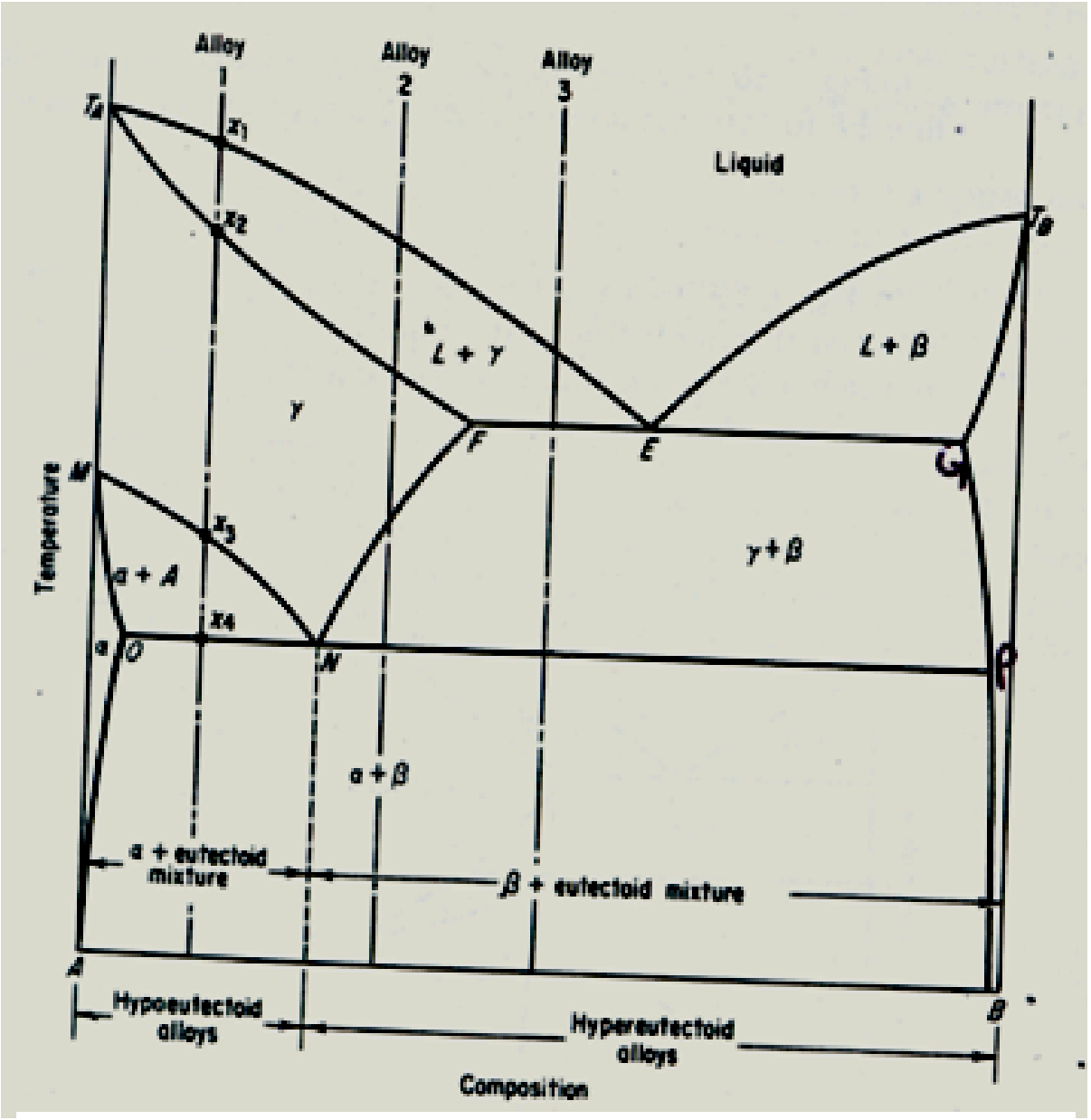


Fig 14: Eutectoid Phase diagram

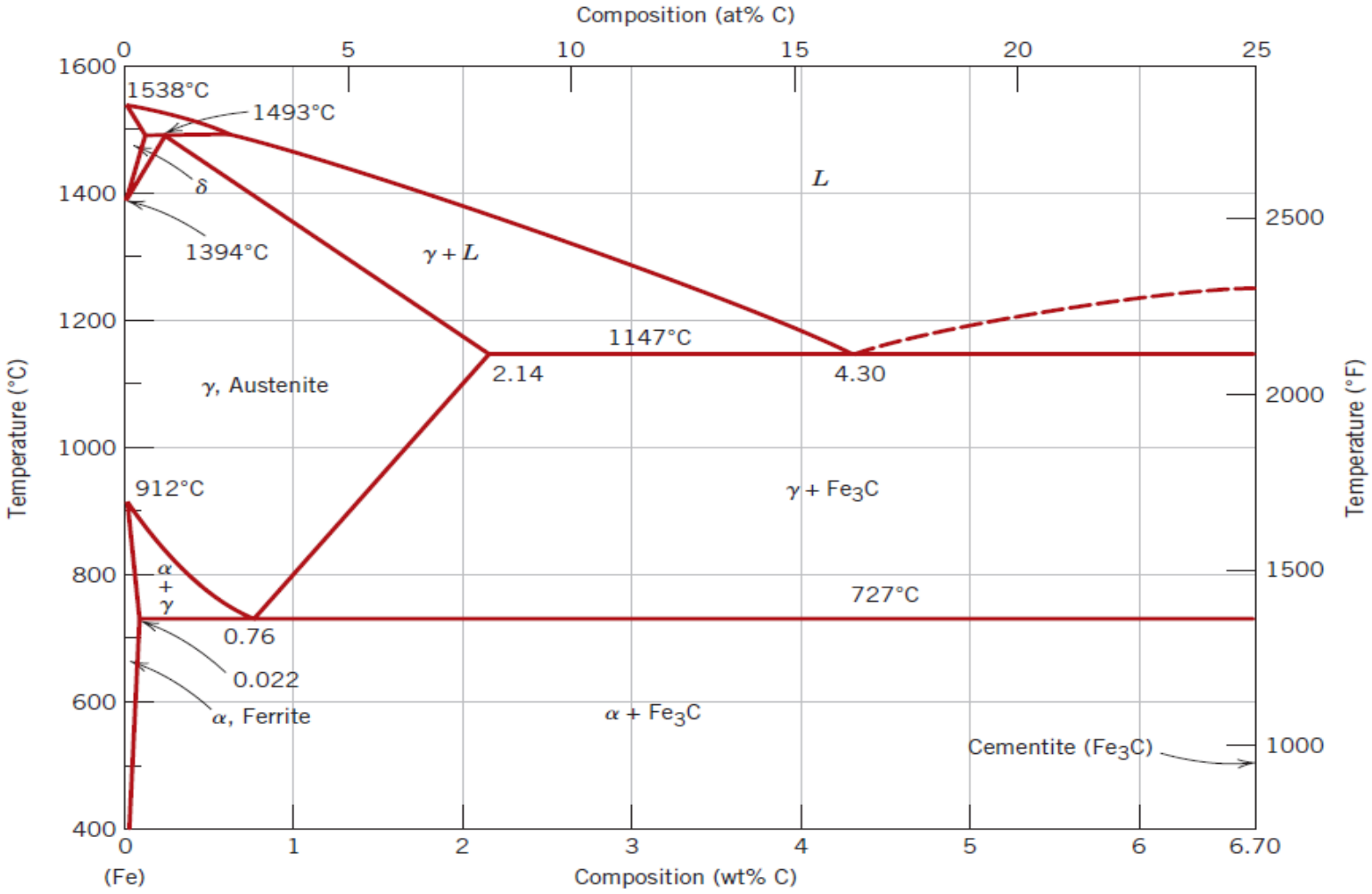


Fig 15: The Fe-Fe_3C Phase diagram
Source: Calister Jr. Pg. 290

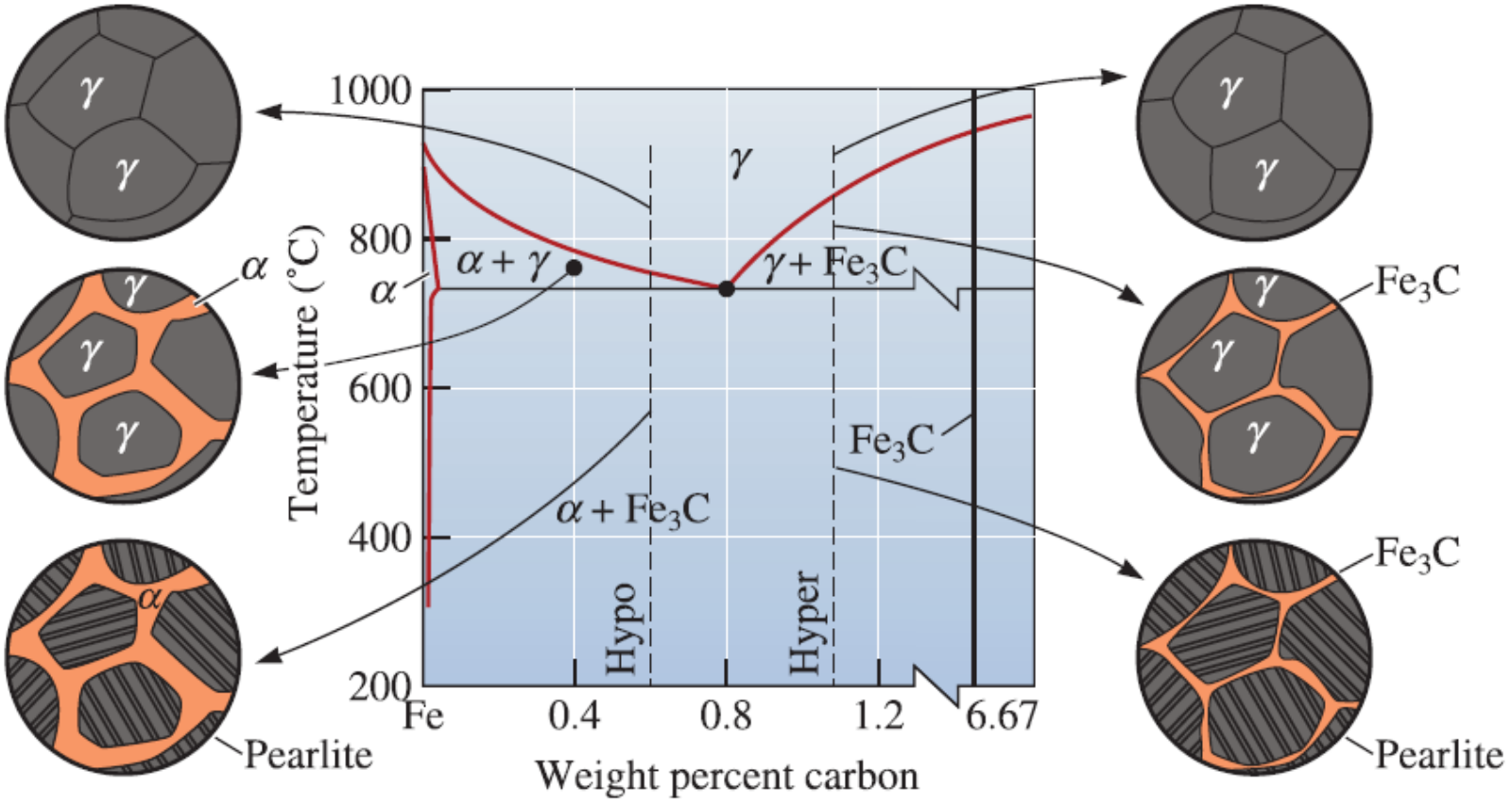


Fig 16: Cooling of Hypo-eutectoid and hypereutectoid steel

Source: Engineering materials by Donald Askeland 6th edition

Fe-Iron Carbide Diagram

- Most important commercial phase diagram
- Basis for **the IRON and STEEL** industries.

Cementite (Fe_3C)

- Consists of 6.67%C

NOTE:(Fe_3C, C=12, Fe=56, Fe_3C=180

hence $C/Fe_3C=12/180$ x100%=**6.67%)**

- Extremely hard, brittle phase of complex crystal structure
- Dissolves in ferrite interstitially
- Is the hardest substance found in the phase diagram

Ferrite (a-Solid solution)

-BCC in structure

-Soft and ductile phase

-- Softest substance in the diagram

-Can contain a maximum of 0.02%C

Austenite (γ-Solid solution)

-Interstitial solid solution of carbon in iron

-FCC in structure

- Slightly harder and less ductile than ferrite

-Can contain a maximum of 2%C

-Unstable at room temperature

Pearlite (0.8%C)

-Eutectoid microstructure

- alternate layers of ferrite and Cementite

-Plate-like (lamellar) mixture of ferrite and Fe_3C

-Hardness and ductility lies between those of ferrite and Cementite

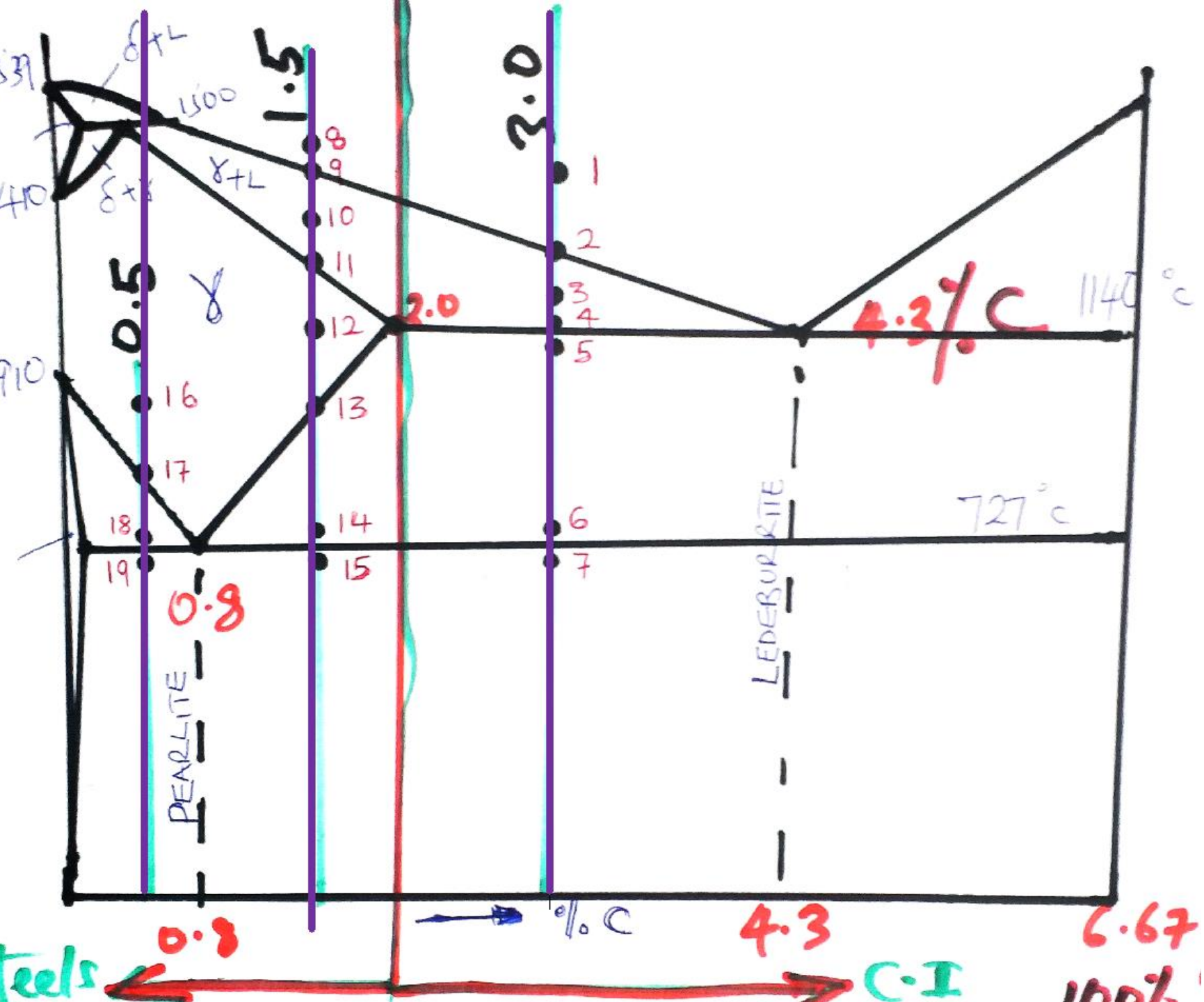
See Fig 16

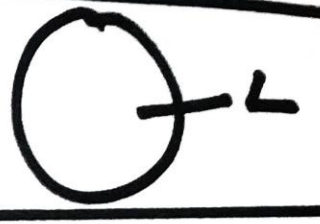
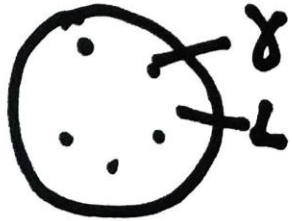
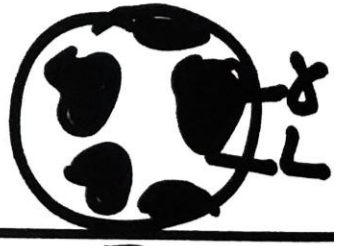
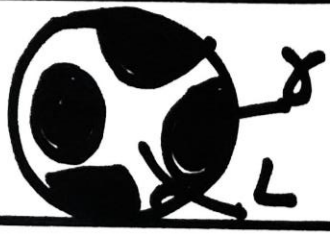
Ledeburrite (4.3 % C)

-Eutectic microstructure

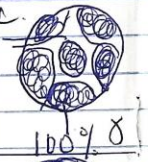
-Occurs in cast irons (> 2%C)

- Colonies of Pearlite in matrix of Cementite


δ+L
1500
1.5
2.0
8
9
10
11
12
13
14
15
1
2
3
4
5
6
7
γ+L
δ+γ
0.5
γ
2.0
4.3% C
1140 °C
727 °C
16
17
18
19
0.8
PEARLITE
LEDEBURITE
% C
0.8
4.3
6.67
Steels
C.I
100%

Point	Phase	Comp	R. A	App. Micro.
1	L	3%C	100%L	
2	L	>3%C	Essentially 100%L	
	γ	~1.3%C	Negligible γ	
3	L	3.6%C	$\frac{3-1.7}{3.6-1.7} \times 100 = 68.4$	
	γ	1.7%C	$= 100 - 68.4 = 31.6$	
4 Just above	Just above L	4.3%C	$\frac{3-2}{4.3-2} \times 100 = 43.4$	
	γ	2.0%C	56.6%	
5 just below				

Line B

Point	Phases	Comp of phases	Relative Amounts	Approx. Sketch
8	L	1.5% C	100% L	
9	L	> 1.5% C	Essentially 100% L	
	γ	~0.75% C	Negligible γ	
10	L	2.2% C	$\frac{1.5-1.1}{2.2-1.1} \times 100 = 36.4\%$	
	γ	1.1% C	$= 63.6\%$	
11	L	< 1.5% C	Negligible L	
	γ	< 1.5% C	Essentially 100% γ	
12	γ	1.5%	100% γ	
13	γ	< 1.5%	Essentially 100% γ	
	Fe_3C	6.67% C	Negligible Fe_3C	
14 Just above Teu	γ	0.8% C	γ = 88.1%	
	Fe_3C	6.67% C	$\frac{1.5-0.8}{6.67-0.8} \times 100 = 11.9\%$	
15 Just below Teu	α	0.02	α = 77.7%	
	Fe_3C	6.67%	$\frac{1.5-0.02}{6.67-0.02} \times 100$ = 22.2%	

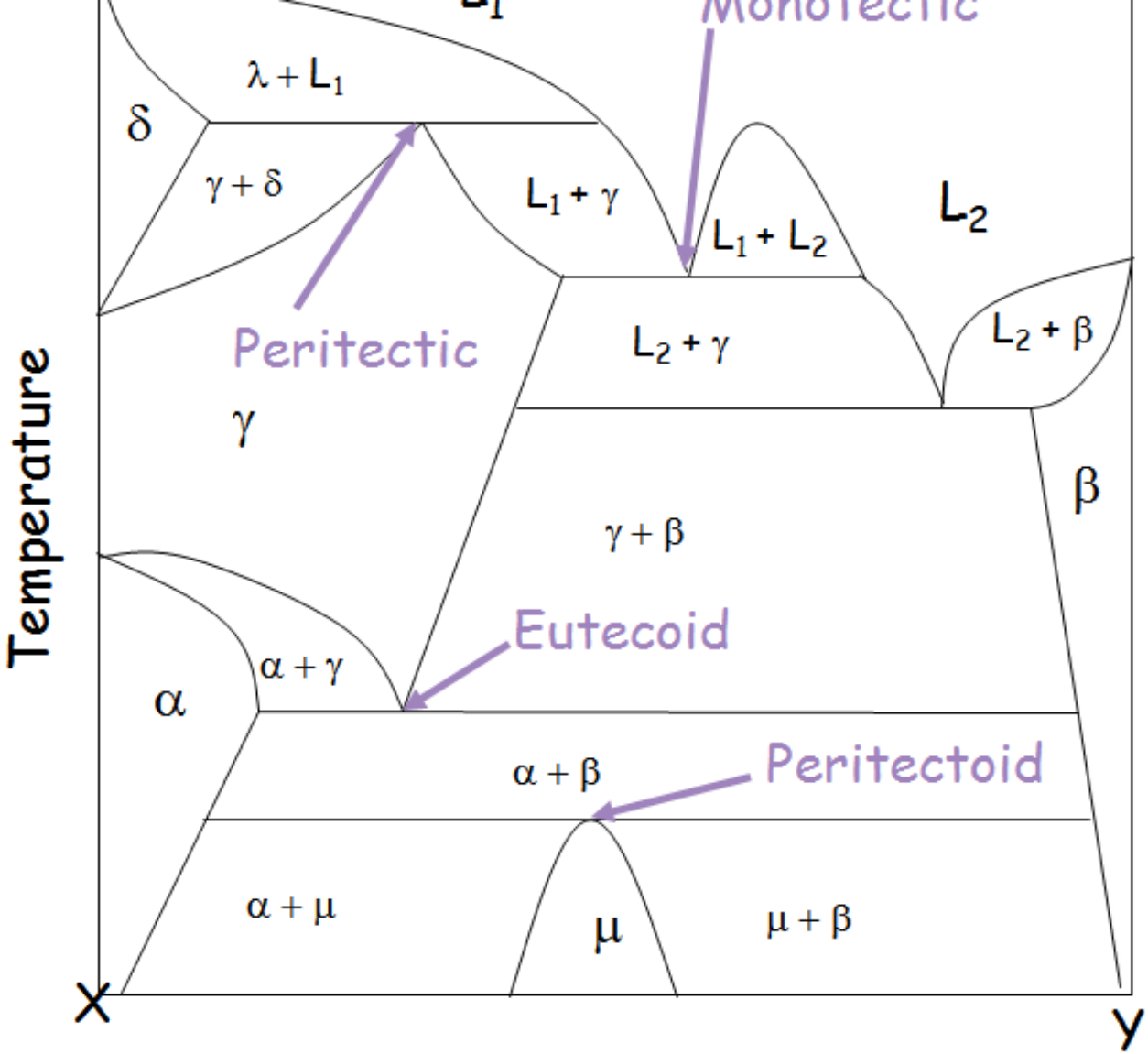


Fig 17: Binary phase diagram with other invariant points

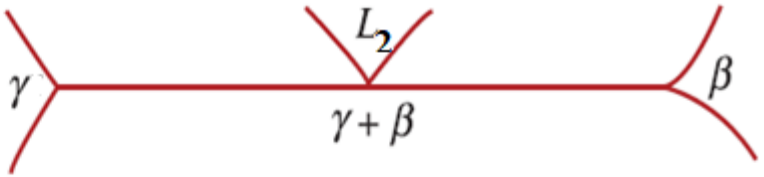
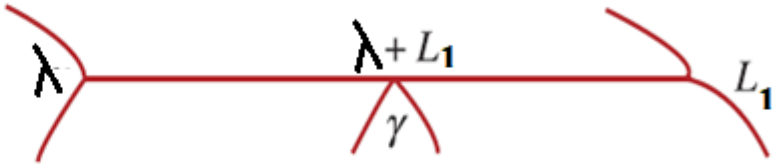
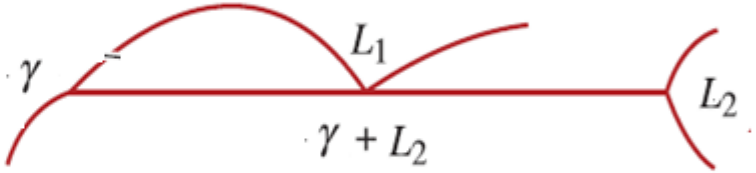
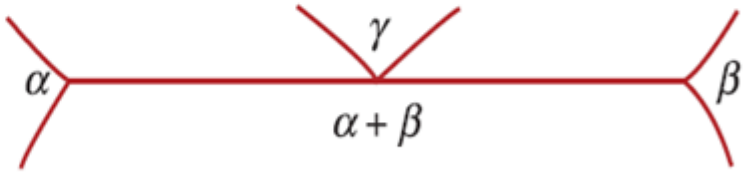
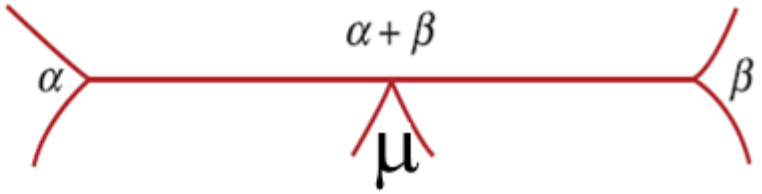
Eutectic	$L_2 \rightarrow \gamma + \beta$	
Peritectic	$\lambda + L_1 \rightarrow \gamma$	
Monotectic	$L_1 \rightarrow \gamma + L_2$	
Eutectoid	$\gamma \rightarrow \alpha + \beta$	
Peritectoid	$\alpha + \beta \rightarrow \mu$	

Fig 18: Diagram showing the invariant points

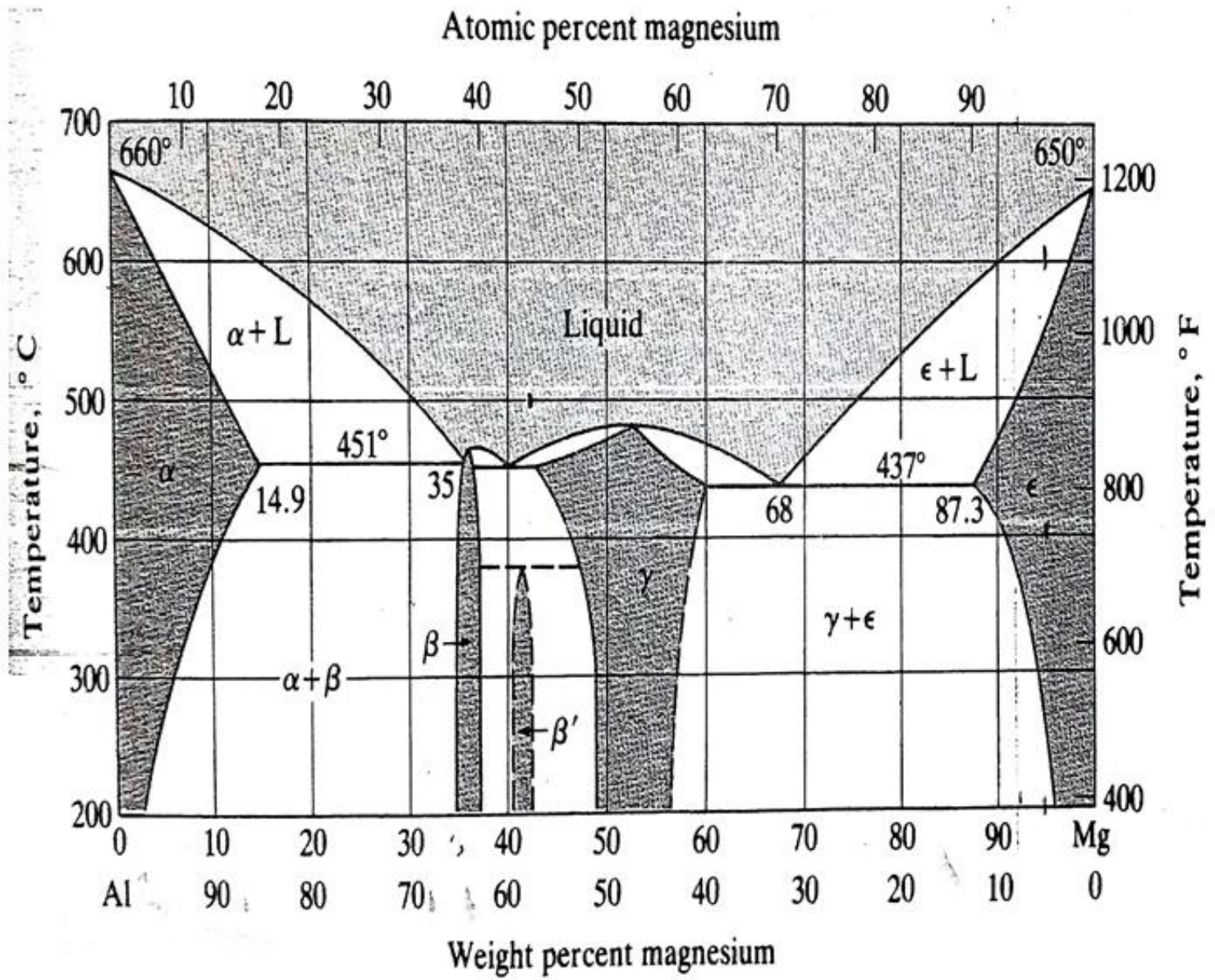


Fig 19: Al-Mg Phase Diagram

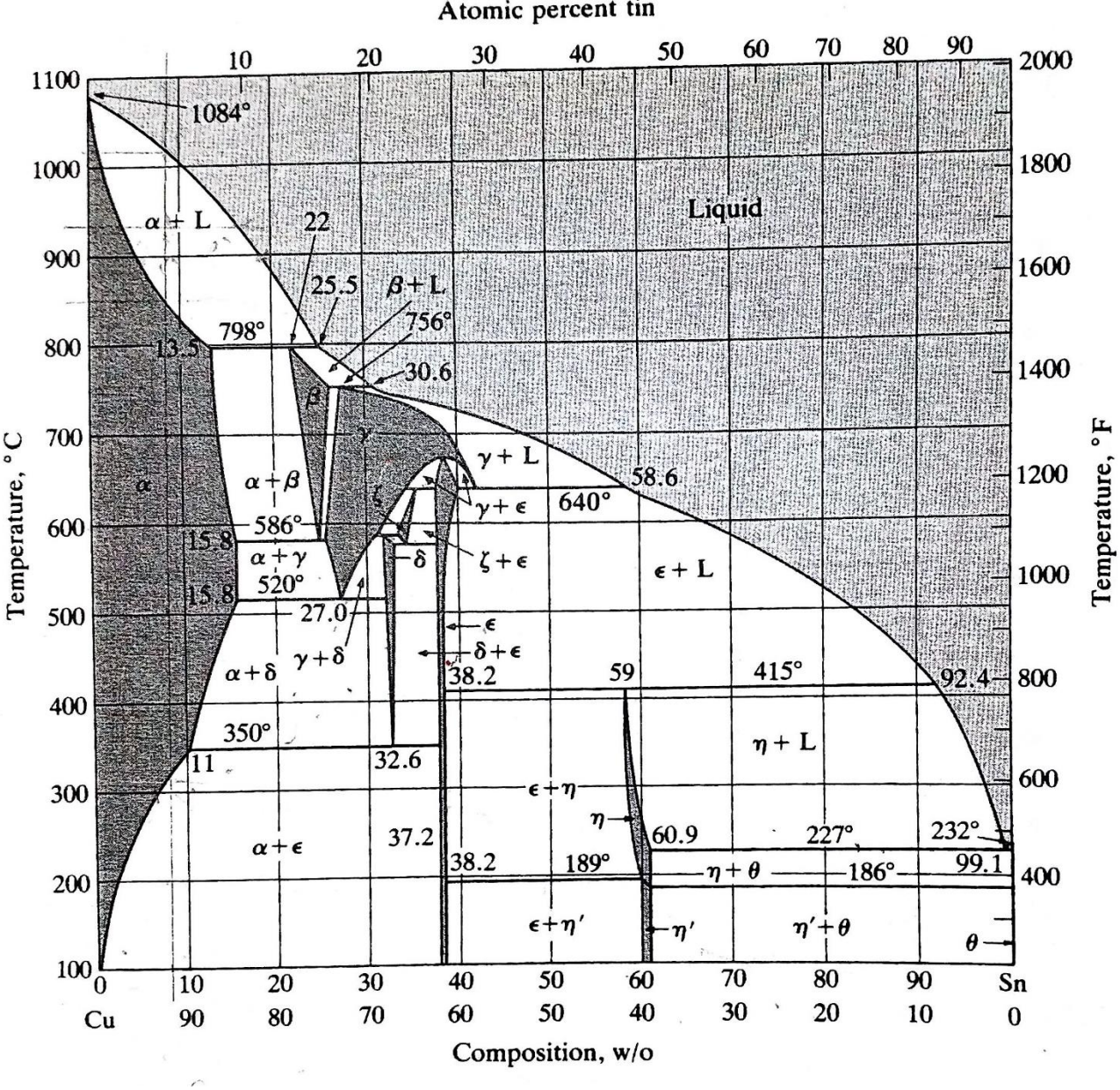


Fig 20 Cu-Sn Phase diagram

WATCH THIS VIDEO ON MANUFACTURE OF STEEL

https://www.youtube.com/watch?v=9AMbKpeJRoU

https://www.youtube.com/watch?v=xejnSzbFMQA