Chapter 19   Problem 26 [†]

Given

$T_H = 570\ K$
$T_w = 0°C = 273\ K$
$T_s = 25°C = 298\ K$

Solution

Find the maximum efficiencies in the summer and the winter.

Using the reversible process the Carnot cycle we have a summer efficiency of

$$e = 1 - \frac{T_C}{T_H} = 1 - \frac{298K}{570K}$$

$$e = 0.477 \text{ or } 47.7\% \text{ efficient}$$

For the winter the maximum efficiency is

$$e = 1 - \frac{T_C}{T_H} = 1 - \frac{273K}{570K}$$

$$e = 0.521 \text{ or } 52.1\% \text{ efficient}$$

The power plant may not reach these efficiencies because we are dealing with an irreversible process and there will be other inefficiencies in the heat engine itself such as friction, etc.

[†] Problem from Essential University Physics, Wolfson