

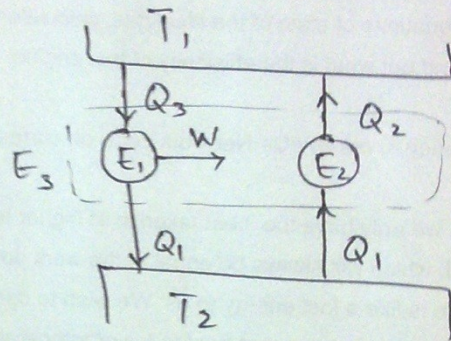
Recitation 3 Solution

Q.1

Let's prove this by contradiction. We assume that Clausius holds and Kelvin does not. Let's consider the following arrangement of two engines E_1 and E_2 . Both obey Clausius but not Kelvin.

$$T_1 > T_2$$

E_1 is doing a work W / cycle and rejecting some heat Q_1 to the reservoir.



E_2 is an engine which takes in heat from colder reservoir and gives off heat to hotter reservoir. The reason I can do this is that Kelvin does not hold.

We choose an E_2 which takes the same heat out of T_2 reservoir as given in by E_1 , i.e. Q . I also know that $Q_2 = Q_1$ just by first law. Now I consider the two engines as one engine E_3 .

$$\text{Heat taken in by } E_3 = Q_3 - Q_2 = Q_3 - Q_1$$

$$\text{Work done by } E_3 = W + 0 = W$$

$$\text{Heat Rejected by } E_3 = Q_1 - Q_1 = 0$$

Clearly this E_3 violates Clausius's Statement. This means that if Clausius holds, Kelvin should also hold.

Recitation 3 Solution

Q. 2 and 3

To see solutions to these Qs
just look @ assignment #2 solutions
both of them are given there.