

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Please construct a phase diagram having the following characteristics.

- (a) The two components are "A" and "B"
- (b) The melting point of A is 500 °C, and the melting point of B is 700 °C.
- (c) The diagram contains only one compound, which is a line compound (exact stoichiometry formula) having the stoichiometry A_2B and a congruent melting point of 750 °C.
- (d) One eutectic point appears at the component composition 80 % A and 400 °C.
- (e) Another eutectic point appears at the component composition 75 % B and 600 °C.
- (f) The maximum solubility of B in A occurs at the eutectic temperature and it is 10% (α -phase)
- (g) The maximum solubility of A in B occurs at the eutectic temperature and it is 5% (β -phase).
- (h) The solubility of A in B and B in A are zero at RT.

Please label all the regions on the diagram.

(30%)

- 2. Calculate the atomic packing factor (APF) for the FCC unit cell, assuming the atoms to be spheres. **(10%)**
- 3. What are hysteresis energy losses for a magnetic material? What factors affect hysteresis losses? **(10%)**
- 4. What are the four major strengthening mechanisms in metal? Describe how metals are strengthened in each mechanism. **(10%)**
- 5. Draw the Fe-Fe₃C phase diagram. **(10%)**
- 6. Explain the major differences between hot working and cold working. **(10%)**
- 7. Please describe how the impurity and free-surface effects will inhibit to limiting the grain growth of materials. **(10%)**
- 8. Explain the differences between single crystalline, poly-crystalline and amorphous materials. **(10%)**