EMBU UNIVERSITY COLLEGE

(A Constituent College of the University of Nairobi)

2015/2016 ACADEMIC YEAR
SECOND SEMESTER EXAMINATION

THIRD YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

SPH 302: THERMODYNAMICS

DATE: APRIL 5, 2016   TIME: 08:30-10:30

INSTRUCTIONS:

Answer Question ONE and ANY Other TWO Questions

Constants:

Density of air at NTP = 1.29 x 10^{32} g/cm^3

Specific heat cap of Copper = 391 J/Kg

Specific heat capacity of Brass = 370 J/Kg

Specific heat capacity of Lead = 145 J/Kg

R = 8.31 J/mol

QUESTION ONE

a) What are thermodynamic potentials of a thermodynamic system? Give an example.

(3 Marks)

b) A gas is suddenly compressed to half its original volume. Find the rise in temperature, the original temperature being 300 K. Take γ = 1.5. (3 Marks)

c) By giving an example describe a reversible process. (4 Marks)

d) What is the principle of operation of a heat engine? (2 Marks)

e) What are the conditions for the standard fixed point of determining temperature measurement of a body? (3 Marks)

f) What is the difference between a thermodynamic process and a cycle? (4 Marks)

g) A gas is heated so that its volume increases from 50 cm^3 to 750cm^3 while the pressure remains constant at 1×10^5 N/m^2. Find the heat required for the work done against the thermal pressure. (3 Marks)

h) Briefly explain the basis of the third law of thermodynamics. (2 Marks)

i) A Carnot's engine operates between the temperatures $T_H = 850$ K and $T_I = 300$ K. It performs 1200 J of work every cycle which takes 0.25 s. Find the efficiency of this engine. (3 Marks)

j) A cylinder contains 7.0 g of nitrogen gas. Find work that must be done to compress the gas at a constant temperature of 80 ^{0}C until the volume reduces to half its original value. (3 Marks)

QUESTION TWO

Show that the work done by a gas of mass, m g during an adiabatic expansion from a volume V_1 to V_2 is given by:

$$W = \frac{1}{\alpha - 1}(P_1 V_1 - P_2 V_2)$$

Consider that the gas is enclosed in a perfectly insulated cylinder at a pressure P, temperature, T and a volume, V. (20 Marks)

QUESTION THREE

a) During an experiment 200 g of lead at 200 ^{0}C was mixed with 400 g of water at 20 ^{0}C. Find the difference in entropy of the system at the end from its value before mixing. (16 Marks)

b) Briefly explain the use of Zeroth law of thermodynamics. (4 Marks)

QUESTION FOUR

a) During an experiment 200 g of lead at 200 ^{0}C was mixed with 400 g of water at 20 ^{0}C. Find the difference in entropy of the system at the end from its value before mixing. (16 Marks)

b) Briefly explain the use of Zeroth law of thermodynamics. (4 Marks)

QUESTION FIVE (20 MARKS)

m grams of a gas are enclosed in a perfectly non conducting wall of cylinder with a piston, briefly explain the stages of the Carnot cycle that the gas can undergo. (20 Marks)

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