Document No : UniKL MFI_SD_AC41
Revision No: 02
Effective Date: 01 December 2008
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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

SEPTEMBER 2013 SESSION

SUBJECT CODE	**:**	**FTD 22103 / FTD 12102**
SUBJECT TITLE	**:**	**METALLURGY**
LEVEL	**:**	**DIPLOMA**
TIME DURATION	**:**	**2 HOURS**
DATE	**:**	

INSTRUCTIONS TO CANDIDATES

1. **Please read the instructions given in the question paper CAREFULLY.**
2. **This question paper is printed on both sides of the paper.**
3. **Please write your answers on the answer booklet provided.**
4. **Answer should be written in blue or black ink except for sketching, graphic and illustration.**
5. **This question paper consists of TWO (2) sections. Section A and B. Answer ALL questions in section A and TWO (2) questions in section B.**
6. **Answer all questions in English.**

THERE ARE 3 PAGES OF QUESTIONS AND 1 PAGE OF APPENDIX EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

INSTRUCTION: Answer ALL Questions.

Please use the answer booklet provided.

Question 1

a) Define steel alloy and give **TWO (2)** example of elements in the steel alloy.

(4 marks)

b) Explain **THREE (3)** differences between Solution and Solid Solution.

(6 marks)

c) There are several process involved in steel production. With aid of diagram, describe **ONE(1)** process flow to produce the steel from pig iron.

(10 marks)

Question 2

a) Describe **THREE (3)** methods to identify the iron and steel.

(4 marks)

b) Normalizing involves a more rapid cooling process than annealing. Describe normalizing process.

(6 marks)

c) Describe the experimental procedures in hardness test.

(10 marks)

Question 3

a) State **TWO (2)** advantages of the gray cast iron and sketch the microstructure.

(4 marks)

b) A 5 mm diameter Brinell hardness indenter produced an indentation of 1.62 mm in diameter in steel alloy when a load of 6000 N was used. Compute the BHN of this material.

(6 marks)

c) Explain the mounthing process in microscopic test.

(10 marks)

SECTION B (Total: 40 marks)

INSTRUCTION:Answer TWO (2) questions only

Please use the answer booklet provided.

Question 1

a) State **TWO (2)** effects of hydrogen in Carbon Steel.

(4 marks)

b) By referring to the Fe – C phase diagram in Figure 1, answer the following:

i. Describe the point **A** and **B**

ii. Calculate the percentage of ferrite and cementite for microstructure ***X***

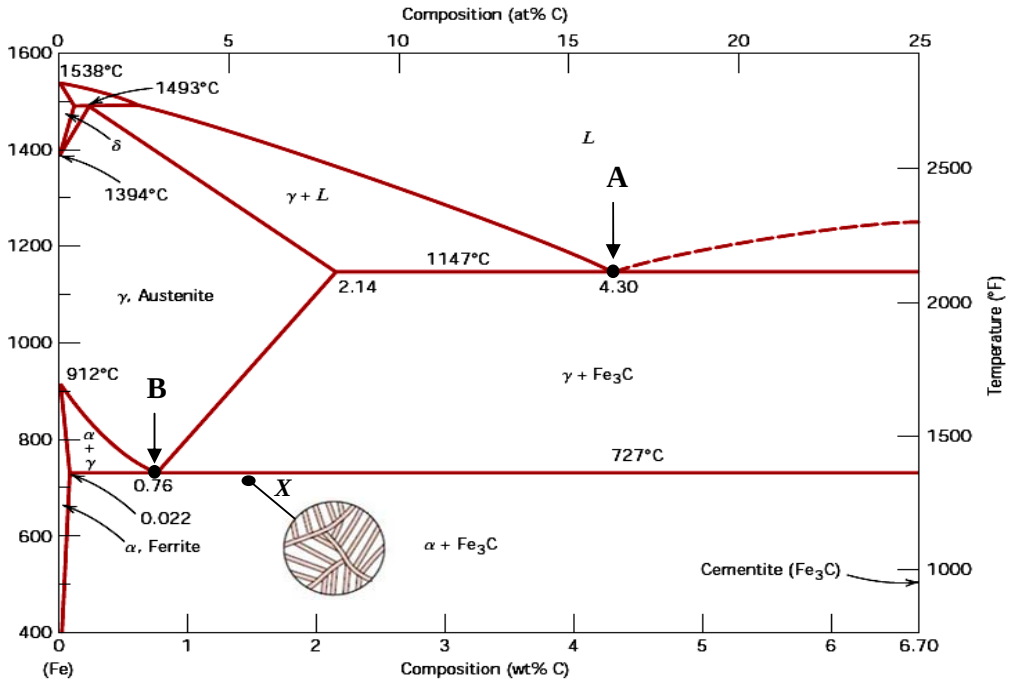

Figure 1. Fe – C Phase Diagram

(6 marks)

c) Quenching process is a heat treatment process that increases the mechanical properties of a material. Describe that process.

(10 marks)

Question 2

a) List down **TWO (2)** methods to apply the etching solution (acid) in metallograpic test.

(4 marks)

b) The strength of the steel can be measured by performing the tensile test. Describe the informations or data that can be obtained by this test with sketching graph.

(6 marks)

c) An element is a **cubic structure** that has a density of 1.55 g/cm^3, an atomic weight of 40.078 g/mol, and a lattice parameter of 0.5588 x10^{-9} m. One atom is associated with each lattice point. Determine the crystal structure (i.e. Simple Cubic - SC, Face Centered Cubic - FCC or Body Centered Cubic - BCC) of the that element. (Given NA = 6.023x10^{23} atoms/mol)

(10 marks)

Question 3

a) State **TWO (2)** advantages of Vickers hardness testing.

(4 marks)

b) List down **THREE (3)** factors that influenced the corrosion.

(6 marks)

c) Describe the process flow in obtaining the microscopic structure in metallograpic test.

(10 marks)

END OF QUESTIONS

APPENDIX

$$APF = (n)(\frac{4\pi r^3}{3})(\frac{1}{a^3})$$

$$\rho = \frac{nA}{V_c N_A}$$

$$N = \frac{N_A \rho}{A}$$

$$N_v = N \exp(\frac{-Q}{kT})$$

$$a_{fcc} = \frac{4r}{\sqrt{2}}$$

$$a_{bcc} = \frac{4r}{\sqrt{3}}$$

$$a_{sc} = 2r$$

$$D = D_o \exp(\frac{-Q_d}{RT})$$

$$m_\alpha \, phase = \frac{m_\beta - m_x}{m_\beta - m_\alpha} x Total\ Mass$$

$$m_\beta \, phase = \frac{m_x - m_\alpha}{m_\beta - m_\alpha} x Total\ Mass$$

$$m_L \, phase\% = \frac{m_s\% - m_x\%}{m_s\% - m_{L\%}} x100$$

$$m_s \, phase\% = \frac{m_x\% - m_L\%}{m_s\% - m_{L\%}} x100$$

$$\rho_\alpha = \frac{100}{\frac{C_{A(\alpha)}}{\rho_A} + \frac{C_{B(\alpha)}}{\rho_B}}$$

$$\rho_\beta = \frac{100}{\frac{C_{A(\beta)}}{\rho_A} + \frac{C_{B(\beta)}}{\rho_B}}$$

$$V_\alpha = \frac{\frac{m_\alpha}{\rho_\alpha}}{\frac{m_\alpha}{\rho_\alpha} + \frac{m_\beta}{\rho_\beta}}$$

$$V_\beta = \frac{\frac{m_\beta}{\rho_\beta}}{\frac{m_\alpha}{\rho_\alpha} + \frac{m_\beta}{\rho_\beta}}$$

$$\sigma = \frac{F}{A_o}$$

$$\varepsilon = \frac{\Delta l}{l_o}$$

$$E = \frac{\sigma}{\varepsilon}$$

$$\%elongation = \frac{\Delta l}{l_o} x100\%$$

$$\%\ area\ reduction = \frac{\Delta A}{A_o} x100\%$$

$$BHN = \frac{F}{\frac{\pi D}{2}(D - \sqrt{D^2 - d^2})}$$

$$VHN = \frac{1.85F}{d^2}$$