



UTHM

Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
(TAKE HOME)
SEMESTER I
SESSION 2020/2021**

COURSE NAME : MATERIALS SCIENCE AND TECHNOLOGY

COURSE CODE : BNT 10202

PROGRAMME CODE : BNT

EXAMINATION DATE : JANUARY / FEBRUARY 2021

DURATION : 3 HOURS

INSTRUCTION : ANSWERS ALL QUESTIONS.
OPEN BOOK EXAMINATION

THIS QUESTION PAPER CONSISTS OF **FOUR (4) PAGES**

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- Q1**
- (a) Define and explain the essence in the Material Science and Materials Engineering (2 marks)
- (b) Determine density of based center cubic (BCC) iron, which have a lattice parameter of 0.2866 nm (2.866×10^{-8} cm), atomic mass = 55.847 g/mol and Avogadro constant $N_A = 6.022 \times 10^{23}$ atoms/mol. (5 marks)
- (c) Construct the following crystallographic direction in a cubic unit cell.
- (i) $[1\ 1\ \bar{2}]$
- (ii) $[2\ 0\ \bar{1}]$
- (iii) $[2\ 0\ 1]$
- (iv) $[2\ 0\ \bar{3}]$
- (12 marks)
- (d) Two indices of the Body Centre Cubic (BCC) given; (110) and (101). Identify the most dense plane. (6 marks)
- Q2**
- (a) Phase Diagram is important in material science engineering as it can be used as a benchmark to identify the characteristic of a material in terms of temperature and composition. Explain on **FOUR (4)** important informations that we can identify from a Phase Diagram. (8 marks)
- (b) You are given a Metal X for certain engineering application. In order to confirm the capability of the metal for the required application, you need to know its characteristics and properties. Examine **TWO (2)** suitable mechanical tests that can be carried out to determine its ability to withstand any applied load and to deform plastically by absorbing energy. (6 marks)
- (c) A 3500 N force is applied to a 0.45 cm diameter copper wire having a yield strength of 320 MPa and a tensile strength of 360 MPa. Determine whether the wire will plastically deform. (6 marks)
- (d) Discuss the difference in between ductile and brittle fracture of a material by giving an appropriate plot of stress and strain that exposed to the uniaxial tensile load and state. (5 marks)

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- Q3** (a) An alloy contains 63 wt% gold (Au) and 37 wt% of nickel (Ni) (which is written Au-37 wt% Ni). Given the atomic weight of Au (197.0) is more than 3 times that of Ni (58.7). By using the right approach, determine the composition of X_{Au} and X_{Ni} . (6 marks)
- (b) A sample of alloy that weighs 1.5kg contains 0.45kg of Zn and the rest is Cu. Calculate:
- (i) the concentration of Cu in the alloy, in wt % : W_{Cu} , and (2 marks)
- (ii) the concentration of Cu in the alloy, in atom % : X_{Cu} (4 marks)
- Given the atomic weight of Cu is 63.5 and Zn is 65.4.
- (c) Based on **Figure Q3(c)** for a Pb 30% Sn, determine the phases present, their amounts and the compositions at the following temperatures (13 marks)
- (i) 300 °C
- (ii) 200 °C
- (iii) 184 °C
- (iv) 182 °C
- (v) 0 °C
- Q4** (a) There are **TWO (2)** types of polymerization processes known as Addition Polymerization and Condensation Polymerization. Differentiate between these processes. (10 marks)
- (b) Give **FIVE (5)** types of non-ferrous metal. (5 marks)
- (c) Compare between thermoplastic and thermoset and give **ONE (1)** example of each type of the polymer. (5 marks)
- (d) Justify the importance usage of composites in aircraft and airframe in the context of material science. (5 marks)

- END OF QUESTIONS -

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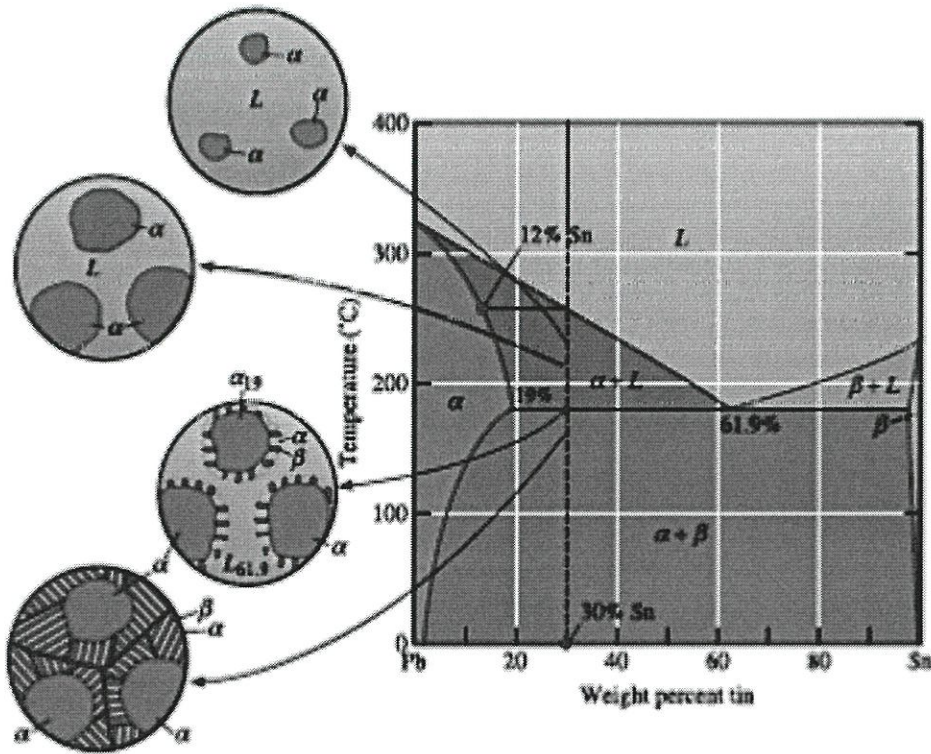


Figure Q3(c): The Solidification and Microstructure of a Hypoeutectic alloy (Pb-30% Sn)

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