1.Show that for isentropic flow of a perfect gas if a pitotstatic probe measures p0, p, and T0, the gas velocity can be calculated from:

$$V^2 = 2C_pT_0\left[1-\left(\frac{P}{P_0}\right)^{(k-1)/k}\right]$$

What would be a source of error if a shock wave were formed in front of the probe?

2. Air flows steadily from a reservoir at 20°C through a nozzle of exit area 20 cm2 and strikes a vertical plate as in Fig.1. The flow is subsonic throughout. A force of 135 N is required to hold the plate stationary. Compute (a) Ve, (b) Mae, and (c) p0 if pa = 101kPa.

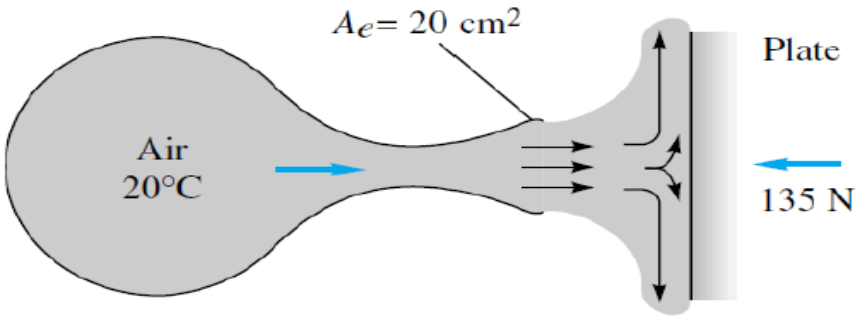


Fig.1

3.A bend in the bottom of a supersonic duct flow induces a shock wave which reflects from the upper wall, as in Fig.2. Compute the Mach number and pressure in region 3.

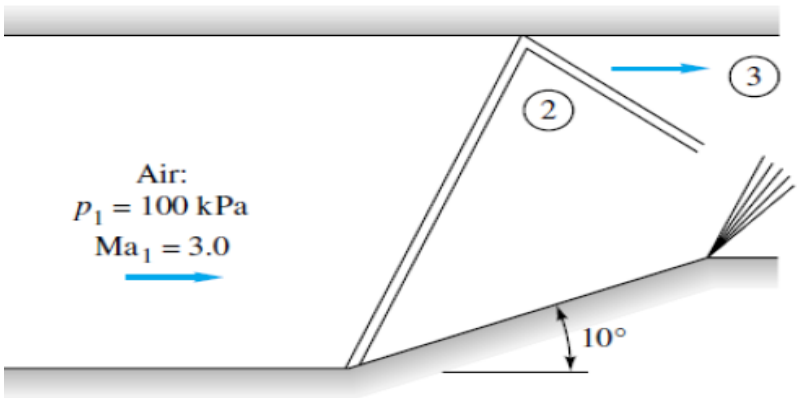
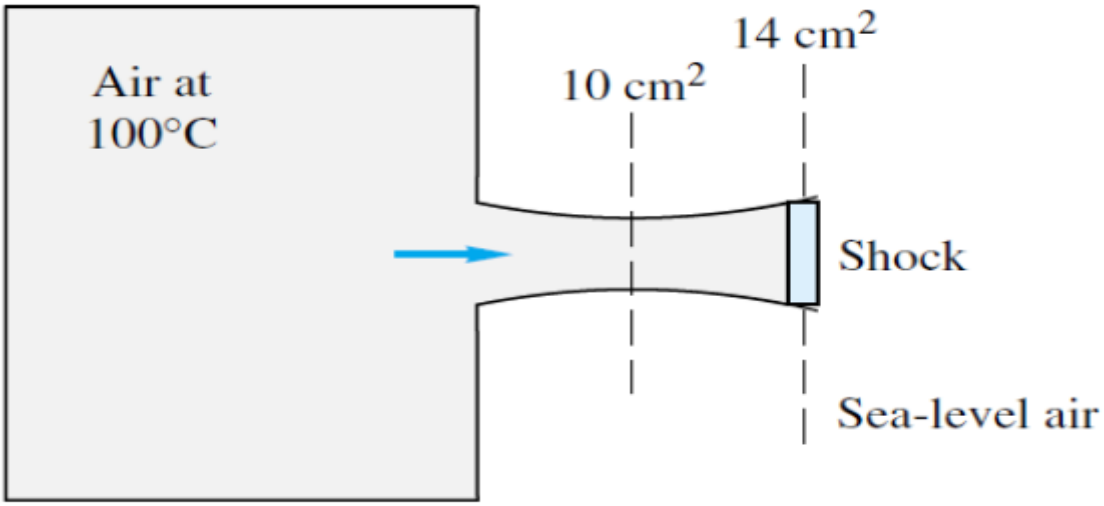


Fig.2

4.Air flows from a tank through a nozzle into the standard atmosphere, as in Fig.3. A normal shock stands in the exit of the nozzle, as shown. Estimate (a) the pressure in the tank and (b) the mass flow.



5.Air flows through a duct as in Fig.4, where A1 = 24 cm2, A2 = 18 cm2, and A3 = 32 cm2. A normal shock stands at section 2. Compute (a) the mass flow, (b) the Mach number, and (c) the stagnation pressure at section 3.