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| **Benha University**  | **Shoubra Faculty of Engineering** |
| **1styear (2016-2017)** | **Electrical Engineering. Dept.**  |
| **Thermodynamics Sheet No. (3)** | **Communication engineering**  |

1. A piston-cylinder assembly contain 1kg of (N2) the gas expand from initial state where T1=700K and P1=5bars to final state where P2=2bar.during the process pressure and specific volume are related by Pv1.3=constant. Assuming ideal gas behavior and neglect kinetic and potential energy effects. Determine the heat transfer during the process ,in KJ
2. In a cylinder fitted with piston is trapped 0.02kg of helium initial at 100kpa with a specific volume of 5.8m3/kg. The helium is compressed frictionless in such the manner that pv1.4=constant until the pressure is 200kpa.determine the heat transfer of the compression process.
3. Two tanks are connected by a valve. One tank contains 2kg of CO gas at 770c and 0.7bar. The other tank holds 8kg of the same gas at 270C and 1.2bar. The valve is then open and the gases are allowed to mix while receiving energy by heat transfer from surroundings. The final equilibrium temperature is 420C determined

A) Final equilibrium pressure

b) The heat transfer for the process.

1. A closed tank has volume of 25L. At time when it filled with saturated vapor steam at 225 kpa. how much will transferred to room when steam pressure is dropped to 100 kpa
2. Piston cylinder assembly initially contains 0.04m3 of water at 10bar and 300K. The water expands to final pressure 1.5bar. Determined the expansion work if the process is assumed to be reversible adiabatic. Also determined the final volume of the piston –cylinder assembly.



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| **Thermodynamics Sheet No. (4)** | **Communication engineering**  |

1. Steam enters a nozzle operation at steady state at 3MPa and 3200C with negligible velocity and exit at 1.5MPa and velocity of 500m/s. the mass flow rate is 2.22kg/s. Neglect heat transfer and potential energy, determine
2. The exit temperature
3. The exit area.
4. Air enters an insulated diffuser operating at steady state with a pressure of 0.7 bar a temperature 570C and velocity 200m/s. at the exit, the pressure is 1 bar. The exit flow area is 20% greater than the inlet flow area. Potential energy effect can be neglected using the ideal gas model determine at the exit

 a) The temperature

 b) The velocity

1. Airexpands with a mass flow rate of 10kg/s through a turbine from 5bar, 900K to 1bar, and 600K. The inlet velocity is small compared to the exit velocity 100m/s. the turbine operates at steady state. Heat transfer from the turbine to the surroundings and potential energy effect are negligible. Calculated the power developed by the turbine.
2. At steady state, a well-insulated steam turbine develops 10MW of power for steam flow rate of 12kg/s. the steam enters at 40 bar and leaves at 0.1bar with a quality of 90%. Kinetic and potential energy changes from inlet to exit can be neglected. What is the inlet temperature of the steam?
3. Steam at 30bar, 5000C, 70m/s enters an insulated turbine operating at steady state and exits at 3 bars, 140m/s. find the work developed per kg of steam