Chapter 6 Question #9

Frequently we model turbines as being adiabatic and quasi static and neglect changes in kinetic and potential energy. For such a device operating with air as an ideal gas (R=287 J/kg-K, c_v=716.5 J/kg-K, c_p=1003.5 J/kg-K) which of the following is true?

1) $W > W_{shaft} > 0 > W_{flow}$

2) $W_{shaft} > W > 0 > W_{flow}$

3) $W_{shaft} > W > W_{flow} > 0$

4) $W > W_{shaft} > W_{flow} > 0$

5) I don't know

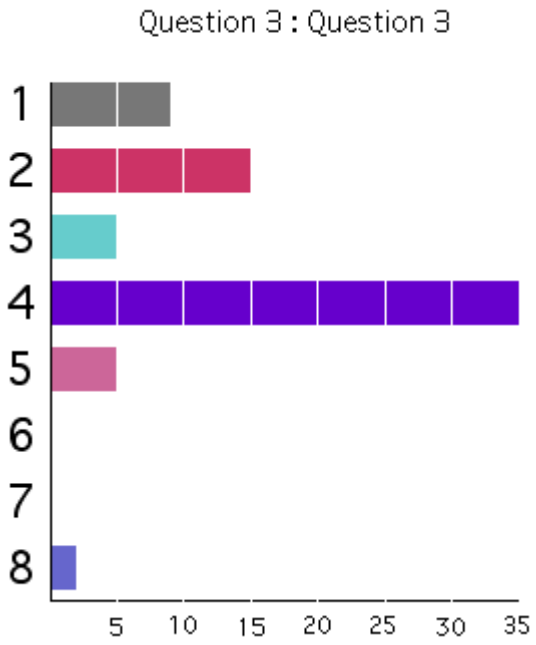
LO#4

Chapter 6 Question 9 Answer:

(2) $w_s > w > 0 > w_f$

For an adiabatic turbine $w_s = -c_p(\Delta T)$, $w = -c_v(\Delta T)$, and $w_f = R(\Delta T)$, and $\Delta T < 0$. For air, $c_p > c_v > R$. Therefore $w_s > w > 0 > w_f$. This illustrates an important point regarding shaft work and flow work. For a steady flow device, what you would like to design to is the work that comes out of the shaft. If you calculate the total work (w), you will get a different answer.

Class Response (2003):



Class Response (2002):