

4. A certain mass of an ideal gas for which $C_V = 3R/2$, independent of temperature, is taken *reversibly* from $\theta = 100$ K, $p = 10^5$ Pa to $\theta = 400$ K, $p = 8 \times 10^5$ Pa by two different paths (1) and (2):
- (1) consisting of (a) at constant volume from $\theta = 100 \rightarrow 400$ K, (b) isothermally to the final pressure
 - (2) consisting of (a) at constant pressure from $\theta = 100 \rightarrow 400$ K, (b) isothermally to the final volume

Calculate the entropy changes and verify that the total entropy change is the same for both paths. Compare this with the heat absorbed or given out for each of paths (1) and (2) – they even turn out to be of opposite sign.

[hint: use the ideal gas law and the fact that for a constant volume process,

$$\delta Q = C_V d\theta ; \text{ also, use Eqn. 4.2.13, the fact that } Q_{\text{rev}} = \int_{S_1}^{S_2} \theta dS , \text{ and the result of Q.8}$$

from section 4.1]