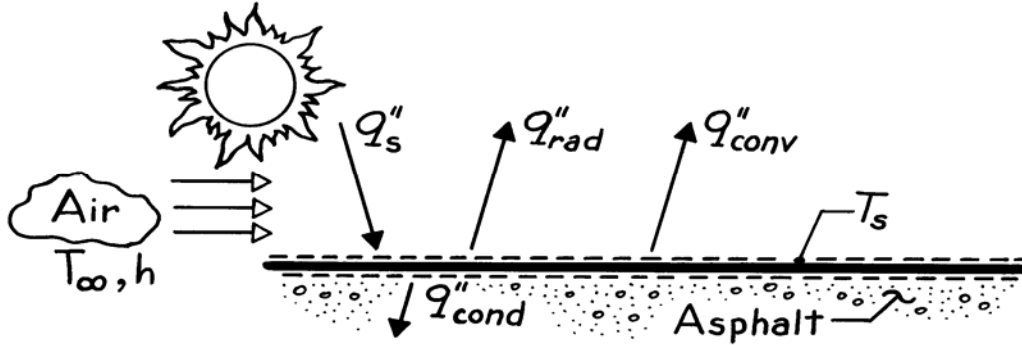# PROBLEM 1.86(a)

KNOWN: Solar radiation is incident on an asphalt paving.

FIND: Relevant heat transfer processes.

SCHEMATIC:

The relevant processes shown on the schematic include:

q_S'' Incident solar radiation, a large portion of which $q_{S,abs}''$, is absorbed by the asphalt surface,

q_{rad}'' Radiation emitted by the surface to the air,

q_{conv}'' Convection heat transfer from the surface to the air, and

q_{cond}'' Conduction heat transfer from the surface into the asphalt.

Applying the surface energy balance, Eq. 1.13,

$$q_{S,abs}'' - q_{rad}'' - q_{conv}'' = q_{cond}''.$$

COMMENTS: (1) q_{cond}'' and q_{conv}'' could be evaluated from Eqs. 1.1 and 1.3, respectively.

(2) It has been assumed that the pavement surface temperature is higher than that of the underlying pavement and the air, in which case heat transfer by conduction and convection are from the surface.

(3) For simplicity, radiation incident on the pavement due to atmospheric emission has been ignored (see Section 12.8 for a discussion). Eq. 1.6 may then be used for the absorbed solar irradiation and Eq. 1.5 may be used to obtain the emitted radiation q_{rad}''.

(4) With the rate equations, the energy balance becomes

$$q_{S,abs}'' - \varepsilon\, \sigma\, T_s^4 - h\left(T_s - T_\infty\right) = -k\,\left.\frac{dT}{dx}\right|_s.$$