



UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2011 SESSION

SUBJECT CODE : FRD 20203
SUBJECT TITLE : REFRIGERANTS AND WATER TREATMENT
LEVEL : DIPLOMA
TIME / DURATION : 12.30pm – 2.30pm
(2 HOURS)
DATE : 09 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 TWO (2) sections. Section A and B. Answer all questions in Section A. For Section B, answer one (1) question only.
 6. Answer all questions in English.
 7. Periodic Table is appended.
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THERE ARE 4 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)**INSTRUCTION: Answer ALL questions.****Please use the answer booklet provided.****Question 1**

- a) Define what is a refrigerant

(5 marks)

- b) List five (5) good properties of refrigerant

(5 marks)

Question 2

- a) Fill in the blanks Table Q2 below, show the details calculation for the Molecular Mass:

(NOTE: rewrite the below table and your answers in the answer sheet)

(10 marks)

Table Q2 a): Refrigerant characteristics

Refrigerant Number	Chemical Name	Chemical Formula	Molecular Mass	ODP	GWP	Safety Group
R32	Difluoromethane (methylene fluoride)	CH ₂ F ₂				
R125	Pentafluoroethane	CHF ₂ CF ₃				
R134a	1,1,1,2-tetrafluoroethane	CH ₂ FCF ₃				
R407C	R-32/125/134a (23.0/25.0/52.0)					

b) (NOTE: rewrite the below table and your answers in the answer sheet)

(10 marks)

Table: Q2 b): Several types of Refrigerants Specification and application

Refrigerant	Cylinder Color code	Application (Large / Domestic / Automobile / Frozen food)	Lubricants (Alkabenzine/ Mineral Oil or POE)	Compressor type (centrigugal / Reciprocating / Rotary / Scroll)	Refrigeration Classification (CFC,HCFC or HFC)
R12					
R22					
R134A					
R407C					

(10 marks)

c) Fill in the Safety Group below:

(NOTE: rewrite the below table and your answers in the answer sheet)

(10 marks)

	Lower Toxicity	Higher Toxicity
Higher Flammability		
Lower Flammability		
No Flame Propagation		

Question 3

a) List three (3) R410A advantages

(10 marks)

b) List two (2) disadvantages of R410A

(10 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer ONE (1) question only

SECTION B (Total: 40 marks)

INSTRUCTION: Answer ONE (1) question only

Question 5

Refer to Appendix and Table attached.

Given:

A once-thru condenser:

Methyl orange alkalinity	=	80 ppm as CaCO ₃
Calcium hardness	=	85 ppm as CaCO ₃
Total solids	=	250 ppm
pH	=	7.5
Condensing water temperature	=	110°F

Find:

- a) Langelier Saturation Index (I_s) (10 marks)
- b) Scaling tendency (10 marks)
- c) Ryznar Stability Index (10 marks)

Question 4

Refer to Appendix and Table attached.

Given:

A once-thru condenser:

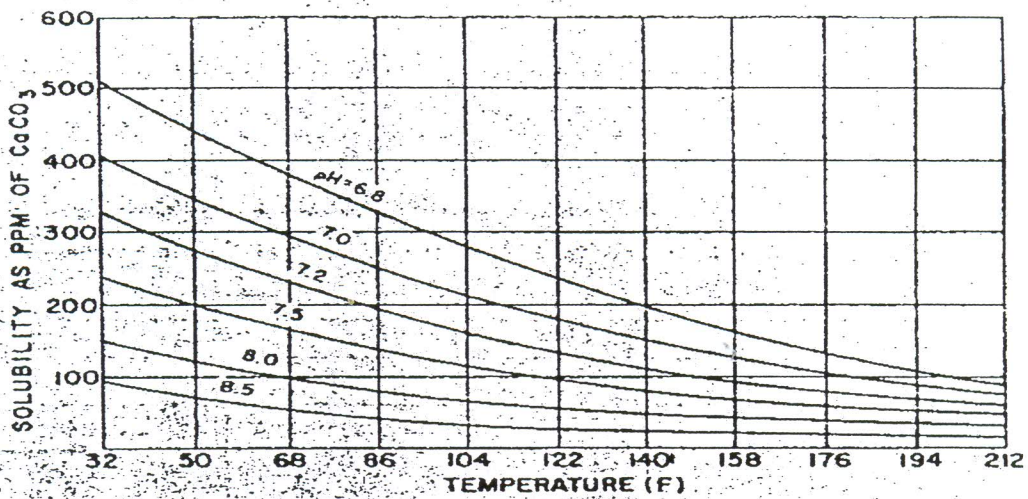
Methyl orange alkalinity	=	80 ppm as CaCO ₃
Calcium hardness	=	85 ppm as CaCO ₃
Total solids	=	250 ppm
pH	=	7.5
Condensing water temperature	=	110°F

Determine the:

- (a). Langelier Saturation Index (I_s) (10 marks)
- (b). Scaling tendency (20 marks)
- (c). Ryznar Stability Index (10 marks)

END OF QUESTION

TECHNICAL DOCUMENTS



NOTE: pH values at approximately 73 F.
 Chart 1: Solubility as ppm CaCO₃ vs. Temperature (°F)

Table 1: Prediction of Water Characteristics by Langelier Saturation Index

LANGELIER SATURATION INDEX	TENDENCY OF WATER
+2.0	scale-forming, and for practical purposes noncorrosive
+0.5	slightly corrosive and scale-forming
0.0	balanced, but pitting corrosion possible
-0.5	slightly corrosive and nonscale-forming
-2.0	serious corrosion

Table 2: Prediction of Water Characteristics by Ryznar Saturation Index

RYZNAR STABILITY INDEX	TENDENCY OF WATER
4.0 - 5.0	heavy scale
5.0 - 6.0	light scale
6.0 - 7.0	little scale or corrosion
7.0 - 7.5	corrosion significant
7.5 - 9.0	heavy corrosion
9.0 and higher	corrosion intolerable

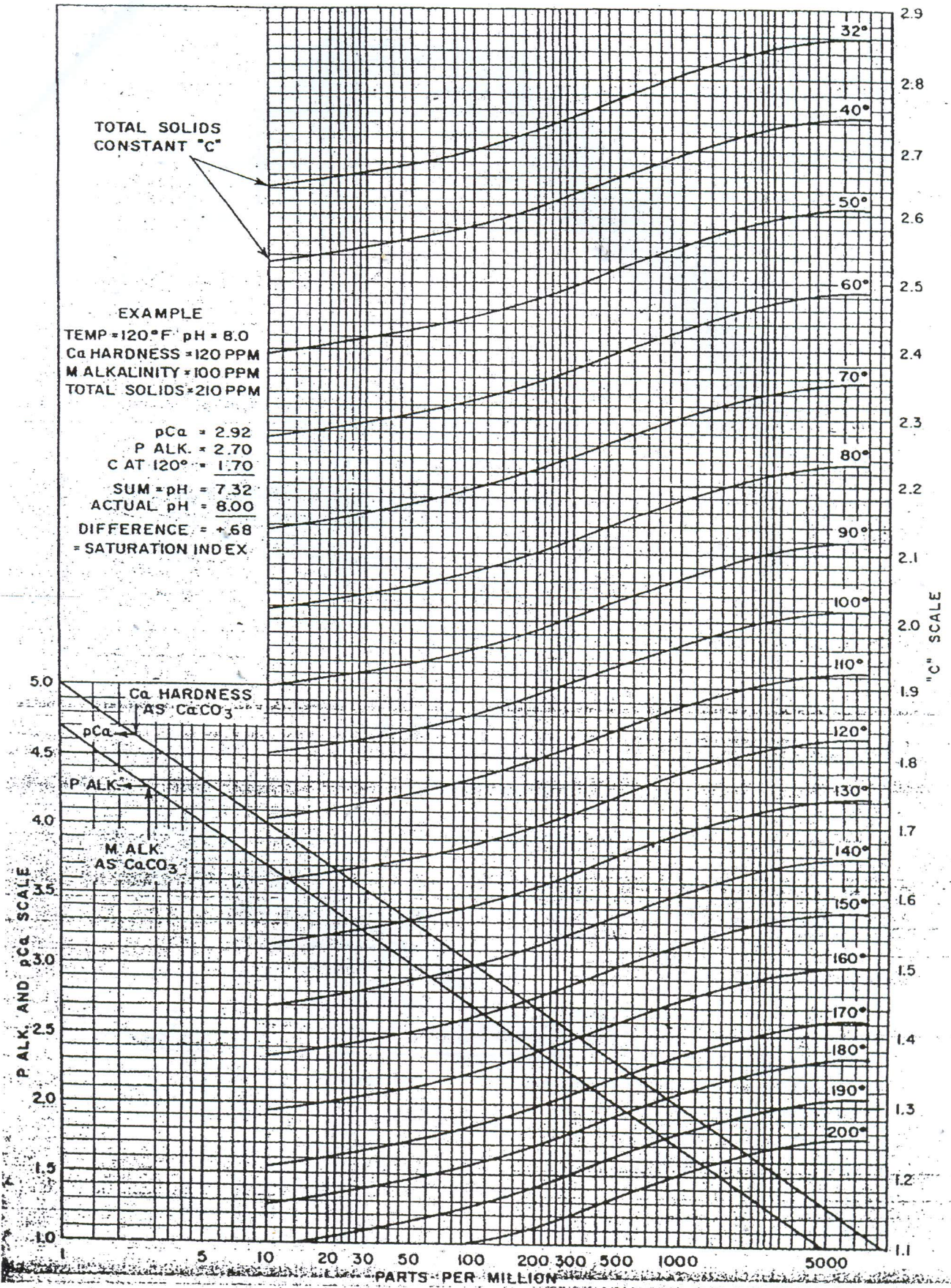


Chart 2: Langelier Saturation Index

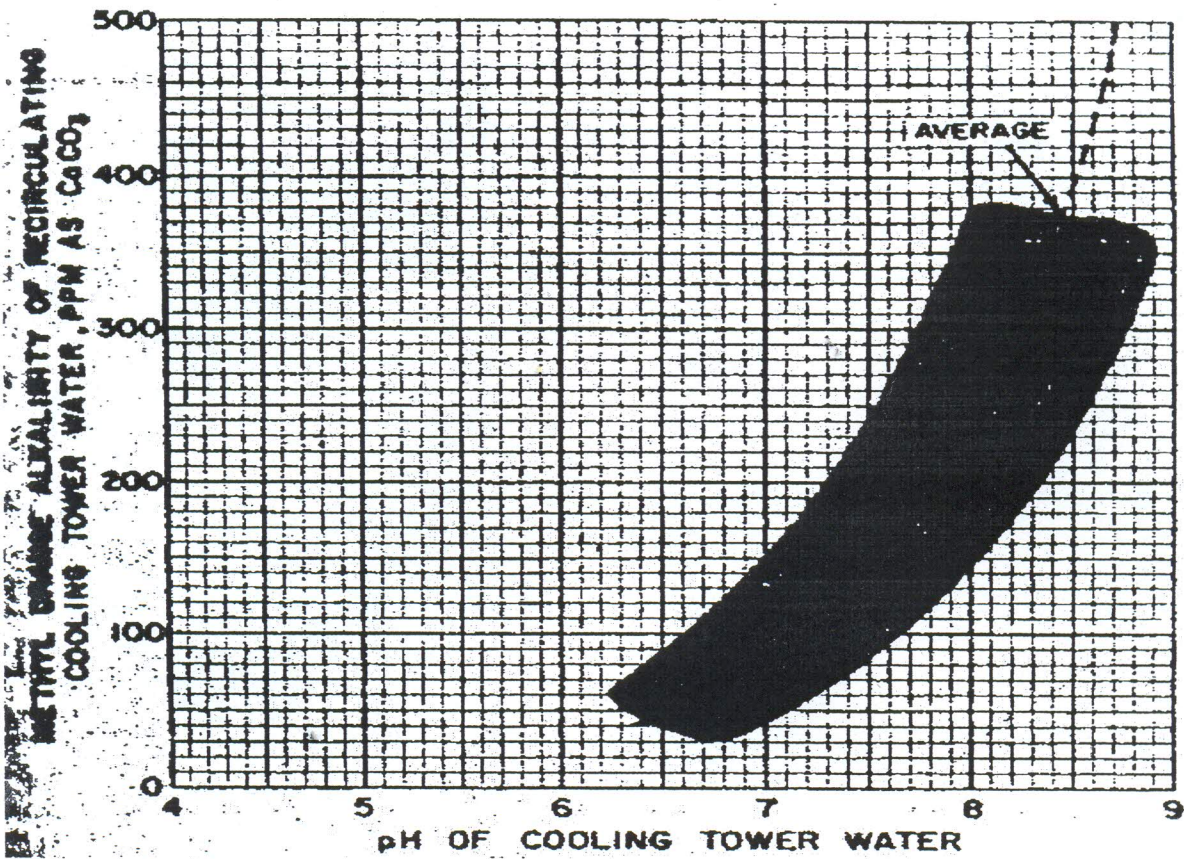


Chart 4: Expected pH of cooling Tower water

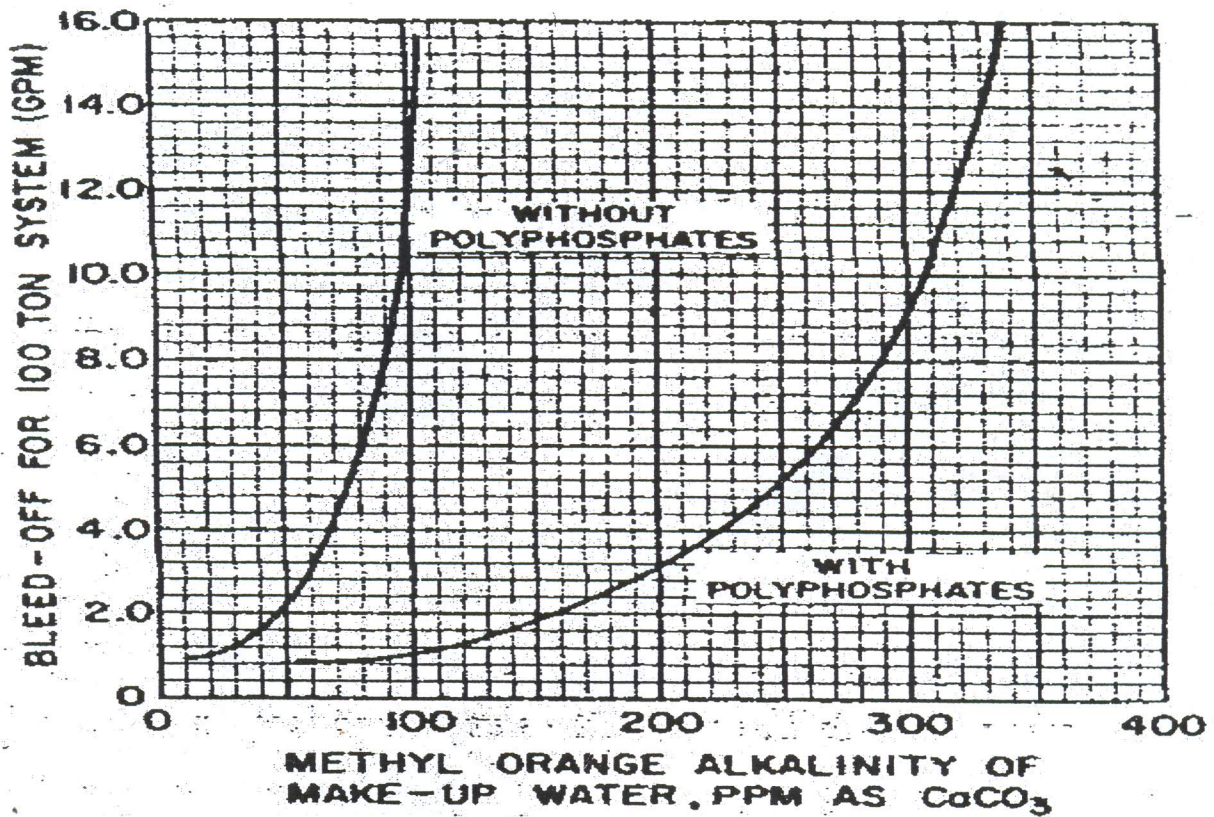


Chart 4: Bleed-off Required to prevent scale formation (100 Ton system)