# Combining the first and second laws of thermodynamics

- **Before watching this video** look up what we mean by the word phase when we use it in thermodynamics and write an explanation?

- **Before watching this video** explain what we can say about the values of the thermodynamic variables in two phases that are in contact.

- Write an expression that relates $dE$ to $T$, $P$, $dS$ and $dV$.

- Write an expression for the change in internal energy if the number of atoms in the system changes by an amount $\Delta N$. Throughout the transition the entropy of the system and the volume are kept fixed.

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- Write an expression for the change in internal energy if the magnetisation changes by an amount $\Delta M$. Throughout the transition you can assume that the entropy, the number of atoms and the volume are kept fixed.

- Explain why, in the part of the video where I illustrate the two phases separated by a diathermal wall, $\mathrm{d}S_1 = -\mathrm{d}S_2$

- Complete the following sentence: If two phases can exchange some extensive quantity...

- Explain in your own words why the minimum energy compatible with a given value of the entropy is equivalent to the maximum entropy for a given value of the energy