Hints for exam 2012-01-16

1 Leaking container

Corrected 2019-01-03: I now get

$$\tau = \frac{2V}{A}\sqrt{\frac{m}{k_B T}},$$

just as in the "Answers".

2 Einstein solids

3 Entropy and energy

Straightforward if one uses

$$C_V = \left(\frac{\partial U}{\partial T}\right)_V, \quad C_V = T\left(\frac{\partial S}{\partial T}\right)_V.$$

to determine U and S.

4 Efficiency

Hint: Note that the efficiency is expressed in terms of Q_h and Q_c. There is thus no need to consider the adiabatic process in any greater detail.

5 Dieterici equation of state

Determine the solutions to

$$\left(\frac{\partial P}{\partial V}\right)_T = 0, \quad \left(\frac{\partial^2 P}{\partial V^2}\right) = 0.$$

Just terrible algebra!