

CONFIDENTIAL



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESI 2016/2017**

COURSE NAME : MATERIALS SCIENCE
COURSE CODE : DAM 20802
PROGRAMME : 2 DAM
EXAMINATION DATE : DECEMBER 2016/ JANUARY 2017
DURATION : 2 HOURS 30 MINUTES
INSTRUCTION : ANSWER FOUR (4) QUESTIONS ONLY

TERBUKA

THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

- Q1** (a) Explain the importance of studying engineering material. (4 marks)
- (b) With suitable sketch, give explanation of ionic bond, covalent bond and metallic bonds (6 marks)
- (c) What is Atomic Packing factor? Show the Atomic Packing Factor (APF) of FCC Structure is 0.74. (6 marks)
- (d) Construct the direction from the indices direction given:
 (i) $[1 \ 1 \ 1]$
 (ii) $[0 \ 1 \ 2]$
 (iii) $[2 \ \bar{2} \ 1]$
 (iv) $[1 \ \bar{2} \ 1]$
 (v) $[1 \ \bar{1} \ 1]$ (5 marks)
- (e) From the Miller indices given below, within a cubic unit cell, sketch the following lattice plane:
 (i) $(\bar{1}\bar{1}0)$
 (ii) $(1\bar{1}1)$
 (iii) $(0\bar{1}\bar{2})$
 (iv) $(\bar{1}\bar{1}1)$ (4 marks)
- TERBUKA**
- Q2** (a) Give definition and **two (2)** example (products) for following types of material:
 (i) Smart material
 (ii) Advance material (5 marks)
- (b) Mechanical properties are used to classify and identify material. Mechanical properties of materials determined by performing specific laboratory experiments. List **four (4)** common hardness test that can be done in laboratory. (4 marks)
- (c) Imperfection in solid can be describes into three which are point defect, line defect and bulk defect. Show the different between point defect for metal and ceramic. (6 marks)

- (d) Impurity point defects are found in solid solutions. There are two types of impurity point defect which are substitutional and interstitial. Discuss any **three (3)** factors that determine the degree of solvent dissolved in solid solution (Hume-Rothery Rules) (6 marks)
- (e) Diffusion is the phenomenon of material transport by atomic motion. There are two types of diffusion in solid which are inter-diffusion and self-diffusion. In order for diffusion to take place, there are two conditions that must be met. Explain these **two (2)** conditions. (4 marks)

Q3 (a) Define invariant reactions below;

- (i) Peritectic
- (ii) Peritectoid
- (iii) Eutectic
- (iv) Eutectoid

(4 marks)

(b) What is **three (3)** important information that we could obtain from phase diagram?

(3 marks)

(c) **Figure 3(b)** showed the copper-silver alloy phase diagram. Name the item as label by:

- Phase
- i. A
- ii. B
- iii. C
- iv. D
- v. E
- vi. F
- Line
- vii. G
- viii. H
- ix. I
- x. J



(10 marks)

- (d) **Figure 3(c)** showed the phase diagram of Cu-Ni. For point X, Y and Z, determine
 - i) Phase Present
 - ii) Phase Composition
 - iii) Phase Amounts

(8 marks)

- Q4** (a) What are the purposes of heat treatments? (2 Marks)
- (b) Describe the following heat treatment procedures for steels and, for each, the intended final microstructure (6 Marks)
- (i) Annealing
 - (ii) Normalizing
 - (iii) Tempering
- (c) Discuss the mechanical properties of the following microstructure: (8 Marks)
- (i) Fine Pearlite
 - (ii) Coarse Pearlite
 - (iii) Martensite
 - (iv) Bainite
- (d) Stainless steel is a class of high alloy steels where major alloying element is chromium. Describe **two (2)** mechanical properties of stainless steel and **three (3)** major applications of stainless steel. (5 Marks)
- (e) Titanium is one non-ferrous material. Describe **two (2)** mechanical properties of titanium and **two (2)** major applications of titanium. (4 Marks)

TERBUKA

- Q5** (a) Briefly explain electrochemical corrosion and cite two locations where corrosion normally started. (2 marks)
- (b) Galvanic series represents the relative reactivities of a number of metals and commercial alloys in seawater. List **two (2)** top cathodic material and **three (3)** most anodic material in galvanic series. (5 marks)

- (c) Briefly explain the following types of corrosion.
- (i) Uniform Attack – General Corrosion
 - (ii) Galvanic Corrosion
 - (iii) Crevice Corrosion
 - (iv) Pitting
 - (v) Intergranular Corrosion
- (10 marks)
- (d) Discuss **four (4)** steps to controlled or prevent corrosion in a metal.
- (8 marks)

- END OF QUESTION -

TERBUKA

**PEPERIKSAAN AKHIR
FINAL EXAMINATION**

SEMESTER / SESI : SEM 1 2016/2017
SEMESTER / SESSION

PROGRAM : 2 DAM
PROGRAMME

KURSUS : MATERIALS SCIENCE
COURSE

KOD KURSUS : DAM 20802
CODE COURSE

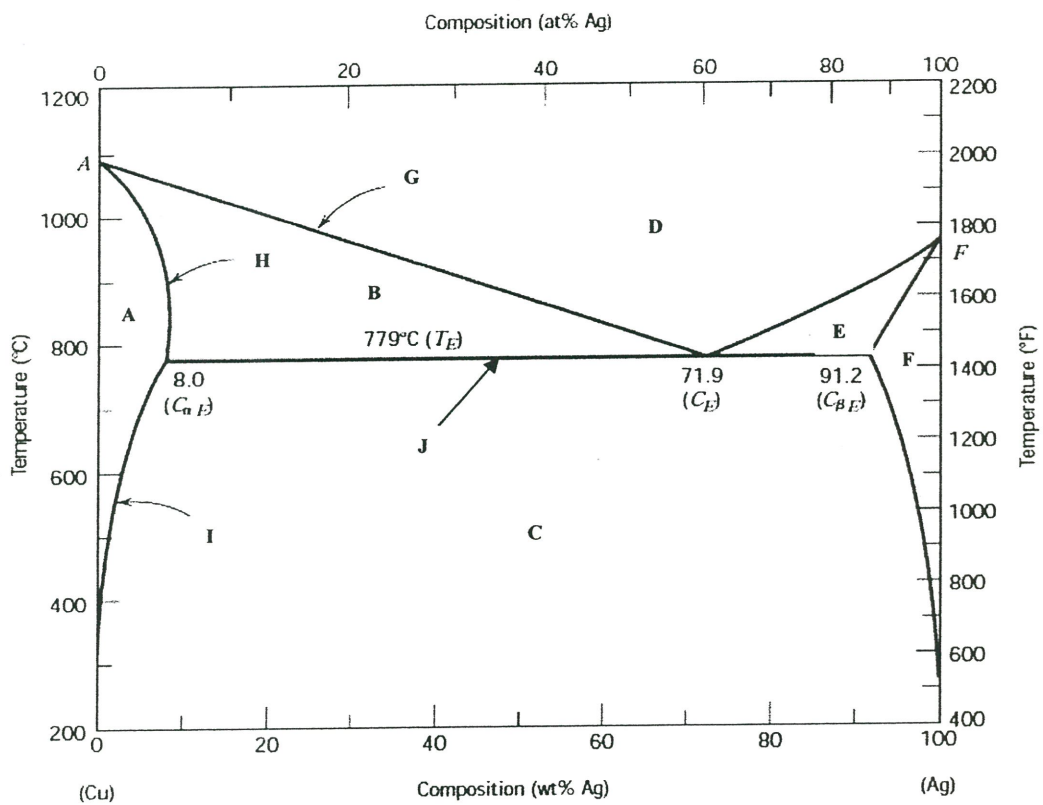


Figure Q3(b)

TERBUKA

PEPERIKSAAN AKHIR
FINAL EXAMINATION

SEMESTER / SESI : SEM 1 2016/2017
SEMESTER / SESSION

PROGRAM : 2 DAM
PROGRAMME

KURSUS : MATERIALS SCIENCE
COURSE

KOD KURSUS : DAM 20802
CODE COURSE

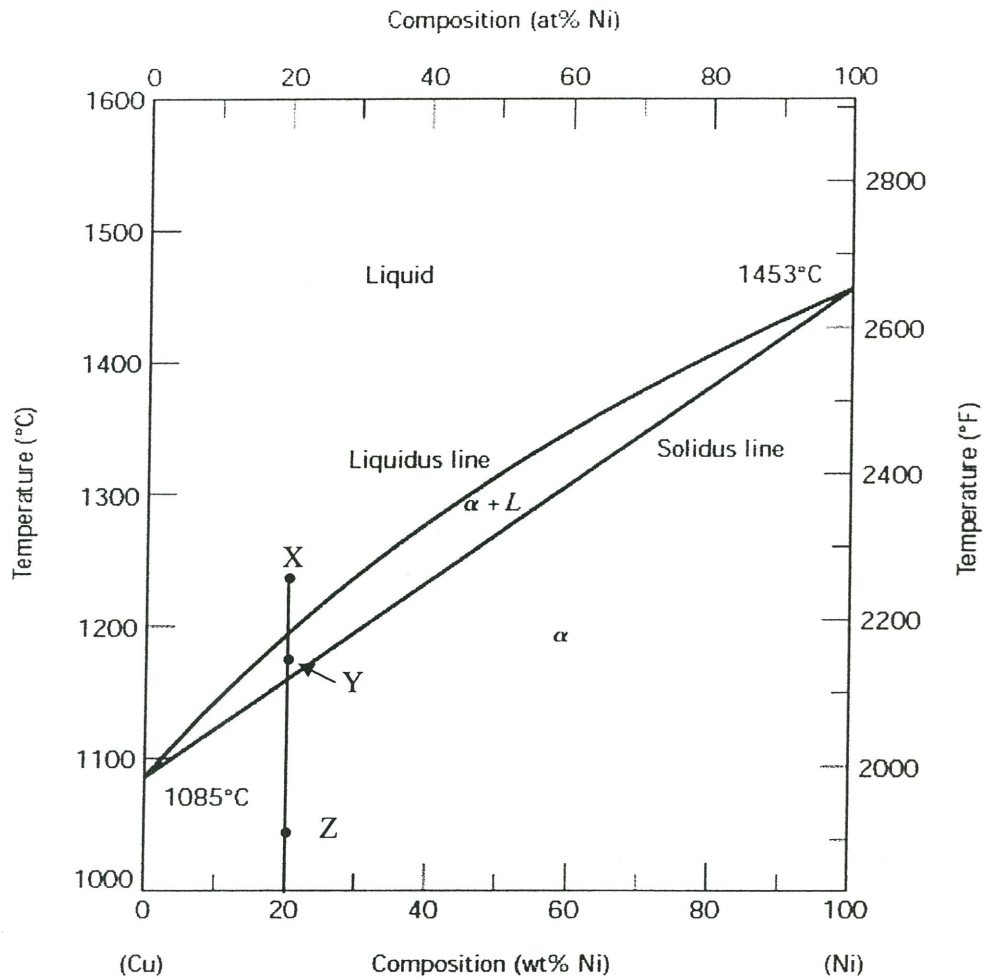


Figure Q3(c)

TERBUKA