

12 Pages

Complete, fold and seal
(see note 2 below)

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1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can choose to ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
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1	Student Number	2411524
2	Title of Examination Paper	PHYSICS (OME)
3	Module Code	ACDB4007
4	Date and Time of Examination	07-05-2025 09:00
5	Examination Venue	IQ310
6	Seat Number	11
7	Number of Answer Books handed in	

[illegible]

86%

(Gweler yr ochr arall am y fersiwn Cymraeg)

① Question 1

a). case = 4kg

explorer = 10kg

turning constant = 3100 ms⁻¹

cyclical.

$$\frac{v}{\sqrt{2E}} = \left[\frac{m}{c} + \frac{1}{a} \right]^{-1/2}$$

$$\frac{v}{3100} = \left[\frac{4}{10} + 0.5 \right]^{-1/2}$$

$$\frac{v}{3100} = 1.05409...$$

$$v = 3267.686916$$

$$v = 3267.69 \text{ ms}^{-1}$$

b) 2kg hits at 15 ms⁻¹ and becomes stationaryi) Impulse $Ft = m(v - u)$.

$$= 2(15 - 0)$$

$$= 30 \text{ ms}^{-1} \text{ NS}$$

$$ii) F \times 0.05 = 30$$

$$F = \frac{30}{0.05}$$

$$F = 600 \text{ N average force}$$

② Question 2.

i). Stress and strain are directly proportional to one another.

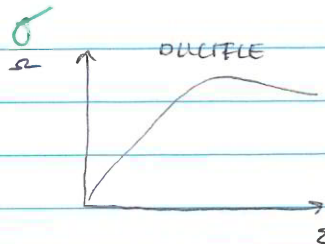
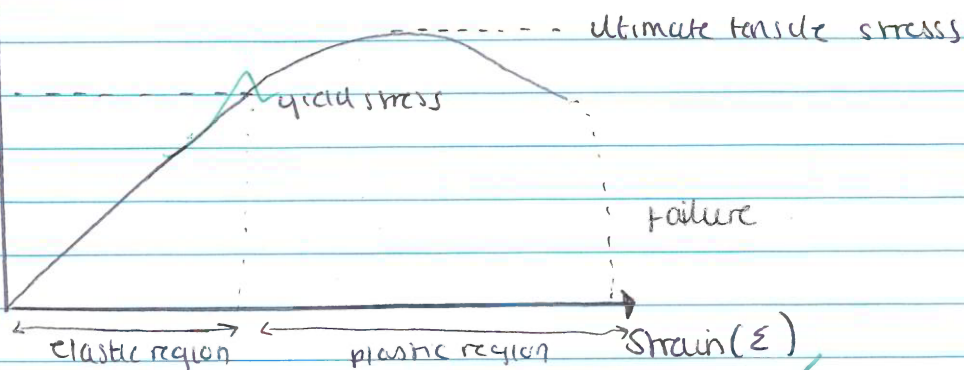
Obeys hooks law up until point of yield stress

$$EA = \text{constant}$$

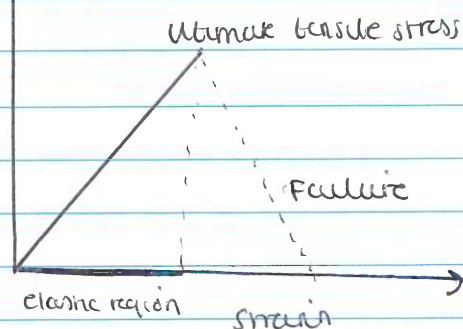
ii)

Stress (σ)

DUCTILE MATERIAL

Stress (σ)

ENGINEERING



obeys hooke's law in the elastic region.

$$b) \quad E = 200 \times 10^9$$

$$CSA = 5 \times 10^{-2} \times 10^{-4} \text{ m}^2$$

$$L = 0.3$$

$$\text{Stress} = \frac{\text{Force}}{\text{Area}}$$

$$\text{Stress} = \frac{150 \times 9.81}{5 \times 10^{-2} \times 10^{-4}}$$

$$\text{Stress} = 294.3 \times 10^6 \text{ N/m}^2$$

$$E = \frac{\text{Stress}}{\text{Strain}}$$

$$\frac{\text{Stress}}{E} = \text{Strain} \quad \frac{294.3 \times 10^6}{200 \times 10^9} = 1.4715 \times 10^{-3}$$

$$\text{Strain} = 1.4715 \times 10^{-3} \\ = 1.47 \times 10^{-3} \text{ (2dp)}$$

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③ Question 3

$$Q = mc\Delta t$$

$$Q = 2 \times 400 \times 30$$

$$Q = 24,000 \text{ J/kg K} \times 5$$

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b) 600J, 700g, $c = 150$. Change in temp?

$$\Delta Q = \Delta U + \Delta W$$

$$\Delta Q = mc\Delta T + \Delta W$$

$$\Delta Q = (0.7 \times 150 \times \Delta T) + 350$$

$$600 = (0.7 \times 150 \times \Delta T) + 350$$

$$600 - 350 = \Delta T$$

$$0.7 + 150$$

$$\Delta T = 2.38095$$

$$\Delta T = 2.38 \text{ K. (2dp)}$$

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(9)

④ Question 4

a) magnitude = 200 Nm.

$$I = 200 \text{ kg m}^2$$

$$T = I \ddot{\theta}$$

$$\frac{200}{200} = 1 \text{ rad s}^{-2}$$

$$\frac{T}{I} = \ddot{\theta}$$

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b) $m = 9.109 \times 10^{-31}$

$$v = 1.6 \times 10^6$$

$$mv = \frac{h}{\lambda} \quad 9.109 \times 10^{-31} \times 1.6 \times 10^6 = \frac{6.626 \times 10^{-34}}{\lambda}$$

$$\lambda = \frac{6.626 \times 10^{-34}}{9.109 \times 10^{-31} \times 1.6 \times 10^6} = 4.54632 \times 10^{-10}$$

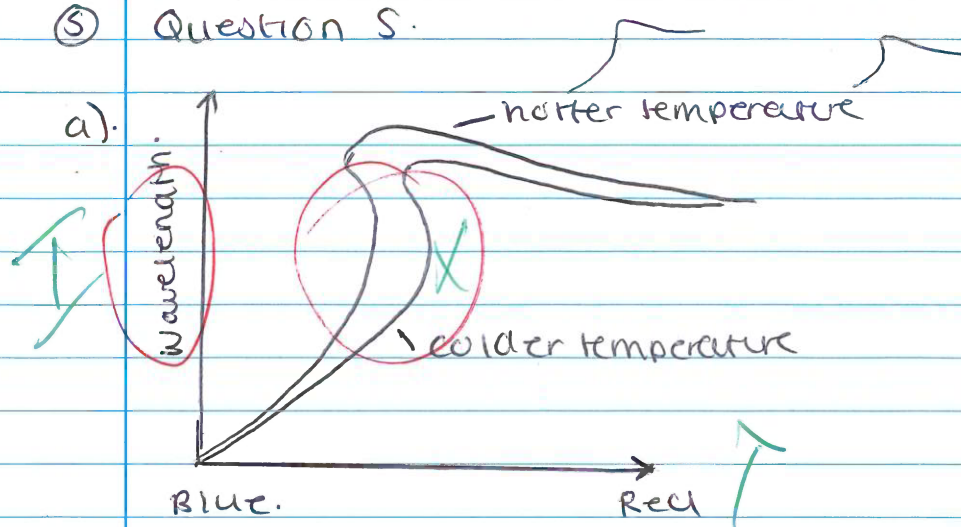
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$$\lambda = 4.55 \times 10^{-10} \text{ m (2dp)}$$

(9)

⑤ Question 5.

a).



ii) peak wavelength. Black body at 1500°C .

$$\lambda_{\text{peak}} = \frac{2.898 \times 10^{-3}}{T}$$

$$1500 + 273.15 = 1773.15$$

$$\frac{2.898 \times 10^{-3}}{1500 + 273.15}$$

$$= 1.63437 \times 10^{-6}$$

$$= 1.63 \times 10^{-6} \text{ m (2dp)}$$

b) thermal radiative power.

$$\text{surface area} = 0.7 \text{ m}^2$$

$$\epsilon = 0.8$$

$$T = 500$$

$$500 + 273.15 = 773.15$$

$$q = A \epsilon \sigma T^4$$

$$q = 0.7 \times 0.8 \times 5.67 \times 10^{-8} \times (773.15)^4$$

$$q = 11345.56496 \text{ (W m}^2 \text{ K}^{-4})$$

$$q = 11345.56 \text{ m}^2$$

$$\text{W m}^2 \text{ K}$$

$$(2 \text{ dp})$$