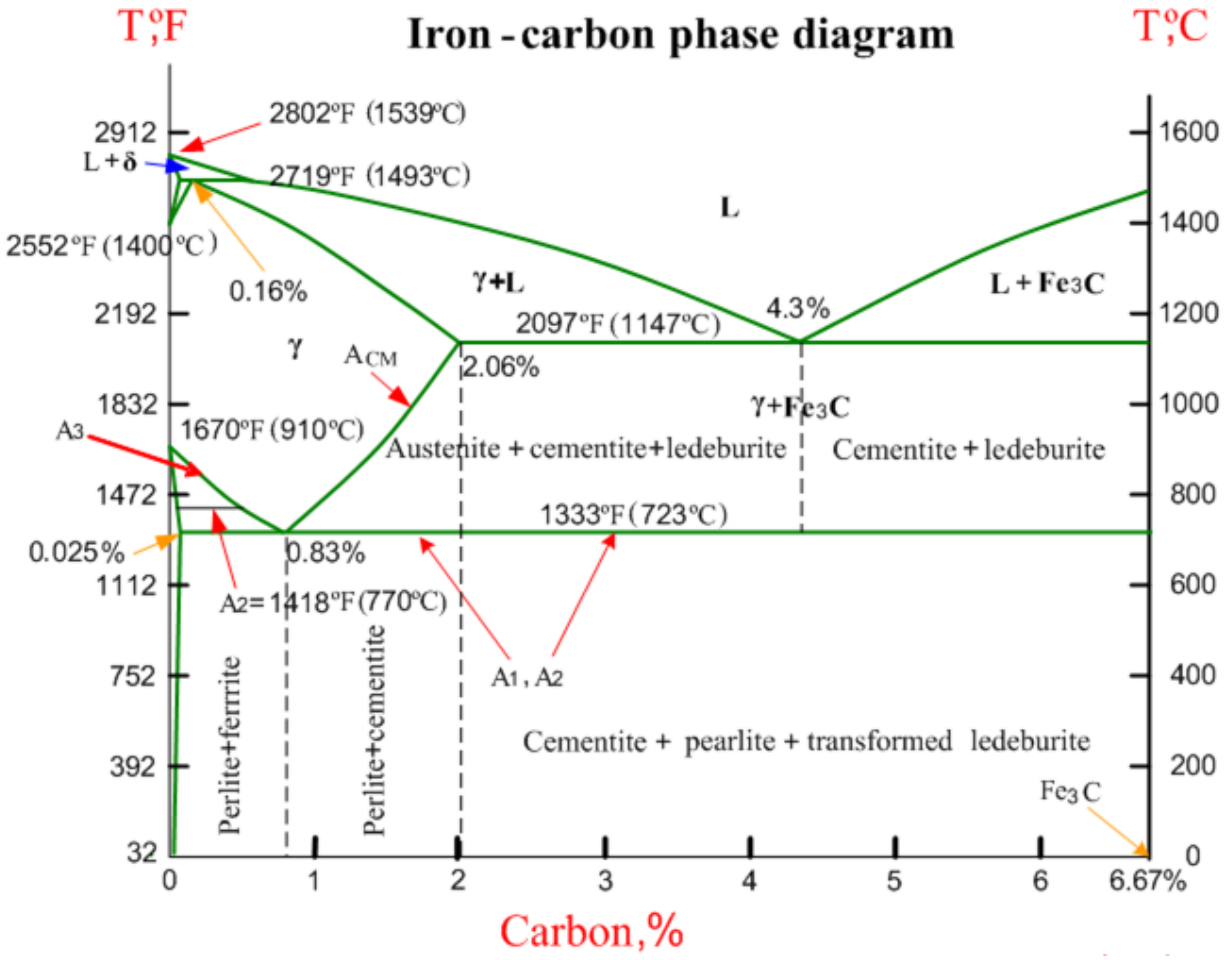
Subject: MATERIALS
Degree: GRADO en INGENIERÍA MECÁNICA. 2nd Grade

IRON – CARBON ALLOYS

1. Considering the following Fe – C diagram:



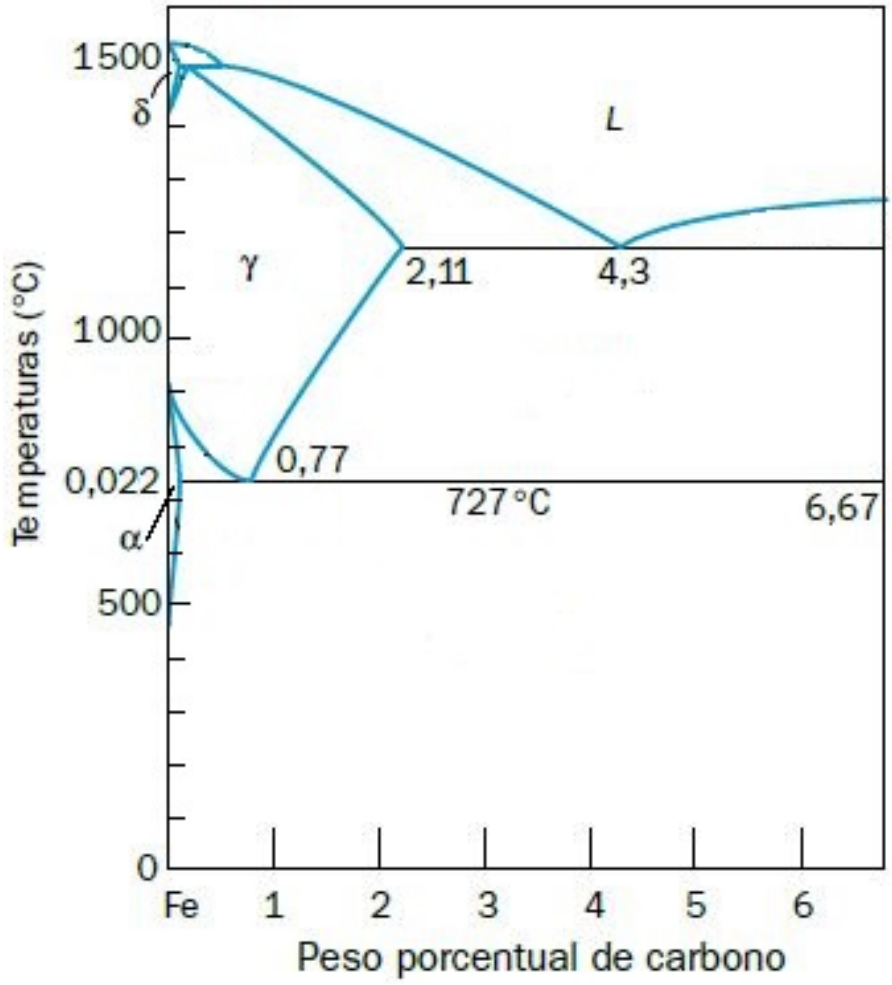
a) Determine the percentages of total perlite, proeutectoid ferrite, proeutectoid cementite, eutectoid ferrrite and total cementite in a hipoeutectoid Steel containing 0.4% of Carbon, just immediately under the eutectoid temperature and at room temperature.

b) Indicate the triple points, pointing theis coordenates of temperatura and composition.

c) Determine the carbón content of an hipereutectoid Steel that has 85% of perlite and 15% of proeutectoid cementite.

d) Draw an schematic of the microstructures of both steels [sections a) and b)] at room temperature.

2. Considering the following Fe – Fe_3C diagram, and knowing the solubility of C en in Fe at room temperature of **0,008%**, determine:



a) Chemical composition of austenite at 800ºC for these three steels:
0,3% C
0.77% C
1.4% C

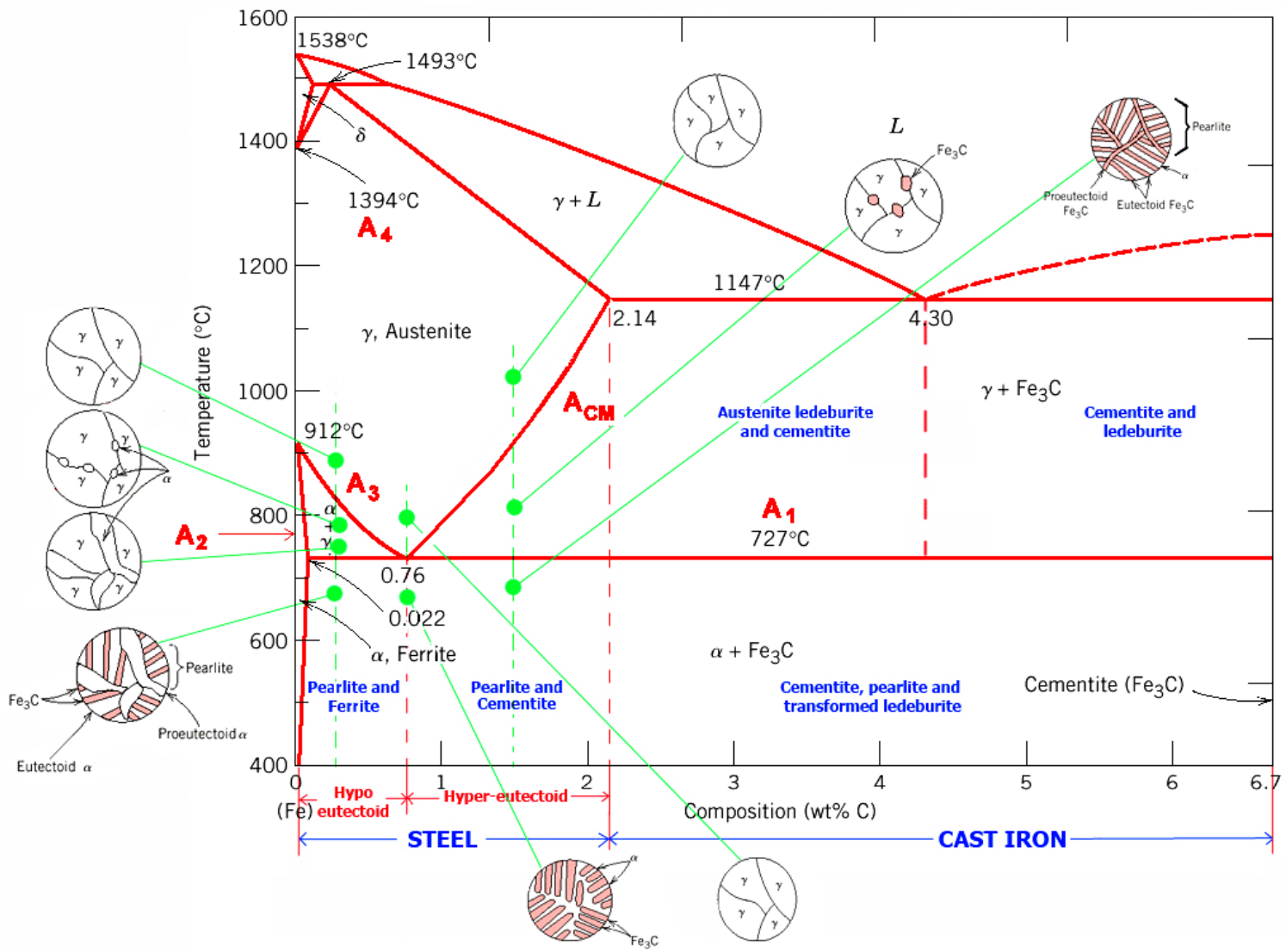
b) Microstructure of the aforementioned three steels (0.3%C, 0.77%C, 1.4%C) at 800ºC and at room temperature.

c) Percentaje of pearlite at room temperature for the three steels (0.3%C, 0.77%C, 1.4%C).

d) A certain steel needs its temperature to be risen up to 1100ºC in order to obtain an structure 100% γ. Determine its phases percentaje at 1000ºC.

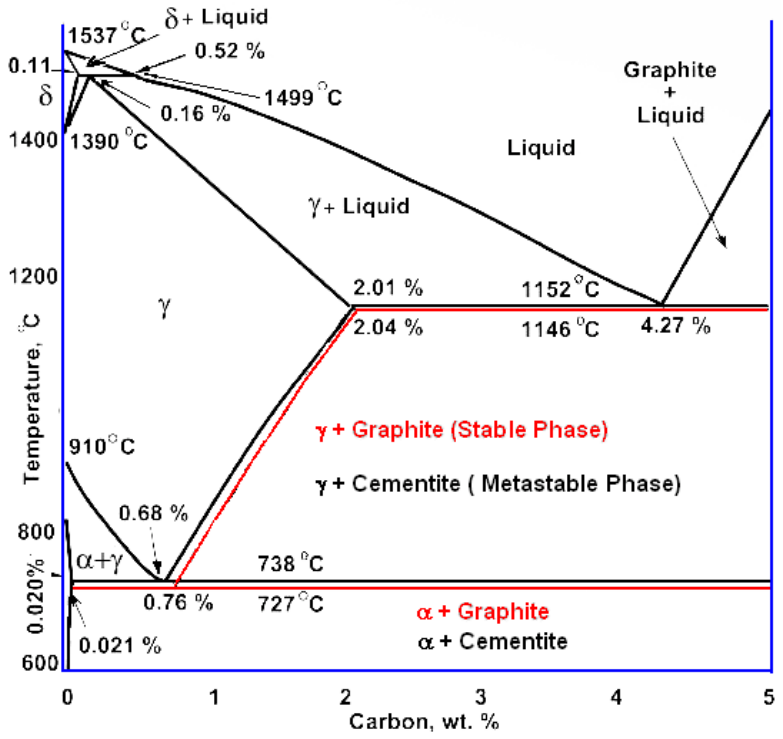
e) If from a ton of this steel (section d) it is intended to obtain an steel that has an structure 100% γ at 1000ºC, ¿what should be done?, ¿add Fe or C?, ¿How many kilos should be added?

f) Carbon content of an hipoeutectoid steel having 40% of pearlite.



Iron-carbon Phase Diagram

- **A_1**: The upper limit of the ferrite / cementite phase field (horizontal line going through the eutectoid point).
- **A_2**: The temperature where iron looses its magnetism (so-called **Curie temperature**). Note that for pure iron this is still in the α-phase.
- **A_3**: The boundary between the γ austenite and the austenite/ ferrite field.
- **A_4**: The point in this case where α changes to δ at high temperatures.
- **A_{CM}**: The boundary between the γ austenite and the austenite / cementite field.



Iron - carbon phase diagram in comparison to the iron cementite phase diagram

Extracted from:
https://www.tf.uni-kiel.de/matwis/amat/iss/kap_6/illustr/s6_1_2.html