UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER I
SESSION 2020/2021

COURSE NAME	:	THERMODYNAMICS
COURSE CODE	:	DAU 34303
PROGRAMME CODE	:	DAU
EXAMINATION DATE	:	JANUARY/ FEBRUARY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 (a) Describe the following:

(i) the Zeroth Law of Thermodynamics.

(2 marks)

(ii) homogeneous of pure substances.

(2 marks)

(b) List **three (3)** examples of various application of thermodynamics in real life.

(3 marks)

(c) Explain **three (3)** types of system that energy can be transfer.

(6 marks)

(d) Describe the phase change process of pure substances exits in many practical situations of thermodynamics application.

(5 marks)

(e) A cylinder of gas is at 0°C. A piston compresses the gas to half its original volume and three times its original pressure. Calculate the final temperature of the gas.

(7 marks)

Q2 (a) Define the net work for a cycle process.

(2 marks)

(b) List **two (2)** types of common process that involve a work done.

(2 marks)

(c) From the **Figure Q2 (c)**, two processes take an ideal gas from State 1 to State 3. From the answers i, ii, iii, iv below, choose the work done by process A to the work done by process B and explain your answer.

(i) $Wa = Wb = 0$
(ii) $Wa - Wb$ but neither is 0
(iii) $Wa > Wb$
(iv) $Wa < Wb$

(5 marks)

(d) i) Sketch a P-V diagram showing the following processes in a cycle.

Process 1-2 : isobaric work output of 11.5 kJ from an initial volume 0.029 m^3.

Process 2-3 : isothermal compression

Process 3-1 : Isochoric heat transfer to its original volume 0.029 m^3 and pressure 150kPa.

(4 marks)

ii) Calculate :

i) the maximum volume in the cycle.

(4 marks)

ii) the isothermal work.

(4 marks)

iii) the net work.

(4 marks)

Q3 (a) Describe endothermic and exothermic.

(4 marks)

(b) Distinguish between standard heat of formation and standard heat of reaction.

(8 marks)

(c) By using Hess's Law and the elementary reaction and enthalpies given, calculate the ΔH for the reactions.

$C_2H_4 + 6\ F_2 \longrightarrow 2\ CF_4 + 4HF$

$H_2 + F_2 \longrightarrow 2HF$	ΔH – -537 kJ/ mol
$C + 2F_2 \longrightarrow CF_4$	ΔH – -680 kJ/mol
$2C + 2H_2 \longrightarrow C_2H_4$	ΔH = 52 kJ/mol

(10 marks)

(d) By using standard enthalpy formation, calculate the enthalpy change of the below reaction:

$C_6H_{12}O_6 + 6\ O_2 \longrightarrow 6\ CO_2 + 6\ H_2O$

Given:

$\Delta H\ C_6H_{12}O_6 = -1271$ kJ/mol
$\Delta H\ CO_2 = 393.5$ kJ/mol
$\Delta H\ H_2O = -241.8$ kJ/mol

(3 marks)

Q4 (a) List the purpose of the Second Law of Thermodynamics, which commonly used in engineering systems.

(3 marks)

(b) Explain reversible processes that makeup the Carnot cycle.

(8 marks)

(c) Carnot heat engine whose low temperature reservoir is at 7 °C has an efficiency of 50 %. It is tend to increase the efficiency to 70 %. Calculate the temperature of the source increased.

(9 marks)

(d) Compute the efficiency of a Carnot's heat engine working between the steam and ice points.

(5 marks)

-END OF QUESTIONS-

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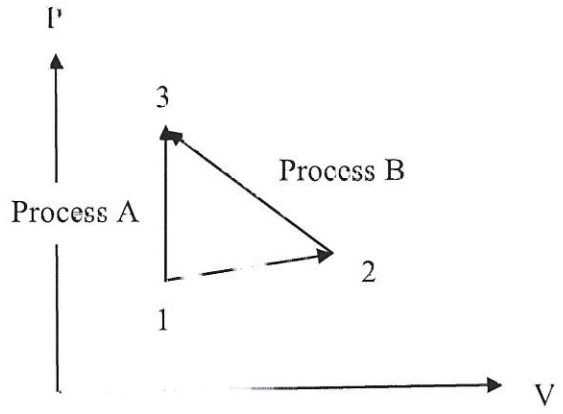

Figure Q2 (C)

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List of formulas and equations

$$(\frac{Q_H}{Q_L})_{rev} = \frac{T_H}{T_L}$$

$$\eta_{th\,rev} = 1 - \frac{T_H}{T_L}$$

$$\eta_{th} = \frac{W_{net,out}}{Q_{in}}$$

$$\left(\frac{T_2}{T_1}\right)_{s=const.} = \left(\frac{v_1}{v_2}\right)^{k-1}$$

$$\left(\frac{T_2}{T_1}\right)_{s=const.} = \left(\frac{P_2}{P_1}\right)^{(k-1)/k}$$

$$COP_R = \frac{Q_L}{W_{net,in}} = \frac{Q_L}{Q_H - Q_L}$$

$F_{in} - F_{out} = \Delta F_{system}$

$Q - W = \Delta U$

$\dot{m} = \frac{1}{v}(VA)$

$W = \dot{W}\Delta t$

$PV = mRT$

$$COP_R = \frac{1}{(T_H/T_L) - 1}$$

$$COP_{HP} = \frac{Q_H}{W_{net,in}} = \frac{Q_H}{Q_H - Q_L}$$

$W = VI\Delta t$

$Q - W = \Delta U + \Delta KE + \Delta PE$

$$W = P_1 V_1 \ln \frac{V_2}{V_1}$$

$\Delta U = U_2 - U_1 = C_v (T_2 - T_1)$

$\Delta H = H_2 - H_1 = C_P (T_2 - T_1)$

$$\dot{W}_{in} = \dot{m}(h_2 - h_1)$$

$$\dot{W}_{out} = \dot{m}(h_1 - h_2)$$

$$q_{net} - w_{net} = \left(u_2 - u_1 + \frac{V_2^2 - V_1^2}{2} + \frac{g(z_2 - z_1)}{1}\right)$$

$$\left(h_1 + \frac{V_1^2}{2}\right) = \left(h_2 + \frac{V_2^2}{2}\right)$$