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Examination Answer Books

12 Pages

Instructions to Candidates

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 either 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	2026635
2	Title of Examination Paper	Physics
3	Module Code	ACDB4007
4	Date and Time of Examination	3/5/23 09:00
5	Examination Venue	1Q-103
6	Seat Number	
7	Number of Answer Books handed in	1

[illegible]

Complete, fold and seal
(see note 2 below)

SURNAME: COPPERTHWAIT

FORENAME(S): SCOTT

Agreed ~~WJ~~

1) a)  $\int_0^L r^2 dm$

$$m=4, L=3$$

$$I = \frac{m}{L} \int_0^L r^2 dr$$

$$I = \frac{m}{L} \left[\frac{r^3}{3} \right]_0^L$$

substitute in L, 0 $0=0 \therefore$

$$I = \frac{m}{L} \times \frac{L^3}{3}$$

$$I = \frac{mL^2}{3}$$

$$I = \frac{4 \times 3^2}{3}$$

$$I = 12 \text{ kgm}^2$$

b) $900 \text{ g} = 0.9 \text{ kg}$ 7.5 m

i) $PE = KE$ (✓) $\text{loss PE} = \text{gain KE}$ ✓

$$mgh = \frac{1}{2} mv^2$$

$$0.9 \times 9.81 \times 7.5 = 0.5 \times 0.9 \times v^2$$

$$\frac{0.9 \times 9.81 \times 7.5}{0.5 \times 0.5} = v^2$$

$$v = 16.27 \text{ ms}^{-1}$$

10
(10)

4
(4)

7)
b) ii)0.9 $\rightarrow$ 0.1mKE = Force $\times$ distance

$$0.5 \times 0.9 \times 16.27^2 = F \times 0.1$$

$$\underline{119.12} = F$$

$$F = \frac{0.1}{119.12} \text{ N}$$

$$0.5mv^2$$

(✓)
✓

✓

follows
through5
5

19

2) 7 revs p/minute

a) $\omega = \frac{7 \times 2\pi}{60}$

$\omega = 0.73 \text{ rad s}^{-1}$

b)



Resolve in F_H and F_V

$F_H = 5 \cos 45 - 8 \cos 60 + 6 \cos 30$

$F_H = 4.73 \text{ N}$

$F_V = 5 \cos 45 + 8 \cos 30 - 6 \cos 60$
 $= 7.46 \text{ N}$



$a^2 + b^2 = c^2$

$F = \sqrt{4.73^2 + 7.46^2}$

$F = 8.83 \text{ N}$

2 d.p.s. (✓)

$\theta = \tan^{-1} \left(\frac{7.46}{4.73} \right)$

$\theta = 57.62 \text{ degrees}$

4 (4)

4 (4)

4 (4)

4 (4)

4 (4)

20 ✓

3)

a) 2 moles $V_1 = 1 \text{ m}^3$, $T_1 = 20$ $V_2 = 2 \text{ m}^3$

$$PV = nRT \quad R = 8.31 \quad N = 2$$

$$P \times 2 = 2 \times 8.31 \times 293$$

$$P = \frac{2 \times 8.31 \times 293}{2}$$

$$P = 2434.83 \text{ Pa}$$

$$P \times 1 = \frac{2 \times 8.31 \times 293}{1}$$

$$= 4869.66 \text{ Pa}$$

$V_1 - V_2 = \text{Work done}$
~~work done~~

b) 250 kwh, 40g ggs, specific 900

$$Q = mc\Delta T$$

$$250 = 0.04 \times 900 \times \Delta T + 50$$

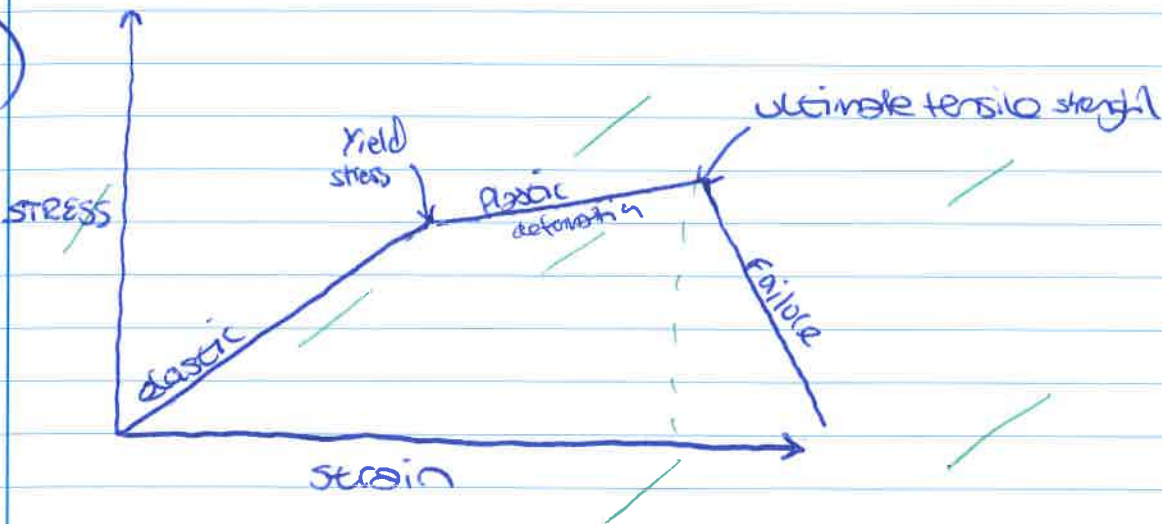
$$200 = 0.04 \times 900 \times \Delta T$$

$$\Delta T = \frac{200}{(0.04 \times 900)}$$

$$\Delta T = 5.60 \text{ K}$$

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

(10)

4)
a)

b) change = 7×10^{-3} , strain = 0.02

$$\text{strain} = \frac{\text{change } L}{L}$$

$$0.02 = \frac{7 \times 10^{-3}}{L}$$

$$L = \frac{7 \times 10^{-3}}{0.02}$$

$$L = 0.35 \text{ m}$$

c) $E = 450 \times 10^9$, $CS = 0.4 \times 10^{-4} \text{ m}^2$, $L = 4.5$, $m = 100$

$$\text{Stress} = \frac{\text{force}}{\text{area}} = \frac{\text{mass} \times \text{acceleration}}{\text{area}}$$

$$= \frac{100 \times 9.8}{0.4 \times 10^{-4}}$$

$$\text{stress} = 24500000 \text{ Pa}$$

$$= 24.5 \times 10^6 \text{ Pa}$$

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

$$\text{Strain} = \frac{24.5 \times 10^6}{450 \times 10^9}$$

$$\text{Strain} = 0.000054$$

$$= 54.44 \times 10^{-6}$$

5
54
44
45
5

118

5)

$$a) 2m^2 \quad \epsilon = 0.9 \quad T = 1400^\circ C / 1673 K$$

$$\dot{Q} = \epsilon \sigma T^4$$

$$\dot{Q} = 0.9 \times (5.67 \times 10^{-8}) \times 1673^4$$

$$\dot{Q} = 399769.201 \text{ watts per } m^2$$

∴ per $2m^2$

$$399769.201 \times 2 = 799538.40 \text{ watts}$$

b)

$$L = 50cm @ T = 30^\circ C, \quad \alpha = 5 \times 10^{-4} / ^\circ C, \quad L \propto T$$

$$L(T) = L(T_0)(1 + \alpha(T - T_0))$$

$$L(120) = 50 \times (1 + (5 \times 10^{-4} \times 90))$$

$$L(120) = 52.25cm$$

$$= 0.5225m$$

$$c) \text{ Energy} = \text{Power} \times \text{time}$$

$$\text{Power} = \frac{\text{Energy}}{\text{time}} \quad \text{5J for } 8\mu s = 8 \times 10^{-6}$$

$$\text{Power} = \frac{5J}{8 \times 10^{-6}}$$

$$= 625000 \text{ J kg}^{-1} \text{ s}^{-1} \text{ kg}^{-1} \text{ s}^{-1}$$