PROBLEM 6.37

KNOWN: Air, water, engine oil or mercury at 300K in laminar, parallel flow over a flat plate.

FIND: Sketch of velocity and thermal boundary layer thickness.

ASSUMPTIONS: (1) Laminar flow.
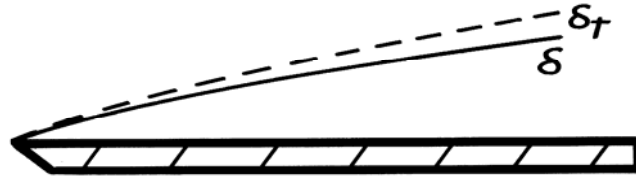
PROPERTIES: For the fluids at 300K:

Fluid	Table	Pr
Air	A.4	0.71
Water	A.6	5.83
Engine Oil	A.5	6400
Mercury	A.5	0.025

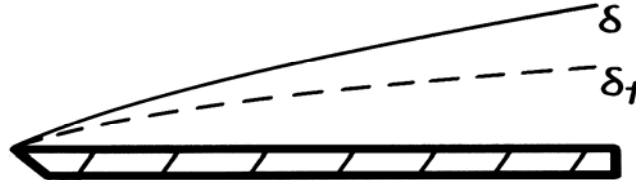**ANALYSIS:** For laminar, boundary layer flow over a flat plate.

$$\frac{\delta}{\delta_t} \sim Pr^n$$

where $n > 0$. Hence, the boundary layers appear as shown below.

Air:
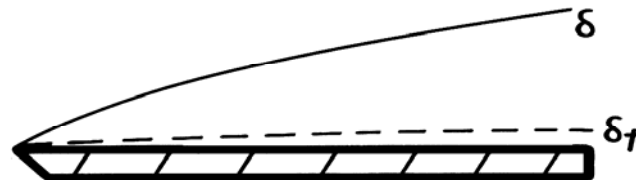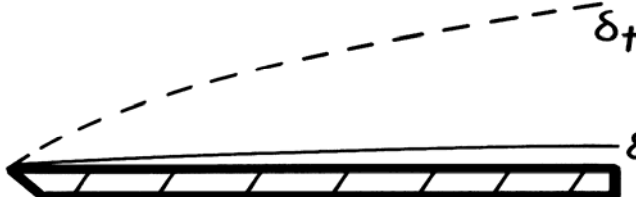

Water:

Engine Oil:

Mercury:

COMMENTS: Although Pr strongly influences relative boundary layer development in laminar flow, its influence is weak for turbulent flow.