48/50

University of Jordan

Industrial Engineering Department

Metallurgical Processes (946513)

Mid-term exam, Thursday, November 23d, 2025, 8:30- 9:20 a[redacted]

Student Name in Arabic [redacted] Univ. Number: [redacted]

14

Q-1(15 Points):

a- What is the purpose of alloying?

- Producing new properties
- Enhancing existing properities ✓

b- What are the preferable conditions for producing intermetallic phases?

- Divergent in the atomic table (weak + strong) ✓
- Dissimillar Crystal structure ✓
- Size factor > 14% ✓

c- How does a substitutional solid solution contribute to strengthening of alloys?

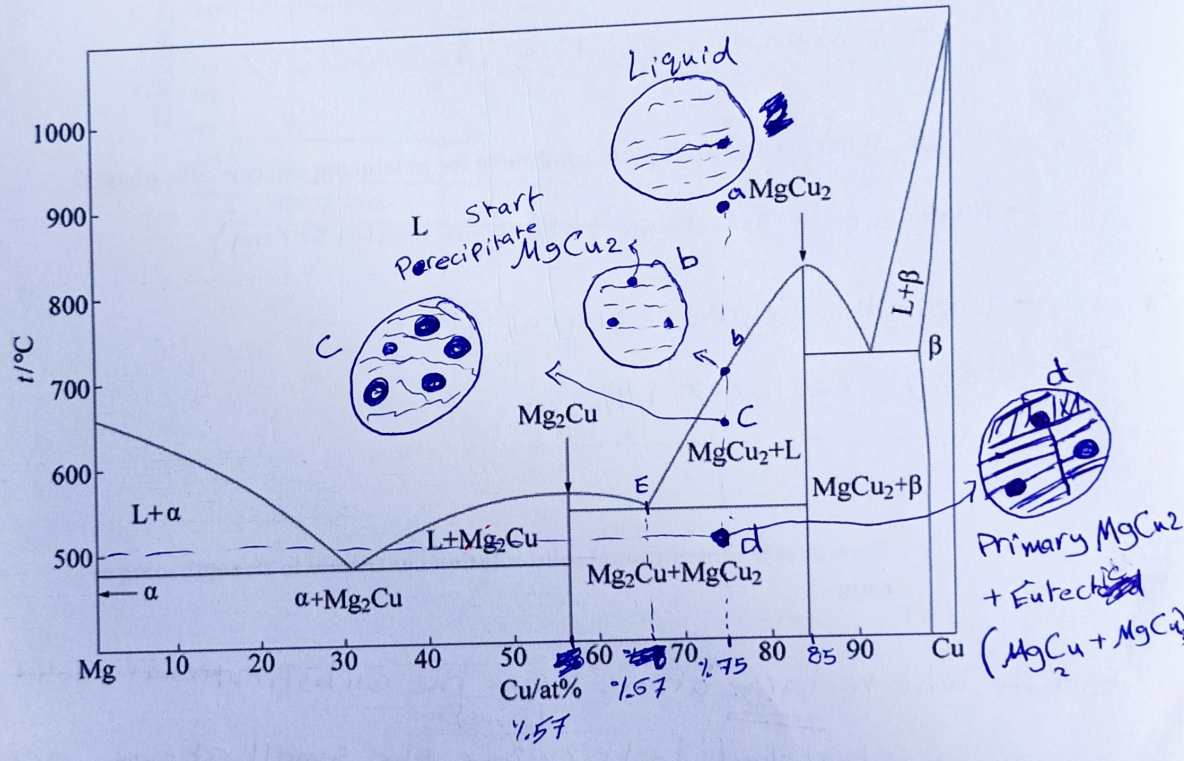
when large atoms from the substitutional Solid Solution (atoms) occupy at stretched lattice, or the small atoms occupy the compressed lattice (atoms) to reduce the stresses, energy level.

d- What is the purpose of tempering

(1) to relif the stresses in the metal and to improve (2) the ductility and.

Q-2(20 Points):

In the phase diagram below:



Liquid

$MgCu_2$

Eutectic

a- Follow the solidification path for an alloy containing 75% Cu using sketches showing phases present and microstructural development under equilibrium Direct at the diagram

b- For this alloy (75% Cu) find the following at 500 °C: Point d

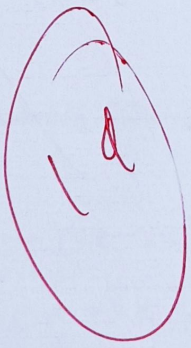
1- Weight percetages of Mg_2Cu and $MgCu_2$
2- Weight percetages of primary $MgCu_2$
3- Weight percetage of Mg_2Cu within the Eutectic

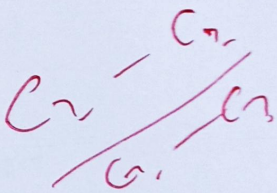
① $W_t(Mg_2Cu) = \frac{85-75}{85-57} \times 100\% = 35.71\%$

$W_t(MgCu_2) = 1 - W_t(Mg_2Cu) = \frac{75-57}{85-57} = 64.29\%$

② $W_t(\text{primary } MgCu_2) = \frac{75-67}{85-67} = 0.44 \simeq 44.44\%$

③ $W_t(Mg_2Cu \text{ Eutectic}) = \frac{85-67}{85-57} = 64.29\%$

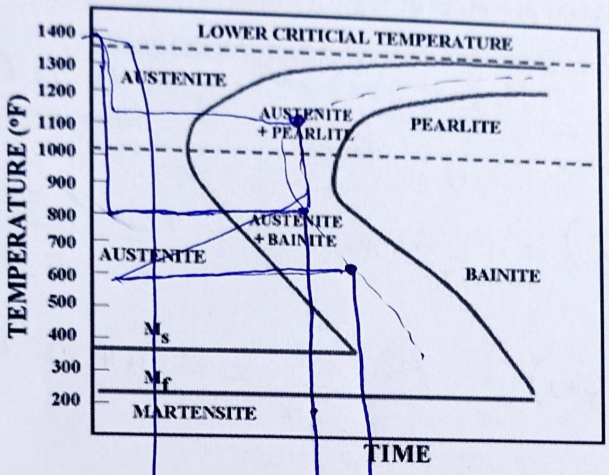




Q-3(15 Points):

For the TTT curve below draw cooling steps that will produce:

a- **50% Bainnite and 50% Martensite**
b- **50% Pearlite, 25% Bainite annd 25% Martensite**
c- **100 Martennsite**



c

%c 100
M

a

50% B
50% M

b

50% P
25% B
25% M

15