

Faculty of Engineering Prince of Songkla University

การสอบกลางภาคการศึกษาที่ 2

ปีการศึกษา 2550

วันเสาร์ที่ 22 ธันวาคม 2550

เวลา 9:00 – 12:00 น

วิชา 237-302

ห้อง R20C

ผู้ออกข้อสอบ ดร. เจษฎา วรรณสินธุ์

คำสั่ง

- (1) เขียนคำตอบให้สมบูรณ์ทุกข้อเพื่อให้ได้คะแนนเต็ม
- (2) ไม่อนุญาตให้นำเอกสารทุกชนิดเข้าสอบ ยกเว้นเครื่องคิดเลข และ Dictionary
- (3) ให้ตรวจสอบข้อสอบให้เรียบร้อยก่อนสอบ
- (4) ข้อที่มีการคำนวณ ใช้ข้อมูลที่ให้ไว้ในหน้านี้

ทุจริตในการสอบโทษขั้นต่ำคือปรับตกในรายวิชาที่ทุจริตและพักการศึกษา 1 ภาคการศึกษา

Question No.	Point	Result
1	50	
2	10	
3	10	
4	30	
	Total	

Useful Equations and Data:

$A_1V_1 = A_2V_2$ $\rho gH = \frac{1}{2} \rho v^2$ $t = \left[\frac{\pi \left(\frac{\rho_c \Delta H_f}{T_m - T_0} \right)^2 \frac{1}{k_m \rho_m c_m}}{4} \right] \left(\frac{V}{A} \right)^2$ $t = \frac{\rho_m \Delta H_f r}{h(T_m - T_0)}$ $Re = \frac{\rho V d}{\mu}$	<ul style="list-style-type: none"> ▪ Thermal conductivity of steel = 20 W/m°C ▪ Heat capacity of steel = 0.5 kJ/kg°C ▪ Heat transfer coefficient (steel/liquid aluminium) = 3,000 W/m²/°C ▪ Heat transfer coefficient (copper/liquid aluminium) = 5,000 W/m²/°C ▪ Density of pure aluminium = 2,700 kg/m³ ▪ Heat capacity of liquid aluminium = 1 kJ/kg°C ▪ Heat of fusion of aluminium = 398 kJ/kg ▪ Heat capacity of sand = 0.6 kJ/kg°C ▪ Density of sand = 2,000 kg/m³ ▪ Thermal conductivity of sand = 1 W/m°C ▪ Viscosity of pure aluminium = 0.0013 Pa-s
---	---

Name: _____ Student ID No: _____

1. Answer the following questions (50 points):

(a) Draw a picture of a forging die showing “Fillet Radii” and “Internal Draft Angle” Also identify them. (4 points)

(b) Which quality testing is used to determine the following requirement? (6 points)

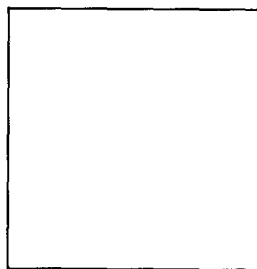
1. Machinability: _____

2. Surface defects: _____

3. Internal defects: _____

(c) Ingot Microstructure (6 points)

i) Draw the common microstructure of an ingot. Hint: there are 3 types of microstructure (3 points)



ii) Why and how these 3 microstructures are created. (3 points)

Name: _____ Student ID No: _____

(d) Explain one method to obtain fine dendrite arm spacing (3 points).

(e) Explain why we want fine dendrite arm spacing (5 points).

(f) Explain one method to obtain grain refinement (5 points).

(g) Explain 2 methods to conduct degassing of aluminum alloys (4 points).

(h) What is "Cold Shut"? Also, how to eliminate cold shut? (3 points).

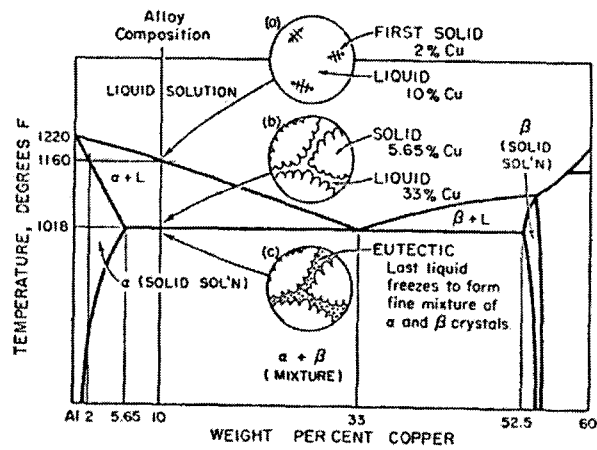
Name: _____ Student ID No: _____

(i) Explain 3 methods to eliminate shrinkage porosity at hot spots (6 points).

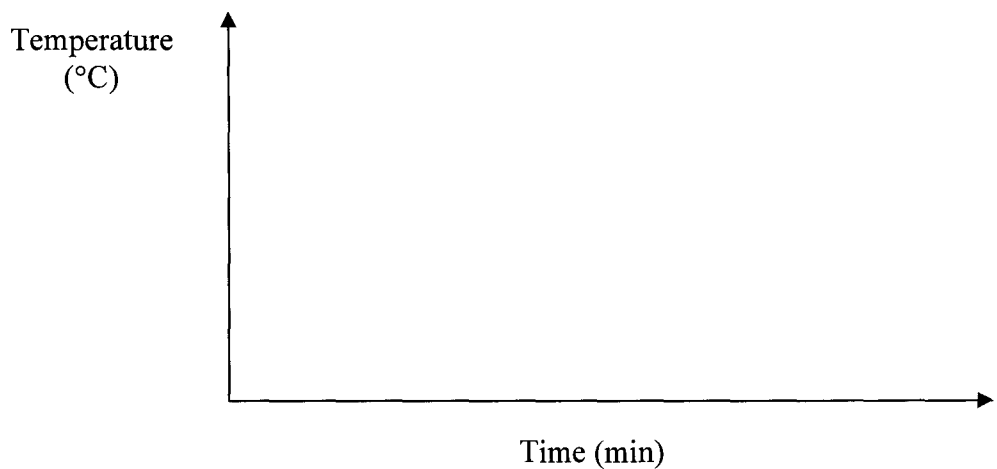
(j) Explain clearly how investment casting is conducted (4 points).

(k) Explain clearly how gas crucible furnace is used (4 points).

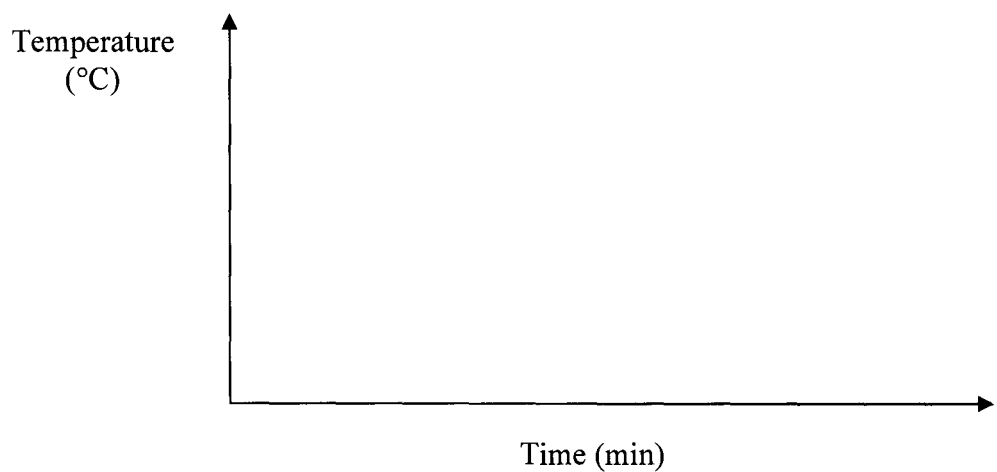
2. Cast Metals (10 points)



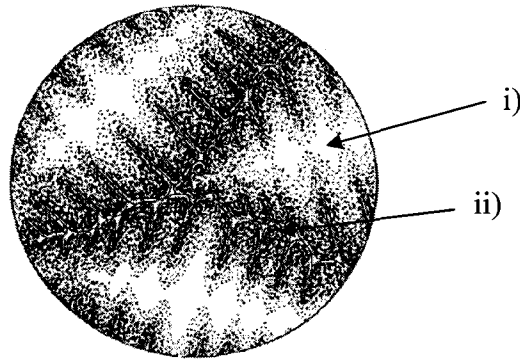
a) Draw a cooling curve of a pure aluminum metal solidifying slowly in a graphite crucible. Include as much detail as possible such as the melting point. (Note: There is a 5°C undercooling) (5 points).



b) Draw a cooling curve of Al-10%Cu alloy solidifying slowly in a graphite crucible. Include as much detail as possible such as the liquidus, solidus, or eutectic temperatures. (Note: There is a 5°C undercooling) (5 points).



3. Given is the microstructure of an Al-20%Cu alloy solidified in an iron mold. The phase diagram is given in question No. 2. Answer the following equations: (10 points)

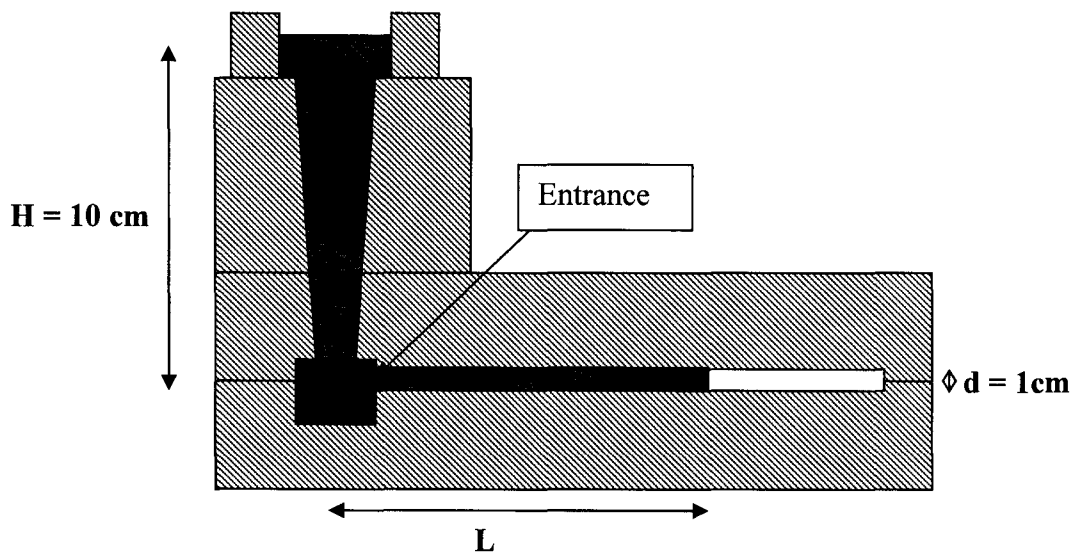


i) What is approximately the amount of copper near the center of the dendrite? (5 points)

ii) What is approximately the amount of copper outside the dendrite? (5 points)

4. Permanent mold casting. (30 points)

(Given: The mold is made of copper at 25°C. The metal is pure aluminum.)



Name: _____ Student ID No: _____

- i) At the "Entrance," is the flow of the liquid metal laminar or turbulent?
Explain your answer clearly (10 points).
- ii) If we pour the metal with the temperature 750°C, how far the metal will
flow (L = ?) (10 points)?
- iii) Explain clearly one method to increase the fluidity length to 300 cm (10
points).