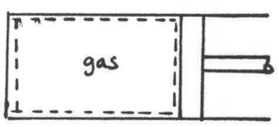
PROBLEM 1.31



Three processes:

- ⊙ 1-2: $pV = \text{constant}$
  $p_1 = 1\,\text{bar}$, $V_1 = 1\,m^3$, $V_2 = 0.2\,m^3$
- ⊙ 2-3 $p = \text{constant}$, $V > V_2$ (expansion), $V_3 = 1.0\,m^3$
- ⊙ 3-1 $V = \text{constant}$

For process 1-2, $pV = \text{constant}$. The constant can be evaluated using data at state 1:

$$pV = \text{constant} = p_1 V_1 = (1\,\text{bar})(1\,m^3) = 1\,\text{bar}\cdot m^3$$

Accordingly, on a pressure-volume plot process 1-2 is described by

$$p = \frac{1\,\text{bar}\cdot m^3}{V}$$

In particular, when $V_2 = 0.2\,m^3$, $p = 5\,\text{bar}$.

Sketching the processes in series,