

**SURNAME:** Howell

FORENAME(S): Kieren

## 12 Pages

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 cannot 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.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. **Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.**

|   |                                  |               |
|---|----------------------------------|---------------|
| 1 | Student Number                   | 2413109       |
| 2 | Title of Examination Paper       | Physics (0ME) |
| 3 | Module Code                      | ACDB4007      |
| 4 | Date and Time of Examination     | 07/05/2025    |
| 5 | Examination Venue                | 10310         |
| 6 | Seat Number                      | 23            |
| 7 | Number of Answer Books handed in | 1             |

[illegible]

(Gweler yr ochr arall am y fersiwn Cymraeg)

gurney theory

a)  $m = 4$

$c = 10$

$\sqrt{2e} = 3100$

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

$$v = \sqrt{2e} \left( \frac{m}{c} + \frac{1}{2} \right)^{-1/2}$$

$$= 3100 \left( \frac{4}{10} + \frac{1}{2} \right)^{-1/2}$$

$3100 (1.054)$

$v = 3267.69 \text{ ms}^{-1} \text{ (2 D.p)}$

b) i)  $m = 2 \text{ kg}$

$u = 15 \text{ ms}^{-1}$

$v = 0$

Impulse  $= m(v - u)$

$$= 2 \times (0 - 15)$$

Impulse  $= -30 \text{ Kgm s}^{-1}$

ii)

b) IF  $t = 0.05$  find  $F$ .

$Ft = \text{Impulse}$

$F = \frac{\text{Impulse}}{t}$

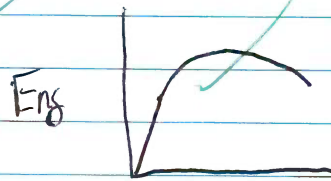
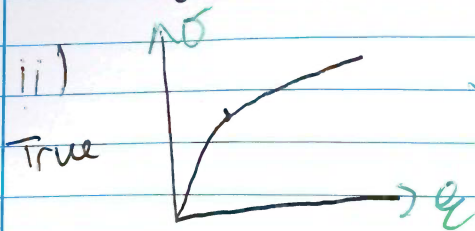
$F = \frac{-30 \text{ Kgm s}^{-1}}{0.05}$

$F = -600 \text{ N}$

denechan

2) a) i) engineering strain and true strain

Engineering stress assumes material is uniform



Label axes?

b)

$$E = 200 \times 10^9 \text{ Pa}$$

$$A = 5 \times 10^{-2} \text{ cm}^2$$

$$l = 0.3$$

150 kg

Calc  $\sigma$  and  $\epsilon$  if  $m = 150$

$$F = ma$$

$$= 150 \times 9.81$$

$$= 1471.5 \text{ N}$$

$$\sigma = \frac{F}{A}$$

area =  $5 \times 10^{-6} \text{ m}^2$

Conversion from  $\text{cm}^2$  to  $\text{m}^2$   
 $= \times 10^{-4}$

$$\sigma = \frac{1471.5}{5 \times 10^{-6}}$$

$$\sigma = 294300000 \text{ Pa}$$

or 294 Mpa

$$E = \frac{\sigma}{\epsilon} \quad \therefore \epsilon = \frac{\sigma}{E}$$

$$\frac{294300000}{200 \times 10^9} = 1.47 \times 10^{-3}$$

$$\epsilon = 1.47 \times 10^{-3} \text{ (2 d.p.)}$$

No units for strain

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$$Q = mc_p \Delta T$$

$$m = 2$$

$$c_p = 400$$

$$\Delta T = 30 \text{ K}$$

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

$$Q = 24000 \text{ J}$$

$$b) \Delta Q = \Delta u + \Delta w$$

$$\Delta u = mc_p \Delta T \quad \text{changed from g to kg}$$

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

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

$$250 = (0.7 \times 150) \Delta T$$

$$250 = 105 \Delta T$$

$$\frac{250}{105} = \Delta T$$

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

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4)

$$a) T = 200 \text{ Nm}$$

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

Find  $\ddot{\theta}$ 

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

$$200 \text{ Nm} = 200 \text{ kg m}^2 \ddot{\theta}$$

$$\frac{200}{200} = \ddot{\theta}$$

$$1 \text{ rad s}^{-2} = \ddot{\theta}$$

$$1 \text{ radian s}^{-2} = \ddot{\theta}$$

b) de broglie

$$p = h/\lambda$$

↑

$$\text{momentum} = mv$$

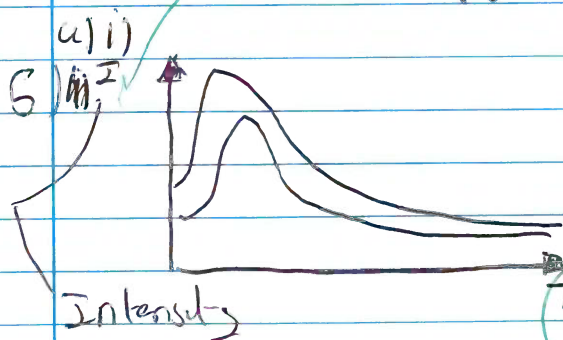
$$m = 9 \cdot 10^{-31}$$

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

$$mv = h/\lambda \therefore \lambda = \frac{h}{mv}$$

$$\lambda = \frac{6.626 \times 10^{-34}}{(9 \cdot 10^{-31} \times 1.6 \times 10^6)}$$

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



Peak I moves to left at different temperatures.

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

$$T = 1500^\circ\text{C} \rightarrow \text{needs to be in K} \therefore + 273.15$$

$$1773.15 \text{ K}$$

$$\lambda_{\text{peak}} = \frac{2.898 \times 10^{-3}}{1773.15}$$

$$\lambda_{\text{peak}} = 1.63 \times 10^{-6} \text{ m} \quad (2 \text{ d.p.})$$

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$$b) A = 0.7$$

$$\epsilon = 0.8$$

$$T = 500^\circ\text{C} (+273.15) \text{ to make into K}$$

$$\text{By Stefans } q_r = A \epsilon \sigma T^4$$

$$\sigma = 5.67 \times 10^{-8}$$

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

$$q_r = 0.7 \times 0.8 \times 5.67 \times 10^{-8} \times 3.57 \times 10^{11}$$

$$q_r = 11345.57 \text{ W} \quad (2 \text{ d.p.})$$

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