IDEAL GAS LAW: EXAMPLE PROBLEM

Consider air enclosed in a cylinder (total height: $H = 2$ m) with stops (stop height: $h = 1$ m) and with a frictionless piston (area: $A = 0.2$ m$^2$). At the initial state, the air is at pressure $P_1 = 200$ kPa and temperature $T_1 = 500$° C.

After cooling, find:
- The temperature of the gas when the piston reaches the stop (state 2)
- The pressure of the gas if the cooling continues to $T = 20$° C (state 3)

**State 1 (initial state)**

![Free-body diagram of piston]

Total volume of air:

Mass of air:
State 2 (piston reaches the stop)

Total volume of air:

Specific volume of air:

Temperature of air:

State 3 (final state)

Pressure of air:
Sketch of \( T-\psi \), \( P-\psi \) and \( P-T \) planes for air-cooling process: