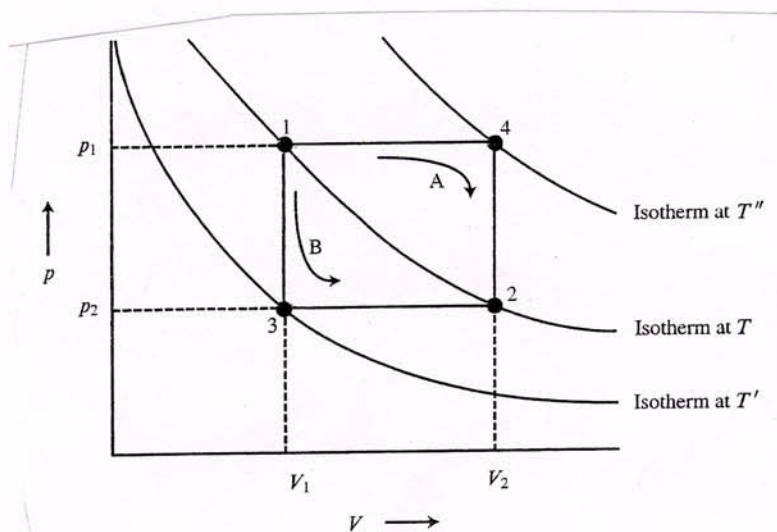


**Problem Set 2**

Due date: October 22, 2007

**Problem 5)**

The cycle as given below was established for a perfect gas. Make use of this cycle in order to demonstrate that  $dq$  is not an exact differential and that  $q$  is not a state function.  
 (4 points)



**Problem 6)**

Derive the following thermodynamic equation of state:

$$\left(\frac{\partial H}{\partial p}\right)_T = V - T\left(\frac{\partial V}{\partial T}\right)_p$$

and derive an expression for  $\left(\frac{\partial H}{\partial p}\right)_T$ : a) for a perfect gas and b) for a *van der Waals* gas.

(4 points)

**Problem 7)**

A ball of zinc of mass 7.000 g is dropped into a beaker of dilute hydrochloric acid. Calculate the work done by the system as a result of the reaction that takes place. The atmospheric pressure in the laboratory is 1013 mbar and the temperature is 20.0 °C.

(2 points)

**Problem 8)**

The fullerenes have attracted the attention of many researchers. The standard enthalpy of combustion and of formation of crystalline C<sub>60</sub> was reported based on calorimetric measurements. In one experimental run, a standard specific internal energy of combustion of -36.0334 kJ/g at 298.150 K was found. Calculate the standard enthalpies of combustion and of formation,  $\Delta_c H^\circ$  and  $\Delta_f H^\circ$ , respectively.

(3 points)