1. A gas you are studying can be described by the following EoS:

$$Z = 2 + 3P = PV/RT$$

Using Maxwell's equations and equation 6.31, express $\left(\frac{\partial G}{\partial V}\right)_T$ in terms of P, V, R, and T.

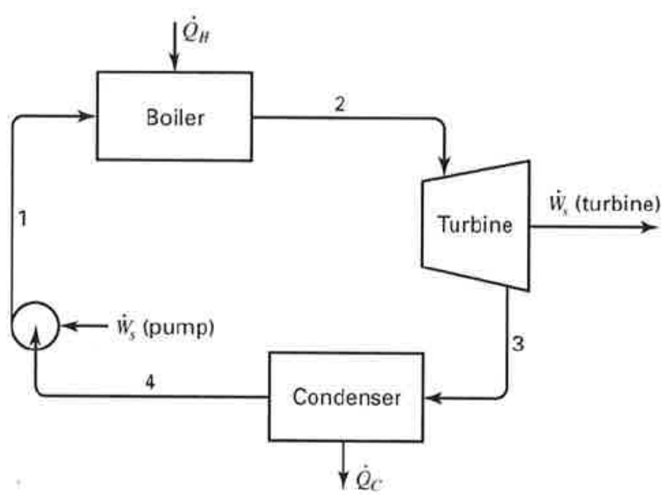
2. Derive expressions for V^R, H^R, S^R, and G^R of a gas undergoing an isothermal pressure change using the following EOS:

$$\frac{P}{RT} = \frac{1}{V} + \frac{AP_R}{VT_R}$$

Would methanol or ethanol behave more like an ideal gas?

3. A heat exchanger using cooling water produces steam at 2600 kPa and 723.15 K. The engineer decides to send the steam to a turbine running adiabatically. The turbine has an estimated power level of 3800 kW. The steam is exhausted from the turbine as a saturated vapor at 30 kPa. At what rate is steam flowing through the turbine, what is the efficiency? (Use Appendix F for steam properties).

4. Steam from a power plant is fed to a turbine operating adiabatically. The exhaust from the turbine is condensed to a saturated liquid, which is then pumped to the boiler. You are given that $P_2 = 8000$ kPa, $T_2 = 400$ ˚C, $T_4 = 100$ ˚C. Assume the pump operates reversibly, and that kinetic and potential energy changes are negligible.



From the data given above, determine the following:

a) What is the thermal efficiency for the Rankine cycle?
b) What is the thermal efficiency of a practical cycle with a turbine efficiency of 0.75?
c) What is the quality of the turbine exhaust for the Rankine and practical cycle?

5. The contents of the freezer in a home refrigerator are maintained at -20°C. If heat leaks amount to 120,000 kJ per day, and the cost of electricity is \$0.08/kWh, estimate the yearly cost of running the refrigerator. Assume a coefficient of performance equal to 60% of the Carnot value.