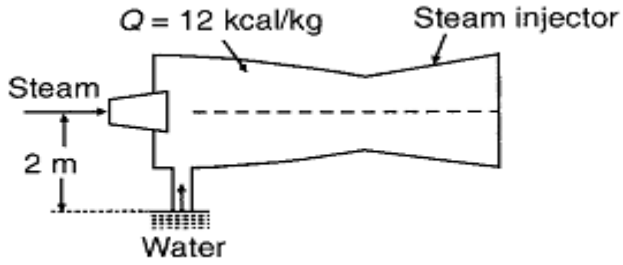
1. In a nozzle air at 627°C and twice atmospheric pressure enters with negligible velocity and leaves at a temperature of 27°C. Determine velocity of air at exit, assuming no heat loss and nozzle being horizontal. Take CP = 1.005 kJ/kg.K for air?

2. An air compressor requires shaft work of 200 kJ/kg of air and the compression of air causes increase in enthalpy of air by 100 kJ/kg of air. Cooling water required for cooling the compressor picks up heat of 90 kJ/kg of air. Determine the heat transferred from compressor to atmosphere?

3. Steam injectors for lifting water from a depth of 2m from axis of injector, determine the rate at which steam should be supplied for pumping unit mass of water. Steam enter at pressure 4 bar and temperature 350oc and water at temperature 90oc, the mixture leaves at drayness factor 0.95, heat loss to surrounding 14 kj/kg?



4. In an air compressor air flows steadily at the rate of 0.5 kg/s through an air compressor. It enters the compressor at 6 m/s with a pressure of 1 bar and a specific volume of 0.85 m3/kg and leaves at 5 m/s with a pressure of 7 bar and a specific volume of 0.16 m3/kg. The internal energy of the air leaving is 90 kJ/kg greater than that of the air entering. Cooling water in a jacket surrounding the cylinder absorbs heat from the air at the rate of 60 kJ/s. Calculate : (i) The power required to drive the compressor ;
(ii) The inlet and output pipe cross-sectional areas.

5. . A turbine, operating under steady-flow conditions, receives 4500 kg of steam per hour. The steam enters the turbine at a velocity of 2800 m/min, an elevation of 5.5 m and a specific enthalpy of 2800 kJ/kg. It leaves the turbine at a velocity of 5600 m/min, an elevation of 1.5 m and a specific enthalpy of 2300 kJ/kg. Heat losses from the turbine to the surroundings amount to 16000 kJ/h. Determine the power output of the turbine.

6. Steam at 18 bar is throttled to 1 bar and the temperature after throttling is found to be 150°C. Calculate the initial dryness fraction of the steam.
7. An air receiver of volume 5.5 m3 contains air at 16 bar and 42°C. A valve is opened and some air is allowed to blow out to atmosphere. The pressure of the air in the receiver drops rapidly to 12 bar when the valve is then closed. Calculate the mass of air which has left the receiver.
8. A 1.6 m3 tank is filled with air at a pressure of 5 bar and a temperature of 100°C. The air is then let off to the atmosphere through a valve. Assuming no heat transfer, determine the work obtainable by utilizing the kinetic energy of the discharge air to run a frictionless turbine.