

37.37 An uninsulated hot water pipe runs horizontally through a room. The water entering the pipe is $130^\circ F$. Where the pipe leaves the room, the water temperature is $110^\circ F$. The room temperature is $70^\circ F$. What is the film temperature?

- A. $90^\circ F$
- B. $95^\circ F$
- C. $100^\circ F$
- D. $120^\circ F$

The **Film Temperature** of a tube is the average of the bulk temperature of the ambient space, T_∞ , and the average surface temperature, T_s . Note this represents the mean boundary layer condition i.e. film condition, for which the coefficient of heat transfer may be specified, if needed.

In this case only the film temperature needs to be calculated. Since the pipe is uninsulated, assume the surface temperature is the same as the hot water temperature, which is the average of the entering and leaving hot water temperature:

$$T_s = \frac{T_e + T_l}{2} = \frac{130^\circ F + 110^\circ F}{2} = 120^\circ F$$

Calculate the film temperature:

$$T_f = \frac{T_s + T_\infty}{2} = \frac{120^\circ F + 70^\circ F}{2} = 95^\circ F$$

Answer B