



Prifysgol Cymru
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Trinity Saint David

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 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.**

Complete, fold and seal
(see note 2 below)

SURNAME: Krol

FORENAME(S): Teo Oliver

1	Student Number	
2	Title of Examination Paper	
3	Module Code	PCPO4001
4	Date and Time of Examination	15/5/24 1100 hrs
5	Examination Venue	
6	Seat Number	
7	Number of Answer Books handed in	

[illegible]

18
14
19
19
4

74%

William 
03/06/24

$$CC - VU$$

$$CV - r1$$

$$Q = CV$$

$$t_e = \frac{1}{2} CV^2$$

Question No.

Examiner Only

1

A

$$4.8 + 4.3 = 9.1$$

$$\frac{1}{12} + \frac{1}{9.1} = 0.1932 = \frac{1}{ans} = 5.1753$$

$$5.1753 + 25 = 30.1753$$

$$\frac{1}{30.1753} + \frac{1}{10} + \frac{1}{12} = 0.21647 = \frac{1}{ans} = 4.619$$

$$4.619 + 50 = \underline{\underline{54.619 \Omega}} \quad K\Omega$$

1

11

B i

$$(22 \times 10^{-9}) + (510 \times 10^{-12}) = 22.51 \times 10^{-9}$$

$$\left(\frac{1}{22.51 \times 10^{-9}} \right) + \left(\frac{1}{220 \times 10^{-9}} \right) + \left(\frac{1}{42 \times 10^{-6}} \right) = 48.491 = \frac{1}{ans}$$

$$= 20.41 nF \quad \checkmark$$

B ii

$$Q = CV$$

$$(20.41 \times 10^{-9}) \times 24 = 489.88 nC \quad \checkmark$$

Biii

$$\text{Total } e = \frac{1}{2} \times c \times v^2$$

$$\frac{1}{2} \times (20.41 \text{ m/s}) \times 24^2$$

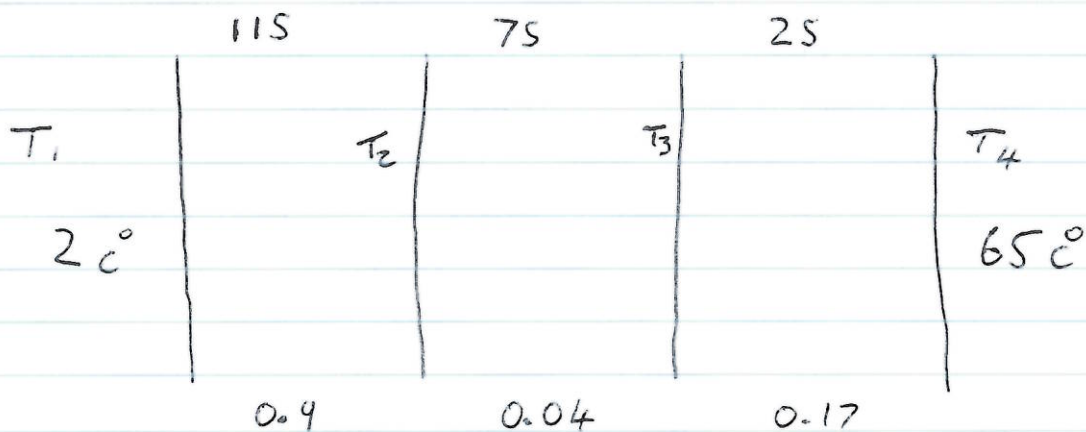
$$= \underline{\underline{5.87 \text{ kJ}}}$$

$$5.87 \times 10^{-6} \text{ J.}$$

18

2.

i



Area = 1

$$Q = \frac{A}{\left(\frac{x}{k}\right) + \left(\frac{x}{k}\right) + \left(\frac{x}{k}\right)} \times T_{\Delta}$$

$$\frac{1}{\left(\frac{0.115}{0.4}\right) + \left(\frac{0.075}{0.04}\right) + \left(\frac{0.025}{0.17}\right)} \times 63 = 24.304 \text{ Watts}$$

$$Q = \underline{\underline{24.304 \text{ Watts}}}$$

ii

$$A = 4.7 \times 2.3 = 10.81$$

$$A = 10.81$$

$$\frac{10.81}{\left(\frac{0.115}{0.4}\right) + \left(\frac{0.075}{0.04}\right) + \left(\frac{0.025}{0.17}\right)} \times 63 = \underline{\underline{316.78 \text{ Watts}}}$$

iii

$$Q = \frac{k \times A \times (T_1 - T_2)}{x}$$

$$\textcircled{T_3} \quad 316.78 = \frac{0.17 \times 10.81 \times (65 - T_3)}{0.025}$$

$$316.78 \times 0.025 = 1.8377 (65 - T_3)$$

$$\frac{7.9195}{1.8377} = 65 - T_3$$

$$4.304 = 65 - T_3$$

$$T_3 + 4.304 = 65$$

$$T_3 = 65 - 4.304$$

$$T_3 = 60.69^\circ \text{C} \quad \checkmark$$

$$\textcircled{T_2} \quad 316.78 = \frac{0.04 \times 10.81 \times (60.69 - T_2)}{0.075}$$

$$316.78 \times 0.075 = 23.75$$

$$0.04 \times 10.81 = 0.4324$$

$$23.75 = 0.4324 (60.69 - T_2) \quad \checkmark$$

or

$$\frac{23.75}{0.4324} = 60.69 - T_2$$

$$54.925 = 60.69 - T_2$$

$$T_2 + 54.925 = 60.69$$

$$T_2 = 60.69 - 54.925$$

$$T_2 = 5.76 \quad \checkmark$$

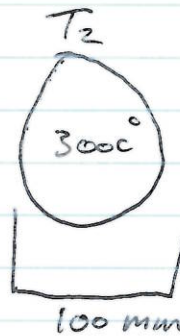
Check T_4 to make sure.

(iv) missing

Question No.

Examiner Only

2
V.



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

$$\epsilon = 0.6$$

$$T_1 = 273 + 60 = 333$$

$$T_2 = 273 + 300 = 573$$

Area of sphere $= 4\pi r^2$

$$Q_1 = 0.6 \times (5.672 \times 10^{-8}) \times (\pi \times 0.05^2) \times 333^4$$

$$Q_1 = 3.286 \text{ Watts}$$

$$Q_2 = 0.6 \times (5.672 \times 10^{-8}) \times (\pi \times 0.05^2) \times 573^4$$

$$Q_2 = 28.81 \text{ Watts}$$

$$\text{net } Q = Q_2 - Q_1 = 28.81 - 3.286$$

$$\text{net } Q = 25.527 \text{ Watts to the left.}$$

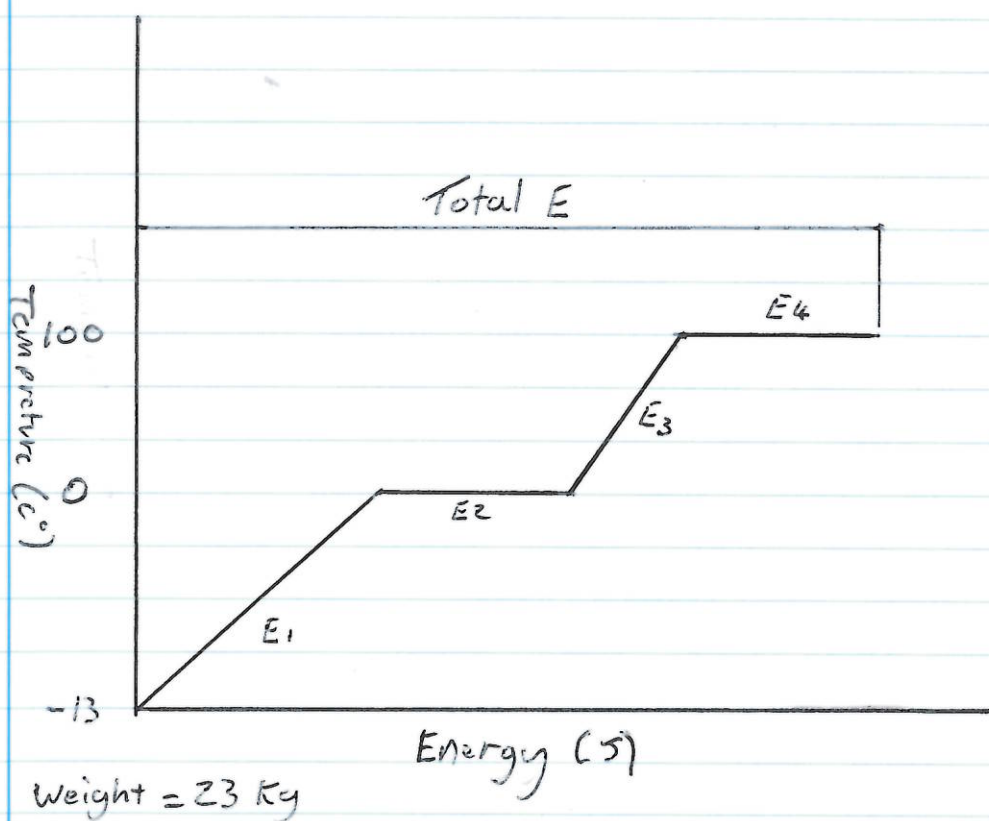
Method
Correct.

Area incorrect

14

3

i



$$E_1 = 23 \times (2.04 \times 10^3) \times 13$$

$$E_1 = 634860$$

$$E_2 = 23 \times (334 \times 10^3)$$

$$E_2 = 7,682,000$$

$$E_3 = 23 \times (4.2 \times 10^3) \times 100$$

$$E_3 = 9,660,000$$

$$E_4 = 23 \times (2.26 \times 10^6)$$

$$E_4 = 50,600,000$$

$$\text{Total } E = E_1 + E_2 + E_3 + E_4$$

$$\text{Total } E = 68,818,600 \text{ J}$$

Method correct.

E4 adding incorrect.

3

ii

$$\begin{aligned}\text{Time} &= 5 \times 60 \\ T &= 300\end{aligned}$$

$$P_{\text{out}} = \frac{\text{total } E}{\text{time}}$$

$$P_{\text{out}} = \frac{68581860}{300}$$

$$P_{\text{out}} = 228606.2$$

$$\text{efficiency} = \frac{P_{\text{out}}}{P_{\text{in}}} \times 100$$

$$\text{efficiency} = \frac{228606.2}{8 \times 10^6} \times 100 = \underline{\underline{2.857\%}}$$

Method correct.

Workdone mistake carries over.

4

A

$$R = \frac{PL}{A}$$

$$10 = \frac{R \times 100}{(\pi \times 0.00025^2)}$$

$$P = \frac{RA}{L}$$

$$P = \frac{10 \times (\pi \times 0.00025^2)}{100}$$

$$P = 14.63 \times 10^{-9}$$

✓
Ωm.

$$R = \frac{PL}{A}$$

$$A = (\pi \times 0.00015^2)$$

$$L = 100$$

$$R = \frac{(14.63 \times 10^{-9}) \times 100}{(\pi \times 0.00015^2)}$$

$$R = 27.7 \Omega \quad \checkmark$$

4 B.

$$R_{\text{new}} = R_{\text{ref}} (1 + \alpha (\Delta T))$$

$$\Delta T = 75 - 20 = 55$$

$$\alpha_{\text{copper}} = 0.00396$$

$$R_{\text{new}} = 95 (1 + 0.00396 (55))$$

$$R_{\text{new}} = 115.691 \Omega \quad \checkmark$$

19

Turn Page for Q5

5

A ii

The type of image that is shown would be a real inverted image. ✓

B

i

The type of image that is shown through the concave lens would be a virtual upright image. ✓

4.