QUESTION BANK UNIT 1

Q1. One kg of air at a pressure of 7 bar and a temperature of 360K under goes a reversible polytropic process which may be represented by PV1.5 = Constant. If the final pressure is 104 bar evaluate:

a) Final specific volume and temperature
b) Work done heat transfer.
c) How the work and heat interaction would be affected if the process is irreversible and 15 kj of work is lost due to internal friction

Q2. 1.5 kg Nitrogen contained in a cylinder at pressure 6 bar and temperature 300K expands three times of its original volume. Assuming the process to be isobaric make calculation for:

a) Initial volume.
b) Final temperature.
c) Work done by the gas.
d) Heat added.
e) Change in internal energy.

Q3. Air initially at 60Kpa pressure and 800K temperature and occupying a volume of 0.1m3 is compressed isothermally until the volume is halved and subsequently it goes further compression at constant pressure till the volume is halved again sketch the process on P-V plot and make calculation for the total heat interaction for the two process. Assume ideal gas behavior for air and take Cp=1.005kj/kg K

Q4. 2 kg of an ideal gas is compressed adiabatically from pressure 100Kpa and temperature 220K to a final pressure of 400Kpa. Given Cp= 1kj/kg k and Cv0.707kj/kg k Make calculation for:

a. Initial volume.
b. Final volume and temperature.
c. Work performed
d. Heat added to or subtracted from the system
e. Change in internal energy.

Q5. 0.5 kg of an ideal gas expands adiabatically until its pressure is halved. During expansion the gas does 30Kj of external work and its temperature falls from 500K to 410K. Make calculation for the adiabatic exponents and the characteristics gas constant.

Q6. An insulated cylinder of 0.4m diameter and 0.8m length contains 10 kg of oxygen. Paddle work is done on the gas to increase its pressure from 3 bar to 6 bar. Determine the change in internal energy work done on the gas and the change in enthalpy Cp = 0.91Kj/Kg K & Cv = 0.64Kj/Kg K.

Q7. 2 kg of an ideal gas occupies a volume of 0.3m3 at 10 bar pressure and 500K temperature. When this expands polytropic (Pv1.2 =constant) the internal energy decreases by 300KJ. Presuming adiabatic exponents $\gamma = 1.4$, determine:

a. Specific gas constant.
b. Final temperature, pressure and volume of gas.
c. Heat and work interaction across the system boundary.

Q8. One kg of air at 1 bar and 300K is compressed adiabatically till its pressure becomes 5 times the original pressure. Subsequently it is expanded at constant pressure and finally cooled at constant volume to return to its original state calculate the heat and work interaction and change in internal energy for each process and for the cycle.

Q9. Define thermodynamics and discuss different approaches to study of thermodynamics.

Q10. Write short notes on the following:

Thermodynamic properties, state, path, process, closed system, isolated system, open system, extensive and intensive properties.

Q12. What is meant by quasi-static process? Also discuss its physical significance.

Q13. Describe thermodynamic equilibrium of a system.

Q14. State thermodynamic definition of work. Also differentiate between heat and work.

Q15. State Zeroth law of thermodynamics.

Q16. Explain, how the Zeroth law of thermodynamics can be used for temperature measurement.

Q17. Write short notes on the following: Thermometry, thermometric substance, thermometric property

Q18. Define the first law of thermodynamics. Also give supporting mathematical expression for it.

Q19. How the first law of thermodynamics is applied to a closed system undergoing a non-cyclic process?

Q20. Show that internal energy is a property.

Q21. Explain the following :

i. Free expansion
ii. Polytropic process
iii. Hyperbolic process

Also obtain expressions for work in each case

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