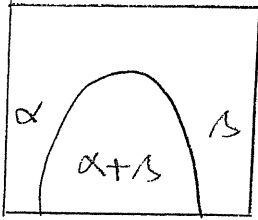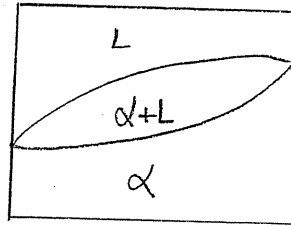3.
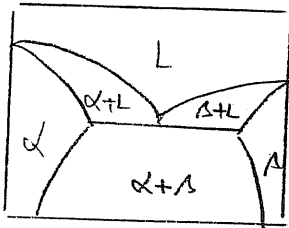
1. Solubility
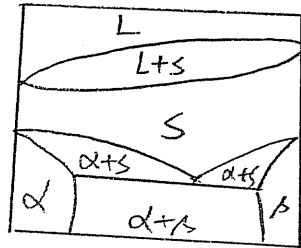

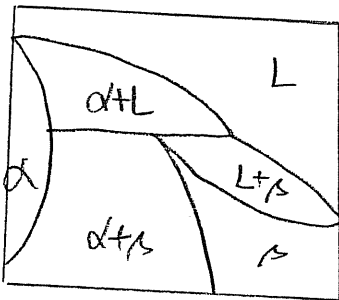2. Binary Isomophous diagram

3. Binary Eutectic

4. Binary Eutectoid

5. peritectic

中正大學機械系 93 學年上學期工程材料期末考試題　94.1.11
1. 可用計算機　2.不可用字典　3.Closed Book　4. Total score: 120

Iso-morphous phase diagram (10%)

1. Using an isomorphous phase diagram of an alloy shown in Fig. 1, *sketch and explain* why the real solidus curve lies below the ideal solidus curve when the alloy is cooled under non-equilibrium solidification. (10%) *Submit Fig.1 together with your answer sheets.*

p267.

Lever rule and phase diagram (20%)

2. A 45 wt% Pb--55 wt% Mg alloy is heated to a fixed temperature within the $\alpha + Mg_2Pb$ region(as shown in Fig. 2). If the mass fractions of α phase and Mg_2Pb are 0.65 and 0.35, then determine:

p281.

(1) The composition of the α phase. (10%)

(2) Estimate the temperature of the alloy. (4%)

(3) What does the point M in the phase diagram mean? (2%)

(4) What does the vertical line *M-80* mean? (2%)

(5) What do we call Mg_2Pb as a compound? (Not its chemical name!) (2%)
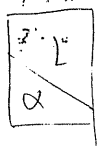
Phase diagram and microstructure prediction (20%)

3. (1) Sketch schematically the microstructures of an alloy at point B, C, D and E in the phase diagram shown in Fig. 3 when it is cooled from liquid state. (12%)

(2) Define the phases missing in the phase diagram. (4%)

(3) The microstructure shows a lead–tin alloy (as shown in Fig. 4) of composition 45 wt% Pb with a few large dark regions and a matrix with lamellar pattern. Which is the primary phase first solidified from liquid? (2%)

(4) What do we call the phase with lamellar pattern? (2%)

Submit Fig.3-4 together with your answer sheets.

Gibbs Phase rule(10%)

4. For the 45 wt% Pb--55 wt% Mg alloy phase diagram shown in Fig.2, by using the Gibbs phase rule, show that the point M is an invariant point. (10%)

$$F = C - P + N$$

Fe-Fe$_3$C equilibrium phase diagram (15%)

5. Plot Fe-Fe$_3$C equilibrium phase diagram of ferrous alloys. Indicate (1) all phases, (2) metallurgical terms of phase, (3) temperature and/or (4) wt.% of carbon of relevant points or lines *as Fig.5. Submit together with your answer sheets.* (15%)

If you can not plot, please specify by which phase diagrams is the Fe-Fe$_3$C phase diagram composed? (6%)

Only for those who have been able to plot the diagram will get an extra bonus (?%) by answering this question.

Fe-Fe$_3$C phase diagram and compositions (24%)

6. According to the Fe-Fe$_3$C phase diagram (You should have plotted it in the previous question or bear it in mind), there is a **HYPO-EUTECTOID** steel with a mass fraction of eutectoid ferrite $W_{\alpha\text{-eutectoid}}=$ 0.82.

   (1) Determine the carbon content C% of this steel. (6%)

   (2) Which phase will first form on grain boundaries, i.e. what is the pro-eutectoid phase of the steel when the steel is cooled from Austenite? (5%)

   (3) Determine the mass fraction of this pro-eutectoid phase you give in (2) at temperature slightly above the eutectoid temperature T_E. (5%)

   (4) Determine the mass fraction of total ferrite $W_{total\ ferrite}$ and total cementite $W_{total\ cementite}$. (8%)

Metallography and microstructures (21%)

7. Identify the phases in the microstructures of steel in figure 6 and answer the questions.
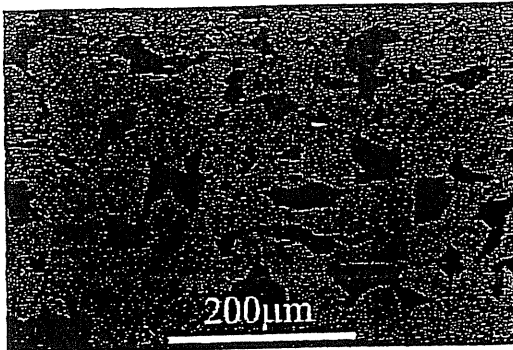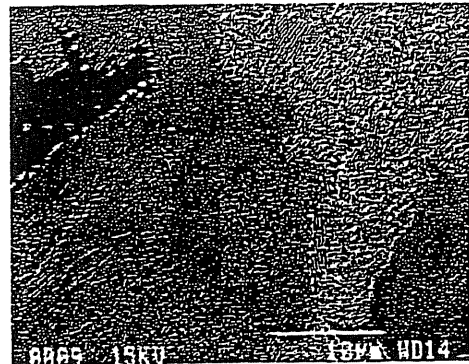
Fig. 6(a)

Fig 6(b)

(1) What is the metallographic terminology of the white grains in 6(a)? (2%)
(2) What is the metallographic terminology of the dark grains in 6(a)? (3%)
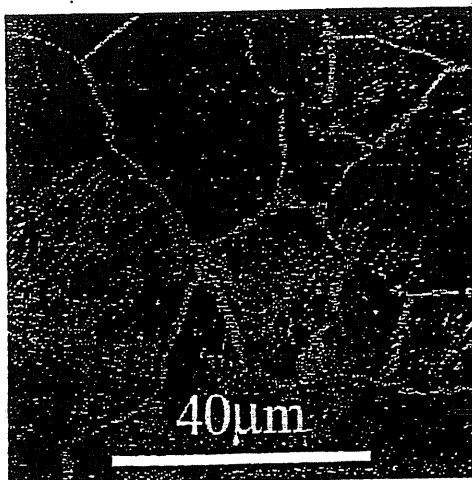(3) What is the lamellar area in 6(b)? Is it a single phase or it contains more than one phase? (4%)

Fig.6(c)

(1) In Fig.6(c), what is phase revealed by the white area on grain boundaries if the steel contains 0.79% C? (3%)
(2) Is the rod-like or plate-like dark area the same microstructure as that shown in fig. 6(b)? (3%)
(3) Estimate the carbon content of the phase revealed by the white area along grain boundaries (3%)
(4) Which is the primary phase forming during cooling from Austenite, the white one or the plate-like one? (3%)

1. 因為T下降太快，所以初始析出濃度偏高
   固体無法平衡 濃度。

   要你的圖請看 P.267

2. 由0:35來的
   (1) $Mg_2Pb = 35\ wt\%$ of all

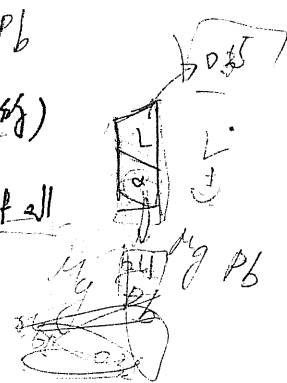 $\begin{cases} Mg & 19\ wt\% \\ Pb & 81\ wt\% \end{cases}$ (課本 P.以圖給的)

   $Mg\quad 35 \times 19\% = 7\ wt\%$ in Mg_2Pb of all

   $Pb\quad 35 \times 81\% = 28\ wt\%$

   $55 - 7 = 48\ wt\%$ in α

   $45 - 28 = 17\ wt\%$ in α

   $\alpha\begin{cases} Mg: & \dfrac{48}{0.65} = 73.8\ wt\% \\ Pb: & \dfrac{17}{0.65} = 26.2\ wt\% \end{cases}$

   (2) $340°C$ ← 這是由上題 26.2 wt% Pb 對照課本 P.284
   圖得來的

   (3) α phase

   (3)   (4)
   Mg_2Pb 熔點 Mg_2Pb

   (5) ~~Mg_2Pb 重量组成百分比~~ (不確定)
   ~~金屬化合物~~

3. X

4. P.84 由$F = C - P + N$

   圖有幾個元素
   M點那點存在幾個相

   參考座標軸，一般是P,T兩個

5. 背 P.290 圖②

6. $\alpha_{P} = \dfrac{Q}{P+R}$ $\qquad \alpha_{total} = \dfrac{Q+R}{P+Q+R}$

$P = X - 0.022$
$Q = 0.76 - X$
$R = 6.7 - 0.76$

$\alpha_{total} - \alpha_{P} = 0.8\sim = \dfrac{Q+R}{P+Q+R} - \dfrac{Q}{P+R}$

$Fe_3C = 1 - \alpha_{total}$

$\rightarrow \alpha$ 相
$\rightarrow Fe_3C$
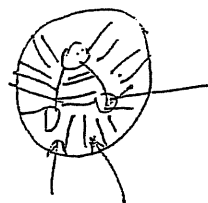
第 1 章：

1. 搞懂 共晶、共析、介金屬、包晶就好了 相圖

2. Level Rule 弄懂
知道怎麼運算 在 相圖上

3. 大ㄉ 那個圖 知道

這些分別是什麼

4.
$F = C - P + N$ 自由度要會算

5. 鐵碳圖背熟比較實際