



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

OPEN DISTANCE AND e-LEARNING

FIRST SEMESTER EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE AND BACHELOR OF EDUCATION SCIENCE SPH 307: THERMAL PHYSICS II

DATE: Sunday 18th December, 2011

TIME: 2.00 - 4.00 p.m.

INSTRUCTIONS:

Answer Questions ONE and any other TWO Questions.

All Questions carry equal marks of 20 each.

- Q.1) (a) State the first and second laws of Thermodynamics. Cite their differences. (10 marks)
- (b) A heat engine takes 500J of heat and performs 200J of work. What is the efficiency of the engine? (10 marks)
- (c) Explain your comprehension of the meaning of internal energy. (10 marks)
- (d) A gas is compressed at constant pressure 2.0×10^5 Pa from a volume of 2.0 m^3 to a volume of 0.500 m^3 . What is the work done? If the temperature initially was 40°C what is the final temperature of the gas? (5 marks)
- Q.2) (a) A gas in a container with a piston expands isothermally (i.e. the temperature stays constant). If heat Q equals 10 J is given to the gas. What is the work done by the gas.? (10 marks)

(b) A gas expands adiabatically (i.e. does not receive or lose heat). Will its temperature increase or decrease? Explain. (10 marks)

Q.3) (a) (i) A refrigerator with a coefficient of performance equal to 5.0 is to Cool 1.0 kg of water at 20°C into ice -10°C in one hour. How much heat must be extracted from the water? How much electrical power is needed?
(ii) Differentiate between reversible and irreversible process. (5,5 marks)

(b) (i) State the null law of thermodynamics.
(ii) Calculate the change in entropy per kg of air expanding Polytropically in a cylinder behind a piston from a pressure of $7.5 \times 10^4 \text{ N/M}^2$ and temperature 555°C to a pressure of $1.5 \times 10^4 \text{ N/M}^2$. The index of expansion is 1.3. (10 marks)

Q.4) (a) Distinguish between an isolated system a closed system and an open system. (10 marks)

(b) A monatomic gas is kept at a constant pressure $3 \times 10^6 \text{ Pa}$, initial volume 0.100 m^3 and temperature 300 K . If the gas is compressed at constant pressure down to a volume of 0.080 m^3 . Find
(i) The work done on the gas.
(ii) The heat taken out of the gas. (10 marks)

Q.5) (a) Describe the operating cycle of a gasoline engine with the help of a p-V Diagram. (10 marks)

(b) (i) In an effort to cool a kitchen during the summer, the refrigerator door is left open and the kitchen's door and windows are closed. What would happen? (5 marks)

(iii) A 1 KW refrigerator whose coefficient of performance is 2.0 takes heat from a freezer compartment at -20°C and exhausts it at 40°C . How does its CP compare with that of an ideal refrigerator? (5 marks)