[tex1] Entropy change caused by expanding ideal gas

Consider the amount $n = 1$ mol of a classical ideal gas in a box of volume $V_1$ with heat-conducting walls. The gas is described by the equation of state $pV = nRT$ and the internal energy $U = C_V T$ with $C_V = \text{const}$. Now we let the gas expand to the volume $V_2 = 2V_1$ via two different processes:

(a) by quasi-static isothermal expansion;
(b) by leakage through a hole in one wall.

Calculate the change in entropy $\Delta S_G$ of the gas and $\Delta S_E$ of the environment during each process. Express the results in SI units.

Solution: