



Prifysgol Cymru ·
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

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.**

Complete, fold and seal
(see note 2 below)

SURNAME: GIBBY

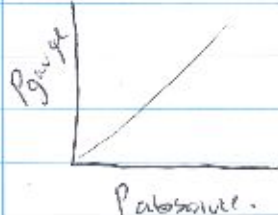
FORENAME(S): LEWYS JAMES

1	Student Number	186653
2	Title of Examination Paper	Thermofluids 1
3	Module Code	SGDM 4004
4	Date and Time of Examination	16/1/20 09:30 Am
5	Examination Venue	
6	Seat Number	
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
1	13
3	12
4	10
Total	35/75

47%

1a) $P = \rho gh$ $h = \frac{P}{\rho g}$ The bigger the head the bigger the pressure. (2)

b)  P_{gauge} accounts for general pressure off an object ~~with~~ alone. (1)

P_{absolute} accounts for P_{gauge} as well as atmospheric pressure. $\times \checkmark$

c) $h_1 + \frac{c_1^2}{2} + gz_1 + Q - W = h_2 + \frac{c_2^2}{2} + gz_2$ (0)

Head Velocity gravity Elevation

d) $P_{\text{gauge}} = \rho \times g \times h$ (0)

$P_{\text{gauge}} = 2 \times 9.81 \times 12 = 235.44 \text{ kg/mq.}$ $\times$

e)  (1) (2)

$P_1 = 400 \times 10^3$ $P_2 = ?$
 $A_1 = 0.15 \text{ m}$ $A_2 = 0.1 \text{ m}$
 $\rho = 1000 \text{ kg/m}^3$

$Q = C_1 A_1 = C_2 A_2$

$0.025 = \pi \times 0.075^2 \times C_1$

$0.025 = \pi \times 0.05^2 \times C_2$

$\frac{0.025}{\pi \times 0.075^2} = C_1 = 1.4 \text{ m/s}$

$\frac{0.025}{\pi \times 0.05^2} = C_2 = 3.2 \text{ m/s}$

$\frac{P_1}{\rho g} + \frac{c_1^2}{2g} + z_1 = \frac{P_2}{\rho g} + \frac{c_2^2}{2g} + z_2 + h_f$ $\checkmark$

$\frac{400 \times 10^3}{1000 \times 9.81} + \frac{(1.4)^2}{2 \times 9.81} + 0 = \frac{P_2}{1000 \times 9.81} + \frac{(3.2)^2}{2 \times 9.81} + 0 + 0$ $\checkmark \checkmark \checkmark \checkmark$

$40.77 + 0.09 = \frac{P_2}{9810} + 0.52$

$40.86 = \frac{P_2}{9810} + 0.52 \quad (-0.52)$

$40.34 = \frac{P_2}{9810} \quad \times 9810$

$40.34 \times 9810 = P_2 = 395.7 \times 10^3$ $\checkmark$
 $= 395.7 \text{ kN/m}^2$

3a) The sum of the work = the sum of the heat. ✓

(2)

bi) $PV^\gamma = c$ $Q=0$ It doesn't give off heat only work. ✓

(1)

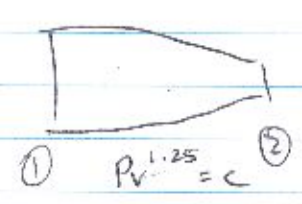
ii) The total of internal heat energy. ✓

(1)

iii) $PV = c$ this process allows both heat and work to be used. ✓

iv) Absolute temperature is maximum temperature in Kelvin (K).
(-273K) ✓

c)



$P_1 = 7 \times 10^5$ $P_2 = 1 \times 10^5$
 $T_1 = 473K$ $T_2 = ?$

$C_p = 1.005 \text{ kJ/kgK}$
 $C_v = 0.715 \text{ kJ/kgK}$

~~h₁ = c_pT₁~~ $h_1 = 1.005 \times 473$ ✓
~~h₂ = c_pT₂~~ $h_2 = 475.37 \text{ kJ/kg}$ ✓

(1)

$h_1 = h_2 + \frac{C_2^2}{2}$ ✓

$\frac{T_1}{T_2} = \left(\frac{P_1}{P_2} \right)^{\frac{\gamma-1}{\gamma}} \therefore \frac{473}{T_2} = \left(\frac{7 \times 10^5}{1 \times 10^5} \right)^{\frac{1.25-1}{1.25}} \therefore \frac{473}{T_2} = 1.476$

(6)

$\frac{473}{1.476} = T_2 = 320.5K$ ✓

$h_2 = c_p T_2$
 $h_2 = 1.005 \times 320.5$
 $h_2 = 322.1 \text{ kJ/kg}$ ✓

$h_1 = h_2 + \frac{C_2^2}{2} \therefore 475.37 = 322.1 + \frac{C_2^2}{2}$ ($\div 322.1$)

$\frac{475.37 - 322.1}{2} = \frac{C_2^2}{2} \therefore 1.476 = \frac{C_2^2}{2} \times 2$

(1)

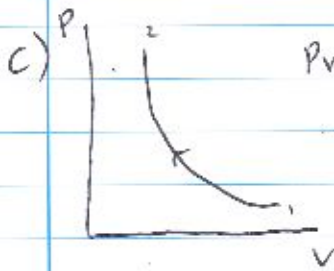
$2.952 = C_2^2$ $C_2 = \sqrt{2.952}$
 $C_2 = 1.72 \text{ m/s}$ ✓

12

4a) A perfect gas is a gas that obeys all gas laws. ✓
 Specific heats of a gas is the ability to heat up ~~some~~ 1kg object by 1 kelvin (K). (1)

b) Open system: lets off energy e.g. Turbine x (0)

closed system = Stores the energy e.g. flowmeter x (0)



$$P V^\gamma = c$$

$$P_1 = 10 \times 10^5$$

$$P_2 = ?$$

$$V_1 = 0.25 \text{ m}^3$$

$$V_2 = 0.085 \text{ m}^3$$

$$T_1 = 423 \text{ K}$$

$$T_2 = ?$$

$$C_p = 1.075 \text{ kJ/kgK} \quad C_v = 0.78 \text{ kJ/kgK}$$

$$\gamma = C_p / C_v$$

$$R = C_p - C_v$$

$$\gamma = 1.075 / 0.78$$

$$R = 1.075 - 0.78$$

$$\gamma = 1.4$$

$$R = 0.295$$

i) $P_1 V_1^\gamma = P_2 V_2^\gamma$ ✓ $(10 \times 10^5) \times (0.25)^{1.4} = P_2 \times (0.085)^{1.4}$ ✓

$$143587.29 = P_2 \times 0.797 \quad (\div 0.797)$$

$$\frac{143587.29}{0.797} = P_2 = 180159.7 \text{ or } 1.8 \text{ bar } 1.8 \times 10^5$$

(3)

ii) $\frac{T_1}{T_2} = \left(\frac{P_1}{P_2} \right)^{\frac{\gamma-1}{\gamma}}$ ✓ $\frac{423}{T_2} = \left(\frac{10 \times 10^5}{1.8 \times 10^5} \right)^{\frac{1.4-1}{1.4}}$

$$\frac{423}{T_2} = 1.632$$

$$\frac{423}{1.632} = T_2 = 259.2 \text{ K}$$

(3)

$$\text{iii)} \quad W.D = \frac{P_1 V_1^\gamma - P_2 V_2^\gamma}{\gamma - 1} \quad /$$

$$W.D = \frac{(10 \times 10^5) \times (0.25)^{1.4} - (1.8 \times 10^5) \times (0.85)^{1.4}}{1.4 - 1} \quad \times$$

$$W.D = 542.6 \text{ J} \quad \times$$

$$\text{iv)} \quad R = C_p - C_v \quad PV = mRT$$

$$R = 1.075 - 0.78$$

$$R = 0.295 \text{ kJ/kg}$$

$$m = \frac{PV}{RT} \quad \therefore \frac{(10 \times 10^5) \times (0.25)}{0.295 \times 423} = m = 2 \text{ kg} \quad /$$

⑥

③

10