



UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2011 SESSION

SUBJECT CODE : FTD 12102
SUBJECT TITLE : METALLURGY
LEVEL : DIPLOMA
TIME / DURATION : 12.30pm – 2.30pm
(2 HOURS)
DATE : 05 MAY 2011

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 FIVE (5) questions. Answer FOUR (4) questions only.
6. Answer all questions in English.

THERE ARE 3 PAGES OF QUESTIONS AND 2 PAGES OF APPENDIX, EXCLUDING THIS PAGE.

INSTRUCTION: Answer FOUR (4) questions only.

Question 1

- (a) In iron ore processing, there are several processes involved. Explain the process to produce iron ore. (15 marks)
- (b) In the microscopic examination procedure, the surface of the sample must be smooth and flat. List down the process involved in order to achieve the surface condition of the sample as above. (6 Marks)
- (c) Show for the body-centered cubic (BCC) crystal structure that the unit length a and the atomic radius R are related through $a = 4R/\sqrt{3}$. (4 marks)

Question 2

- (a) Why Manganese is considered as one of the important elements in carbon steel? (4 marks)
- (b) Describe the advantages of nodular and malleable cast iron compared to gray cast iron in industry. Sketch the microstructure of nodular cast iron. (6 marks)
- (c) Heat treatment involves the use of heating and cooling of metals to alter the physical and mechanical properties without changing the product shape. Annealing is the one of the heat treatment process. Explain the annealing process. (15 marks)

Question 3

- (a) For a bronze alloy, the stress at which plastic deformation begins is 267 MPa and the modulus of elasticity is 115 GPa. What is the maximum load (in N) that may be applied to a specimen having a cross-sectional area of 200 mm² without plastic deformation? (5 marks)
- (b) Define the meaning of quenching and list down each type of quenching starting from Phase 1 to Phase 2. Then, briefly describe the process involved in Phase 1. (15 marks)
- (c) Give **ONE (1)** example of etchant type and its uses.

Question 4

(5 marks)

By referring to the Iron – Carbon diagram in Figure 1, answer the following questions

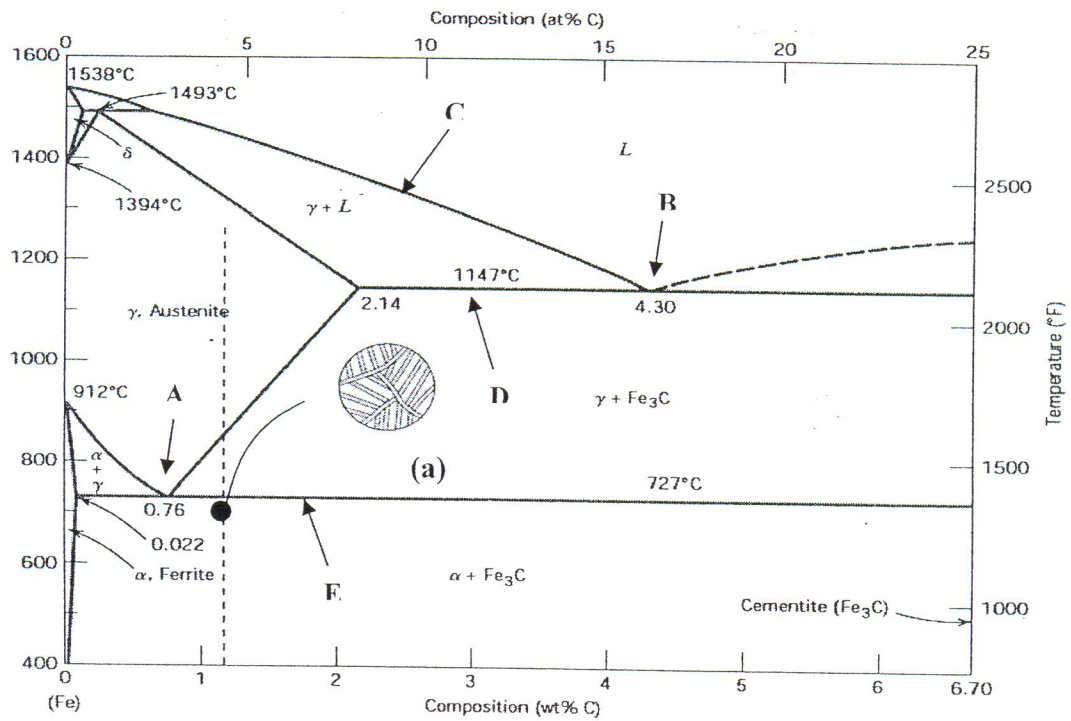


Figure 1: Iron-Carbon diagram of Fe-C

(a) Name the points labeled A and B and line labeled C, D and E.

(10 marks)

(b) Describe liquidus and solidus line.

(5 marks)

(c) Calculate the percentage of Austenite and Ferrite for microstructure (a)

(10 marks)

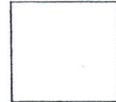


Question 5

- (a) Calculate the Vickers Hardness Number (VHN) for metal if the indentation cause by 60 kg is 2.5 mm for d1. (4 marks)
- (b) List **FOUR (4)** factors that influencing corrosion. (8marks)
- (c) Describe the annealing process. (13 marks)

END OF QUESTION

		IA		IIA		IIIA		IVA		VA		VIA		VIIA		0			
	1	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
	H	Li	Be	B	C	N	O	F	Ne	Na	Mg	Al	Si	P	S	Cl	Ar		
	1.0080	6.939	9.0122	10.811	12.011	14.007	15.999	18.998	20.183	22.990	24.312	26.982	28.086	30.974	32.064	35.453	39.948		
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
	39.102	40.08	44.956	47.90	50.942	51.996	54.938	55.847	58.933	58.71	63.54	65.37	69.72	72.59	74.922	78.96	79.91	83.80	
	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	
	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
	85.47	87.62	88.91	91.22	92.91	95.94	(99)	101.07	102.91	106.4	107.87	112.40	114.82	118.69	121.75	127.60	126.90	131.30	
	55	56	Rare earth series	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	
	Cs	Ba		Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
	132.91	137.34		178.49	180.95	183.85	186.2	190.2	192.2	195.09	196.97	200.59	204.37	207.19	208.98	(210)	(210)	(222)	
	87	88	Actinide series																
	Fr	Ra																	
	(223)	(226)																	

Key

 Metal
 Nonmetal
 Intermediate

29 ← Atomic number
 Cu ← Symbol
 63.54 ← Atomic weight

Rare earth series		Actinide series	
57	58	89	90
La	Ce	Ac	Th
138.91	140.12	(227)	232.04
			(231)
	59		91
	Pr		Pa
	140.91		238.03
	(145)		(237)
	60		92
	Nd		U
	144.24		238.03
	(145)		(242)
	61		93
	Pm		Np
	150.35		237
	(145)		(243)
	62		94
	Sm		Pu
	151.96		242
	(145)		(247)
	63		95
	Eu		Am
	157.25		243
	(145)		(247)
	64		96
	Gd		Cm
	158.92		247
	(145)		(253)
	65		97
	Tb		Bk
	162.50		249
	(145)		(254)
	66		98
	Dy		Cf
	167.26		251
	(145)		(256)
	67		99
	Ho		Es
	168.93		254
	(145)		(258)
	68		100
	Er		Fm
	173.04		257
	(145)		(262)
	69		101
	Tm		Md
	174.97		261
	(145)		(266)
	70		102
	Yb		No
	178.90		269
	(145)		(274)
	71		103
	Lu		Lw
	174.97		262
	(145)		(270)

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

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

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

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

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

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

$$a_{sc} = 2r$$

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

$$m_\alpha \text{ phase} = \frac{m_\beta - m_x}{m_\beta - m_\alpha} \times \text{Total Mass}$$

$$m_\beta \text{ phase} = \frac{m_x - m_\alpha}{m_\beta - m_\alpha} \times \text{Total Mass}$$

$$m_L \text{ phase} \% = \frac{m_s \% - m_x \%}{m_s \% - m_L \%} \times 100$$

$$m_s \text{ phase} \% = \frac{m_x \% - m_L \%}{m_s \% - m_L \%} \times 100$$

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

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

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

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

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

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

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

$$\% \text{ elongation} = \frac{\Delta l}{l_o} \times 100\%$$

$$\% \text{ area reduction} = \frac{\Delta A}{A_o} \times 100\%$$

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

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

Metal Nonmetal Intermediate

Key

29	← Atomic number
Cu	← Symbol
63.54	← Atomic weight

IA		IIA		IIIB		IVB		VB		VIB		VIIB		VIII		IIB		IIIA		IVA		VA		VIA		VIIA		0																																																																																																																																																																																																																																																												
1	H	2	He	3	Li	4	Be	5	B	6	C	7	N	8	O	9	F	10	Ne	11	Na	12	Mg	13	Al	14	Si	15	P	16	S	17	Cl	18	Ar	19	K	20	Ca	21	Sc	22	Ti	23	V	24	Cr	25	Mn	26	Fe	27	Co	28	Ni	29	Cu	30	Zn	31	Ga	32	Ge	33	As	34	Se	35	Br	36	Kr	37	Rb	38	Sr	39	Y	40	Zr	41	Nb	42	Mo	43	Tc	44	Ru	45	Rh	46	Pd	47	Ag	48	Cd	49	In	50	Sn	51	Sb	52	Te	53	I	54	Xe	55	Cs	56	Ba	Rare earth series		57	La	58	Ce	59	Pr	60	Nd	61	Pm	62	Sm	63	Eu	64	Gd	65	Tb	66	Dy	67	Ho	68	Er	69	Tm	70	Yb	71	Lu	87	Fr	88	Ra	Actinide series		89	Ac	90	Th	91	Pa	92	U	93	Np	94	Pu	95	Am	96	Cm	97	Bk	98	Cf	99	Es	100	Fm	101	Md	102	No	103	Lw	104	Uut	105	Uuq	106	Uub	107	Uuq	108	Uub	109	Uut	110	Uuq	111	Uub	112	Uut	113	Uuq	114	Uub	115	Uut	116	Uuq	117	Uub	118	Uut																																																																							
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