Thermal Physics, Autumn 2016 CMI

Problem set 5

Due by the beginning of lecture on Monday, Oct 3, 2016

Maxwell relations, Energy equation

1. ⟨**7**⟩ We used the exactness of $\delta Q/T$ to derive the Maxwell relation

$$\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial p}{\partial S}\right)_V . \tag{1}$$

Now use the triple product identity and rules for partial differentiation to convert this into a different Maxwell relation

$$\left(\frac{\partial T}{\partial p}\right)_S = \left(\frac{\partial V}{\partial S}\right)_p . \tag{2}$$

Hint: On the LHS of (1) regard T as a function of p and S. And use an appropriate triple product identity on the RHS.

2. ⟨**7**⟩ We derived the (T, V) form of the energy equation in the class. Here derive the (p, T) form. Then specialize to a gas satisfying the ideal EOS $pV = nRT$ and comment on what the energy equation implies.