

AMA4004 Statistical mechanics: Adsorption

In order to do this exercise you will need to work through the following topics:

- http://gtribello.github.io/mathNET/CANONICAL_ENSEMBLE.html
- http://gtribello.github.io/mathNET/GRAND_CANONICAL_ENSEMBLE.html
- <http://gtribello.github.io/mathNET/ADSORPTION.html>

The Haber process is the industrial process that is used to make the majority of the ammonia that is used in fertilizers and explosives. In one of the steps in this process iron is used as a heterogeneous catalyst and to speed up the rate of reaction of the nitrogen and hydrogen gases. Write an essay that explains the derivation of a model that can be used to describe the adsorption of these gases on the iron catalyst. Within your essay you should:

1. Discuss what a heterogeneous catalyst is and how a heterogeneous catalyst differs from a homogeneous catalyst.
2. Discuss the derivation of the Langmuir adsorption isotherm, plot the isotherm for various values of the temperature and discuss the approximations and limitations of this model
3. **(Hard)** Generalize the Langmuir adsorption isotherm and hence obtain a model that can be used to describe the adsorption of two different gases on a solid surface.