

本試題是否可以使用計算機: 可使用, 不可使用 (請命題老師勾選)

1. A tank has a volume of 0.5 m^3 and contains 10 kg of an ideal gas a molecular weight of 24 g/mole . The temperature is $25 \text{ }^\circ\text{C}$. What is the pressure? ($\bar{R} = 8.314 \text{ kJ/kmol K}$) (14%)
2. A vessel having a volume of 0.4 m^3 contains 2.0 kg of a liquid water and water vapor mixture in equilibrium at a pressure of 600 kPa . Calculate (1) the volume and mass of liquid (2) the volume and mass of vapor. (from table of saturated water, $v_f = 0.001101 \text{ m}^3/\text{kg}$ and $v_g = 0.3157 \text{ m}^3/\text{kg}$ for pressure 600 kPa) (24%)
3. In a reversible process, nitrogen is compressed in a cylinder from 100 kPa , $20 \text{ }^\circ\text{C}$ to 500 kPa . During this compression process the relation between pressure and volume is $PV^{1.3} = \text{constant}$. (1) Calculate the work and heat transfer per kilogram (24%), and (2) show this process on P-V and T-S diagrams (8%). (nitrogen : $R = 0.2968 \text{ kJ/kg K}$ and $C_v = 0.7448 \text{ kJ/kg K}$)
4. Let us consider the heat engine, schematically shown in Figure 1, that receives a heat transfer rate of 1 MW at a high temperature of $550 \text{ }^\circ\text{C}$ and rejects energy to the ambient at 300 K . Work is produced at a rate of 450 kW . (1) How much energy is discarded to the ambient and what is the engine efficiency? (12%) and (2) Compare both of these to a Carnot heat engine operating between the same two reservoirs (18%).

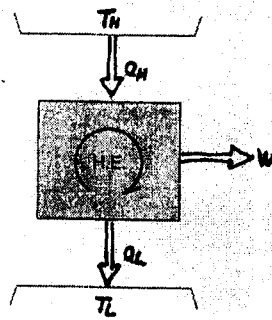


Figure 1