an observer on Earth. The observed wavelength is 0.007 % less than the value in (c)(i).

Outline how this difference arises. [2]

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(iv) Determine the speed, in $km\,s^{-1}$, of Star A relative to Earth. [2]

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(Question 5 continued)

(d) Describe how the light from stars is studied to determine their composition. [3]

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