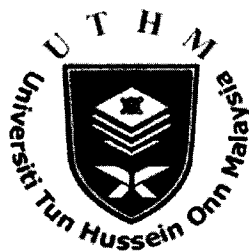


SULIT



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**PEPERIKSAAN AKHIR
SEMESTER III
SESI 2012/2013**

NAMA KURSUS : SAINS BAHAN

KOD KURSUS : DAM 20803

PROGRAM : 2 DAM

TARIKH PEPERIKSAAN : MEI 2013

JANGKA MASA : 2 ½ JAM

**ARAHAN : JAWAB LIMA (5) SOALAN
DARIPADA TUJUH (7) SOALAN**

KERTAS SOALAN INI MENGANDUNGI LAPAN (8) MUKA SURAT

SULIT

- Q 1 (a)** Materials can be divided into 5 categories, which are metals, ceramics, composites, polymers and electronic materials. Each material has their advantages and disadvantages. From the given statement, answer the following question:
- (i) Give ONE (1) example of material for each category.
(5 marks)
- (ii) List ONE (1) advantage and ONE (1) disadvantage for FOUR (4) materials categories only.
(8 marks)
- (b) Mechanical property testing or destructive testing is used to determine the materials mechanical properties. There are several types of mechanical properties testing. List and describe FOUR (4) types of mechanical testing.
(12 marks)
- Q2 (a)** Give definition of any TWO (2) of the following terms:
- (i) Schottky imperfection
 - (ii) Frenkel imperfection
 - (iii) Mixed dislocation
 - (iv) Edge dislocation
 - (v) Screw dislocation
- (5 marks)
- (b) State FIVE (5) factors, which are involved in materials selection.
(5 marks)
- (c) Explain THREE (3) methods of materials selection.
(9 marks)
- (d) The support cable rod for a new crane system for a lightweight use required to be designed to withstand a maximum load of 440KN. With 4 supports cables to bear the load equilibrium. Plain carbon steels from 1045 series was selected. The minimum yield strength and tensile strength of this alloy are 620 MPa and 1130 MPa respectively. Assume safety factor, $N = 5$
- Calculate the suitable size of cable rod diameter.
(6 marks)

- Q3** (a) Heat treatment used to adjust the microstructure and mechanical properties of a material for a specific purpose. There are several types of heat treatment for example annealing, normalizing, quenching, and tempering.

Describe the purposes of each type of the above heat treatment.

(8 marks)

- (b) Sketch the design flow chart in designing process.

(5 marks)

- (c) By plotting phase diagram of Pb-Sn (Refer Figure Q3 (c)), plot the graph and make a phase analysis for composition of 30 % Sn at $183\text{ }^{\circ}\text{C} + \Delta T$ and 30 % Sn at $183\text{ }^{\circ}\text{C} - \Delta T$ by find:

- (i) Each phase composition for 30 % Sn at $183\text{ }^{\circ}\text{C} + \Delta T$ and 35 % Sn at $183\text{ }^{\circ}\text{C} - \Delta T$.

(6 marks)

- (ii) Amount of weight proportion for each fraction for 30 % Sn at $183\text{ }^{\circ}\text{C} + \Delta T$ and 35 % Sn at $183\text{ }^{\circ}\text{C} - \Delta T$.

(6 marks)

- Q4** (a) *Translation* is one of the first steps in materials selection process. List down the FOUR (4) items related to *translation* that needs to be analysed and explain briefly each of the items.

(12 marks)

- (b) Based on the four items in relation to the above Q4(a), show that, for a light strong tie (tensional load), $M = (\sigma_y / \rho)$, where M is the Material Index, σ_y is the yield strength and ρ is the density of the material.

{ Given $\sigma_y > F/A$ }

(13 marks)

Q5 Figure Q5(a) shows a design of a table with a flat sheet of toughened glass supported on slender cylindrical legs. The legs must be solid (to make them thin) and as light as possible (to make the table easier to move). They must support the table top and whatever is placed upon it without buckling. Using the Ashby Method of materials selection, recommend a suitable material for the legs, using the following information and the Young Modulus-Density Chart as in figure Q5(b).

(Please note that there are TWO (2) objectives)

(a) For mass, $m = \pi r \ell^2 \rho$

(b) For load P without buckling, $P_{\text{crit}} = \pi^2 EI / \ell^2 = \pi^3 E r^4 / 4 \ell^2$

Where r = radius of the legs

ℓ = length of the legs

E = Young Modulus

(25 marks)

Q6 (a) Explain briefly the difference between ferrous and non-ferrous metals. Give TWO (2) examples for each type.

(4 marks)

(b) Steels are basically categorized into 3 types, namely, low carbon, medium carbon and high carbon steels. Indicate the percentage of carbon content for each type of steel and give TWO (2) examples (products) for each one of them.

(9 marks)

(c) List FOUR (4) properties of any THREE (3) of the following non-ferrous metal:

- (i) Aluminium
- (ii) Titanium
- (iii) Magnesium
- (iv) Nickel
- (v) Copper

(12 marks)

Q7 (a) Briefly explain electrochemical corrosion

(5 marks)

(b) The following are the types of corrosion. Briefly explain any FIVE (5) of them.

- (i) Uniform Attack – General Corrosion
- (ii) Galvanic Corrosion
- (iii) Crevice Corrosion
- (iv) Pitting
- (v) Intergranular Corrosion
- (vi) Selective Leaching
- (vii) Erosion Corrosion

(20 marks)

- END OF QUESTIONS -

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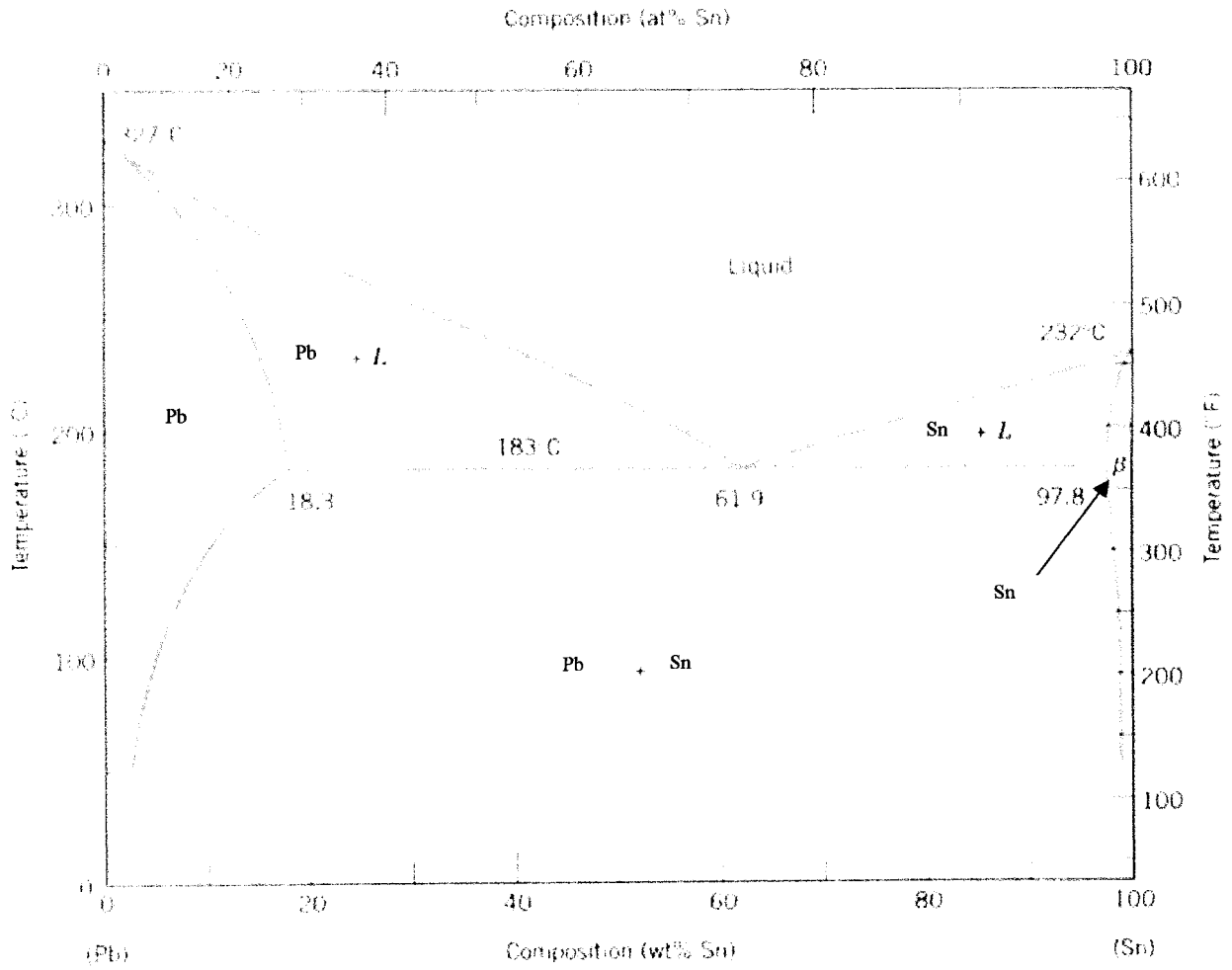


Figure Q3 (c)

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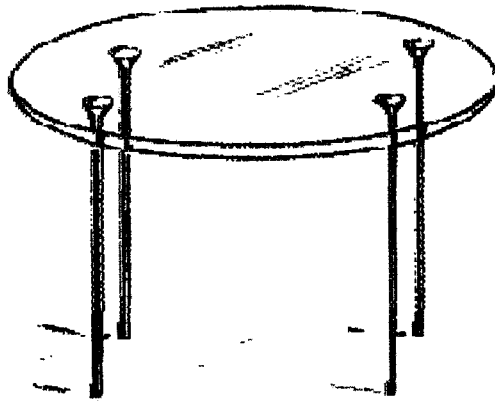


Figure Q5(a)

