

CONFIDENTIAL



UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015**

COURSE NAME : MATERIALS SCIENCE
COURSE CODE : BDA 10803
PROGRAMME : 1 BDD
EXAMINATION DATE : JUNE / JULY 2015
DURATION : 3 HOURS
INSTRUCTION : ANSWER **FIVE(5)** QUESTIONS
ONLY

THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

MAMAS JURAGAB WIS MA...
Tun Hussein Onn Malaysia

CONFIDENTIAL

CONFIDENTIAL

BDA10803

- Q1** (a) How would you assess a material's impact characteristics from a tensile test? (5 marks)
- (b) A tensile test on a specimen having an initial diameter of 13.11 mm and an initial gauge length of 200.0 mm, gave the following data:

Load (kN)	Elongation (mm)	Load (kN)	Elongation (mm)
12.6	0.04	85.05	5
22.2	0.07	94.5	10
30.45	0.1	107.1	20
39.9	0.13	114.45	30
46.2	0.15	119.7	40
54.6	0.18	123.48	50
59.85	0.2	124.95	60
66.15	0.3	126	70
70.35	0.5	124.95	80
71.4	0.65	119.7	90
78.33	2.5	98.7	100 (Fails)

- (i) Plot a stress vs strain diagram. (6 marks)
- (ii) What is the proof strength of the material? (2 marks)
- (iii) What is the percentage of reduction area of the material? (2 marks)
- (c) In the Vickers hardness tests, the average diagonal produced from the indentation of four different metals are shown below. Which metal is the hardest and why?

Metal Type	Metal A	Metal B	Metal C	Metal D
Diagonal Size	0.250 mm	0.350 mm	0.450 mm	0.550 mm

(5 marks)

- Q2** (a) How do you classify composite material according to its reinforcement? (6 marks)
- (b) You have been asked to design a fiber composite consisting of continuous glass fibers embedded in a polymer matrix. The fibers are all aligned and parallel to the loading direction. The properties of the glass fiber are listed below.

Material Type : Glass Fiber
Young's Modulus : 69 GPa
Density : 2500 kg/m³

- (i) You have been asked to design a composite using the glass fibers with a volume fraction of glass fibers equal to 25%. The composite must have an overall Young's modulus of 19.5 GPa. What is the minimum value of the Young's modulus of the matrix material you must use?
(7 marks)
- (ii) If you make a composite with a matrix Young's modulus of 5 GPa and 25% volume fraction of fiber, what would you expect the Young's modulus of the composite to be for loading perpendicular to the fiber axis?
(7 marks)

- Q3**
- (a) Distinguish between one dimensional defect and two dimensional defects.
(5 marks)
 - (b) The self-diffusion of iron atoms in BCC iron is significantly higher than in FCC iron. Explain why.
(3 marks)
 - (c) If aluminum is diffused into a thick slice of silicon with no previous aluminum in it at a temperature of 1100°C for 6 h, what is the depth below the surface at which the concentration is 10^{16} atoms/cm³ if the surface concentration is 10^{18} atoms/cm³? ($D = 2 \times 10^{-12}$ cm²/s for aluminum diffusing in silicon at 1100°C).
Given

<i>z</i>	<i>erf(z)</i>	<i>z</i>	<i>erf(z)</i>	<i>z</i>	<i>erf(z)</i>
0	0	0.55	0.5633	1.3	0.9340
0.025	0.0282	0.60	0.6039	1.4	0.9523
0.05	0.0564	0.65	0.6420	1.5	0.9661
0.10	0.1125	0.70	0.6778	1.6	0.9763
0.15	0.1680	0.75	0.7112	1.7	0.9838
0.20	0.2227	0.80	0.7421	1.8	0.9891
0.25	0.2763	0.85	0.7707	1.9	0.9928
0.30	0.3286	0.90	0.7970	2.0	0.9953
0.35	0.3794	0.95	0.8209	2.2	0.9981
0.40	0.4284	1.0	0.8427	2.4	0.9993
0.45	0.4755	1.1	0.8802	2.6	0.9998
0.50	0.5205	1.2	0.9103	2.8	0.9999

(12 marks)

CONFIDENTIAL

BDA10803

- Q4**
- (a) Describe THREE (3) importance of phase diagram. (3 marks)
 - (b) By referring Cu-Ag phase diagram in Figure Q2, apply phase analyses of an 88wt% Ag-12wt%Cu alloy at $780 + \Delta T$. (12 marks)
 - (c) With appropriate figure, what is the relationship between cooling rate, hardness and the formation of martensitic structure in Jominy end quench test? (5 marks)
- Q5**
- (a) What is the function of alloying elements in tool steels? (2 marks)
 - (b) Give the distinctive features, limitations, and applications of the following alloy groups: titanium alloys, refractory metals, super alloys, and noble metals. (8 marks)
 - (c) State the classification of ceramics materials (3 marks)
 - (d) List SIX(6) general properties of ceramic materials. (3 marks)
 - (e) Explain briefly about TWO(2) methods of ceramic processing. (4 marks)
- Q6**
- (a) List FOUR(4) classifications of steels. (2 marks)
 - (b) Briefly describe the properties and typical applications for four classifications of steels. (8 marks)
 - (c) Sketch molecular structure for linear, branched, cross-linked and network polymers. (4 marks)
 - (d) Explain briefly about THREE(3) methods of polymer processing. (6 marks)

~ END OF QUESTIONS ~

DR. NUR AZAM BIN BADA'ULZAMAN
Kampus
Kementerian Pendidikan dan Kebudayaan
4
Kampus
Kementerian Pendidikan dan Kebudayaan

CONFIDENTIAL

FINAL EXAMINATION

SEMESTER/SESSION: SEM II / 2014/205
COURSE NAME : MATERIAL SCIENCE

PROGRAMME : 1 BDD
COURSE CODE: BDA 10803

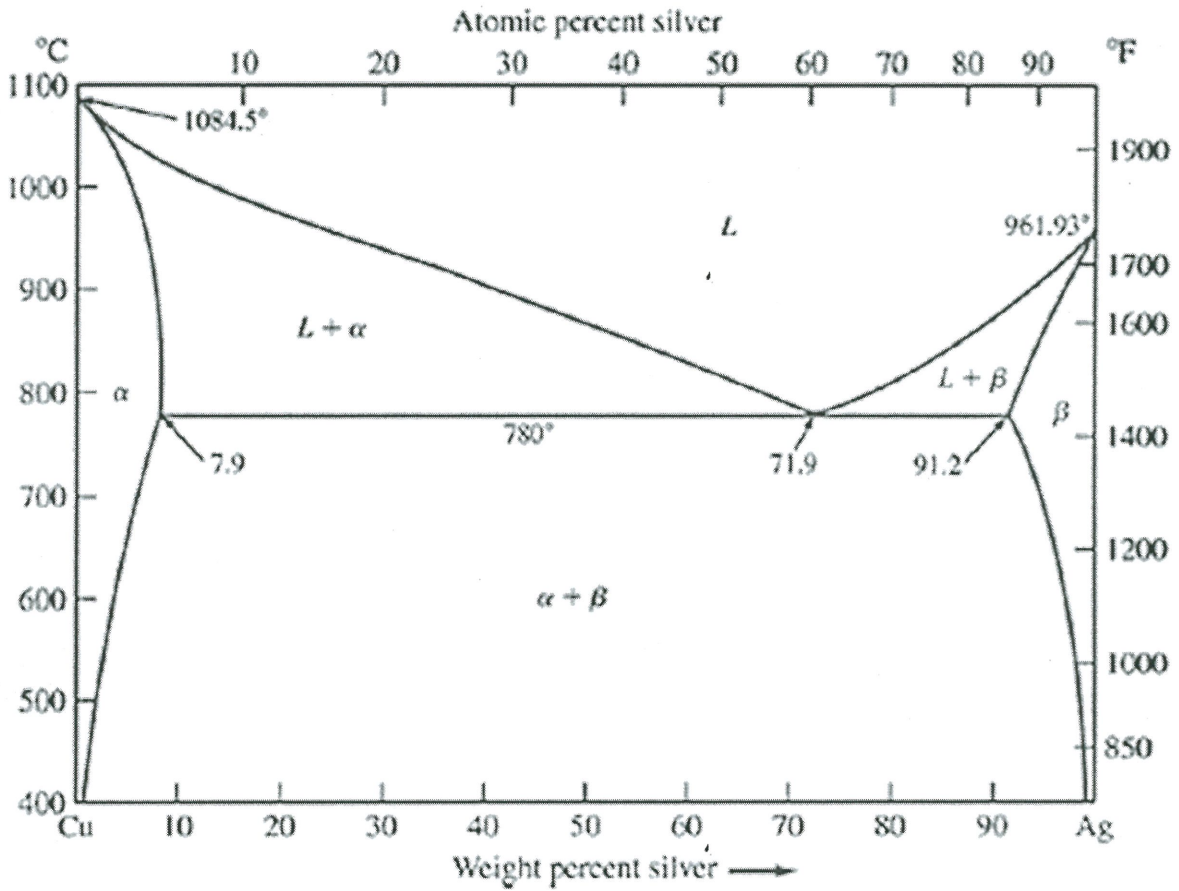


FIGURE Q2