2nd-HOMEWORK

1. Describe the following concepts(do not use equations, use words)

   Carnot Cycle

   Fermi-Dirac distribution

   Bose Einstein Distribution

   Nernst Theorem

2. Using Nernst therom, show that

$$\lim_{T \to 0} \frac{C_P - C_V}{C_V} = 0 \tag{1}$$

3. Fow a Carnot Engine that uses the ideal gas as the working substance, and has the given PV diagram shown in Fig. (1), calculate its efficience. (The cycle goes from $a \to b \to c \to a$) (*Hint:* As the engine goes from the point c to the point a, in a fraction of it, it absorbes heat, in the other fraction, it emits heat.)
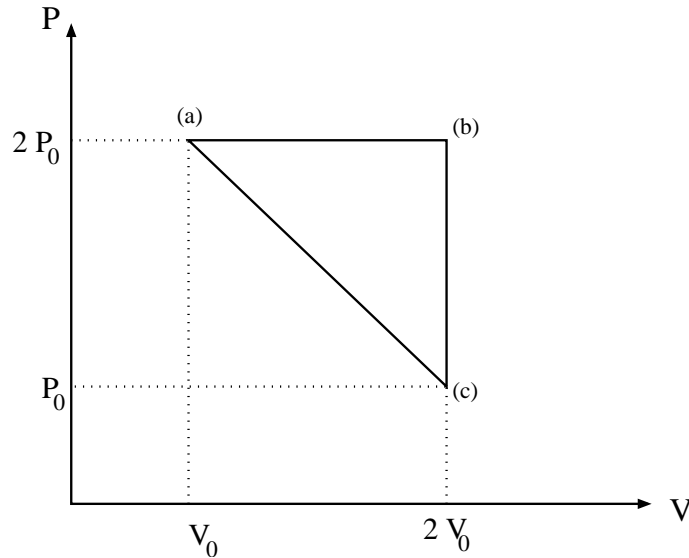

Figure 1: PV diagram for Q3

4. Consider a heat bath at temperature T_1 and another substance that is initially at the temperature $T_2 < T_1$. What is the maximum work that can be obtained as heat is tranfered from the heat bath to the

1

substance if the substance has a heat capacity C? (*Hint:* Imagine a Carnot engine running between the two system such that at each step, it absorbs an infinitesimal amount of heat, so the temperature of the system can be considered constant)