UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2014 SESSION

SUBJECT CODE	:	FRD 20203
SUBJECT TITLE	:	REFRIGERANTS AND WATER TREATMENT
LEVEL	:	DIPLOMA
TIME / DURATION	:	3.30 pm - 5.30 pm (2 HOURS)
DATE	:	0 2 JUN 2014

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 two(2) question only.

6. Answer all questions in English.

7. Periodic Table is Appended (RETURNABLE)

THERE ARE 6 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 and 5 good properties of refrigerant.

(6 marks)

(b)   Explain about ozone depletion potential process

(6 marks)

(c)   Give 5 effects of ODP in Air-Coditioning Industries.

(8 marks)

Question 2

(a)   What is recovery, recycle and reclaim of refrigerant

(5 marks)

(b)   Explain procedure to do pump-down process

(7 marks)

(c)   List 5 safety procedure during air-conditioning work

(3 marks)

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

Table: Q2 d): 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)
R22					
R123					
R410A					
R717					

(10 marks)

(e)   Fill in the Safety Group below (A1,A2,A3,B1,B2,B3):

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

Table: Q2 e): Safety group of Refrigerants Specification

	Lower Toxicity	Higher Toxicity
Higher Flammability		
Lower Flammability		
No Flame Propagation		

(5 marks)

Question 3

a) A heat pump that operates on the ideal vapor-compression cycle with refrigerant-134a is used to heat a house and maintain it at 24 C by using underground water at 10 C as the heat source. Select reasonable pressures for the evaporator and the condenser, and explain why you chose those values.

(5 marks)

b) A refrigerator that operates on the ideal vapor-compression cycle with refrigerant-134a is to maintain the refrigerated space at -10 C while rejecting heat to the environment at 25 C. Select reasonable pressures for the evaporator and the condenser, and explain why you chose those values.

(5 marks)

SECTION B (Total: 40 marks)
INSTRUCTION: Answer TWO(2) questions only.

Question 4

Refer to Figure Q4.

(a)   What is the problem might be happening due to these arrangement. Explain your
        answer.

(5 marks)

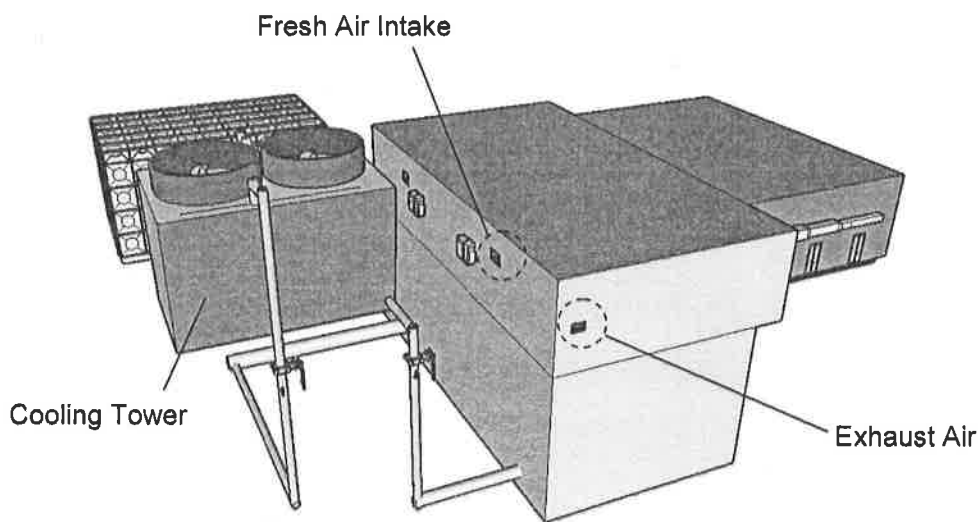Figure Q4(a): HVAC system in Building

(b)   Explain Bleed-off, Addition of Acid and pH adjustment methods of scale control in
        condenser water piping system? Explain your answer.

(10 marks)

(c)   Is scale control required in chilled water piping system?
        Explain your answer

(5 marks)

Question 5

Refer to Appendices attached.

Given:

A once-thru condenser:

Methyl orange alkalinity	=	110pm as $CaCO_3$
Calcium hardness	=	85 ppm as $CaCO_3$
Total solids	=	250 ppm
pH	=	8.0
Condensing water temperature	=	115°F

**(Note: Plot and detach related chart and attached to your answer sheet)**

(a)   Calculate the Langelier Saturation Index (I_s)

(5marks)

(b)   Calculate the Scaling tendency and state the tendency of water

(5 marks)

(c)   Calculate the Ryznar Stability Index and state the tendency of water

(5marks)

(d)   Explain corrosion control of water problems in HVAC water treatment

(5 marks)

Question 6

Refer to Appendices attached.

Given:

A once-thru condenser:

Methyl orange alkalinity	=	80pm 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)   Calculate the Langelier Saturation Index (I_8)

(5marks)

(b)   Calculate the Scaling tendency and state the tendency of water

(5 marks)

(c)   Calculate the Ryznar Stability Index and state the tendency of water

(5 marks)

(d)   Explain 3 effect of corrosion in air-conditioning system.

(5 marks)

END OF QUESTION

APPENDICE

APPENDIX 1
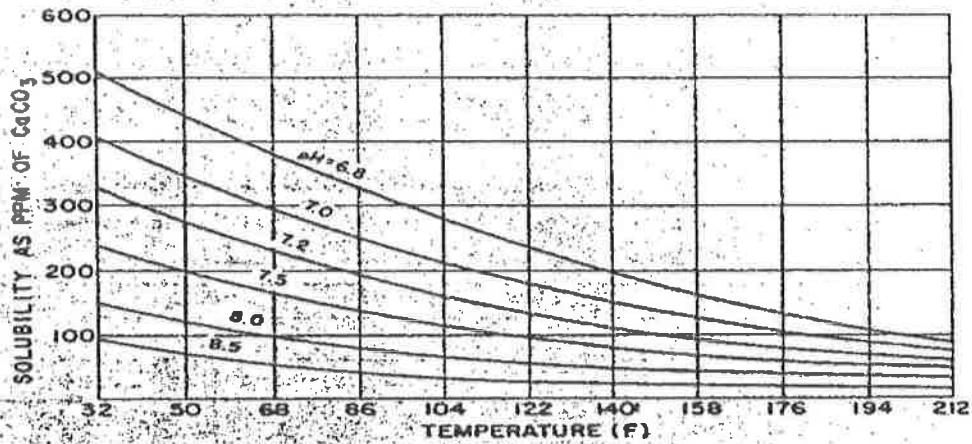
NOTE: pH values at approximately 73 F.

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

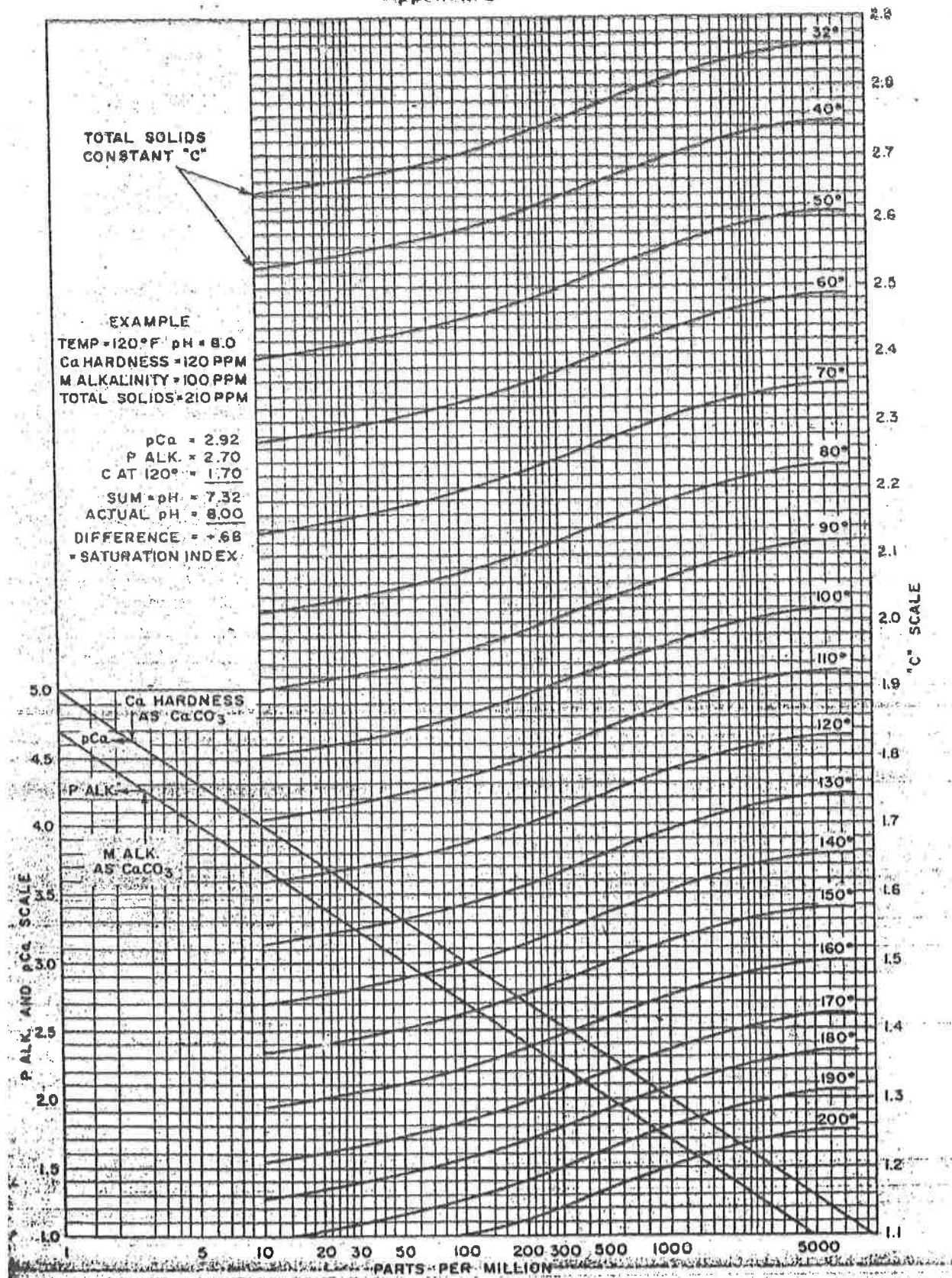| RYZNAR STABILITY INDEX	TENDENCY OF WATER
4.0 - 5.0	heavy scale
5.0 - 6.0	light scale
6.0 - 7.0	little scale or corrosion
7.0 - 7.5	corrosion significant
7.5 - 9.0	heavy corrosion
9.0 and higher	corrosion intolerable

Appendix 2

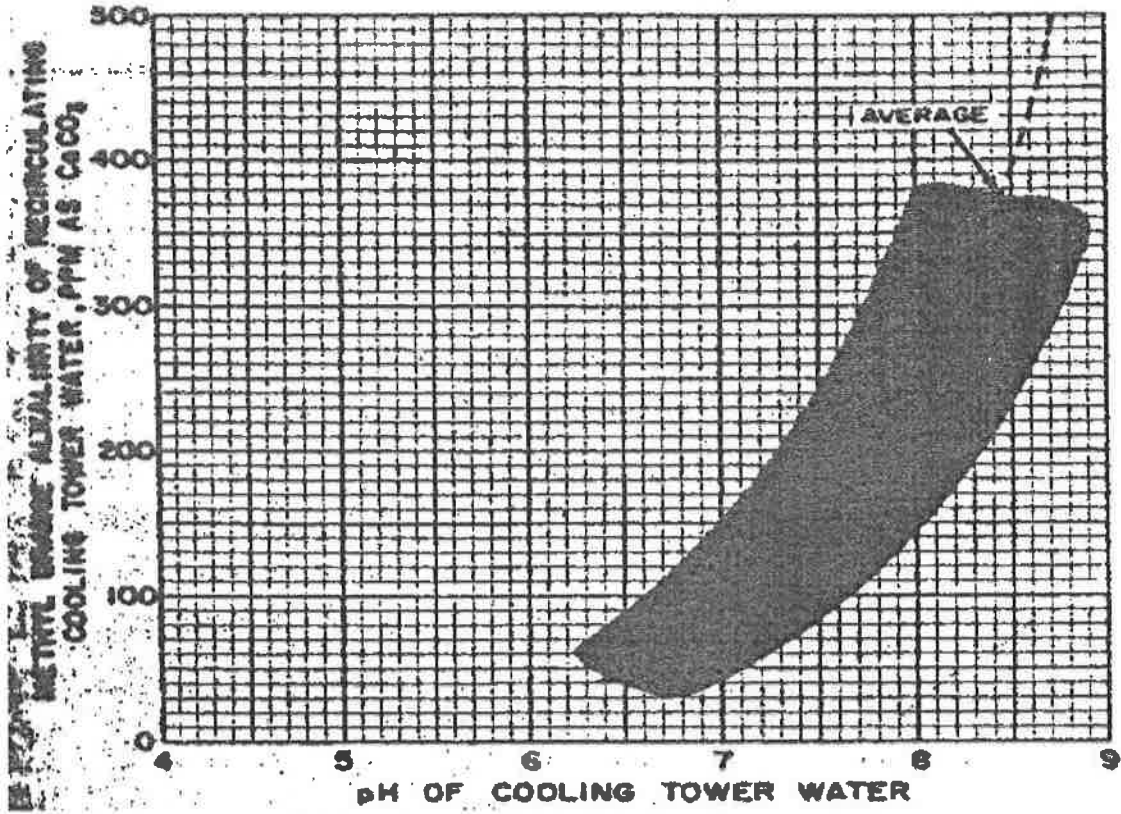**Chart 2: Langelier Saturation Index**
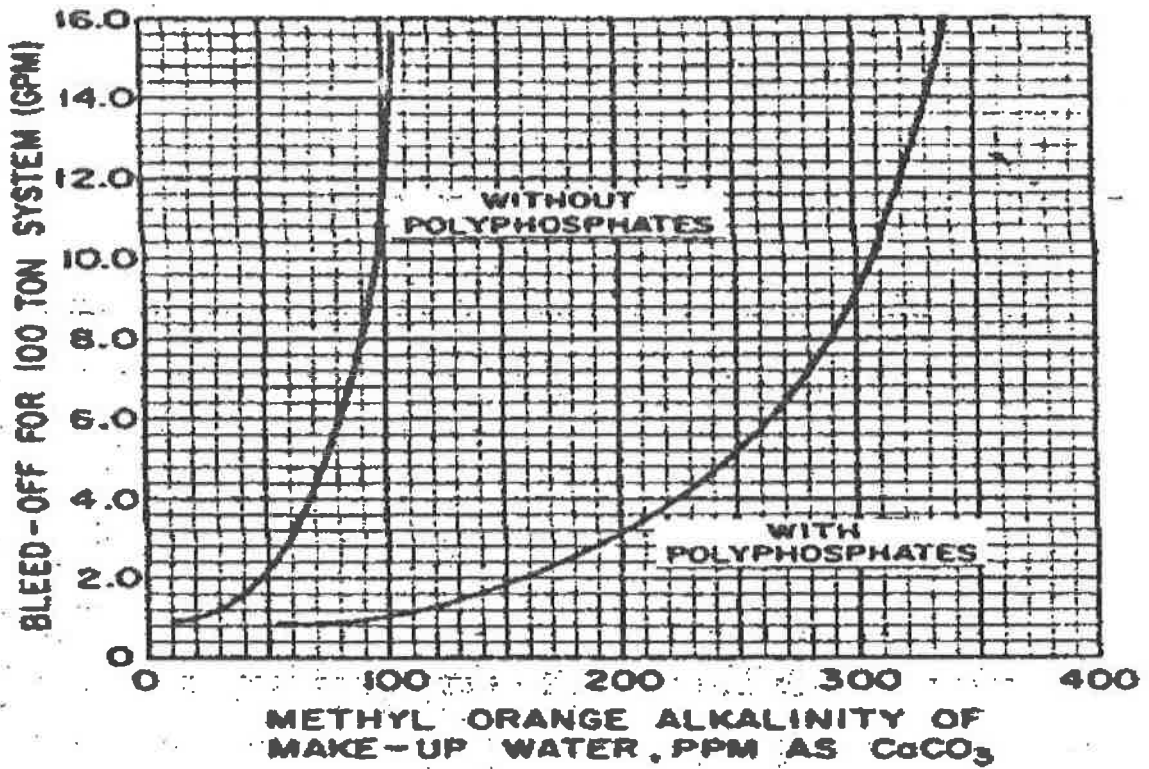
Appendix 3

Chart 4: Expected pH of cooling Tower water

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