

AE 3450 Thermodynamics and Compressible Flow
Assignment # 6

Note: Please show your work.

(Note: unless otherwise stated, assume all gases are ideal with constant γ , and that all flow are one-dimensional.)

1) A wind tunnel is used to (isentropically) expand air from a pressure of 125 kPa and a temperature of 100 °C to a pressure of 80 kPa. The speed of the airflow at the exit is 325 m/s. Find: a) the exit temperature, b) the exit Mach number, c) the inlet stagnation temperature, d) the exit stagnation pressure, e) the inlet speed, and f) the inlet Mach number.

2) An axisymmetric wind tunnel is being designed for the following conditions:

Test section: Mach number = 4.5, diameter = 15 cm

Nozzle inlet: stagnation press. = 700 kPa, stagnation temp. = 950 K, diam. = 15 cm

Gas: $\gamma = 1.4$, $R = 287 \frac{\text{J}}{\text{kg}\cdot\text{K}}$

Assuming reversible and adiabatic flow, find: a) the throat area, b) T and P in the test section, c) the Mach number at the inlet, and d) the mass flow rate through the wind tunnel.



3) Problem 3 at end of Chapter 3 in John textbook [However, use $A = 0.14 \text{ m}^2$ instead of $A = 0.12 \text{ m}^2$]

4) Problem 5 at end of Chapter 3 in John textbook