

1.1 Show that in a reversible process for a system described by  $T$  and  $P$  as natural thermodynamic variables

$$TdS = C_p dT - T\left(\frac{\partial V}{\partial T}\right)_P dP$$

1.2 Find the equations governing an adiabatic (constant  $S$ ) transformation of an ideal gas.

1.3 Problem 1.4 of Huang

1.4 A substance has the following properties

(i) At a constant temperature  $T_o$  the work done by it on expansion from volume  $V_o$  to  $V$  is

$$W = RT_o \log (V/V_o)$$

Where  $R$  is a constant.

(ii) The entropy as a function of  $T$  and  $V$  is given by

$$S = R (V/V_o)(T/T_o)^a$$

Where  $V_o$ ,  $T_o$ , and  $a$  are constants

- (a) Calculate the Helmholtz free energy
- (b) Find the equation of state
- (c) Find the work done at an arbitrary constant temperature  $T$