



**UNIVERSITI KUALA LUMPUR
Malaysia France Institute**

**FINAL EXAMINATION
SEPTEMBER 2014 SESSION**

SUBJECT CODE : FRB10103
SUBJECT TITLE : REFRIGERATION FUNDAMENTALS
LEVEL : BACHELOR
TIME / DURATION : 9.00 AM – 11.00 AM
(2 HOURS)
DATE : 2 JANUARY 2015

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. Answer all questions in English.
 6. Mollier and psychrometric chart is appended.
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THERE ARE 4 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

(Total: 100 marks)

INSTRUCTION: Answer all questions.

Please use the answer booklet provided.

Question 1

- (a) Explain briefly the difference application between Air conditioning system and Refrigeration (refrigerator) system. (4 marks)
- (b) When selecting a refrigerant for certain application, what is the five (5) qualities refrigerant that you are looking for? (5 marks)
- (c) Gives four (4) major components consist in refrigeration system and define each component function. (6 marks)
- (d) Define the term of Sensible Heat and Latent Heat. (4 marks)
- (e) List down the 3 modes of heat transfer and explain briefly each modes (6 marks)

Question 2

(Please write answers on the answer booklet provided)

- (a) Complete table Q3(a) by writing your answer derived from the Psychrometric chart
(Appendix 1)

Table Q3(a): Value reading from the chart

Dry Bulb (°C)	Wet Bulb (°C)	Dew point (°C)	RH (%)	SpV (m ³ /kg)	Moisture (kg/kg.da)	Enthalpy (kJ/kg)
30			60			
30	27					
20		15				

(15 marks)

- (b) Fill in the blank in Table Q3 (b) below.

Table Q3(b): The most commonly type of refrigerant

Refrigerant (symbol)	Cylinder Color code	Application	Classification
R12			
R22			
R410A			
R134A			HFC
R11	Orange	Centrifugal Chiller	

(10 marks)

Question 3

Figure Q4 below shows the cooling coil passing through an Air Handling Unit (AHU). The volume flow rate of air is 67 CFM with the temperature at entry of 90°F (DB) / 60% RH and the leaving condition of 50°F (DB) saturated after the cooling coil.

a) Determine the properties of specific volume , wet bulb , grain of moisture, dew point and enthalpy for entering air and leaving cooling coil air by using psychrometric chart

(Appendix 2)

Please submit with the answer booklet.

(10 marks)

b) Calculate :

- i. The heat added per pound Δh
- ii. The grain of moisture added Δw
- iii. Sensible heat , Btu/hr
- iv. Latent heat , Btu/hr
- v. Total heat , Btu/hr
- vi. Total heat (formula : $4.5 \times \text{cfm} \times \text{Btu/hr}$)

(10 marks)

vii. Between the total heat from question (v) and (vi) what is your conclusion?

(3 marks)

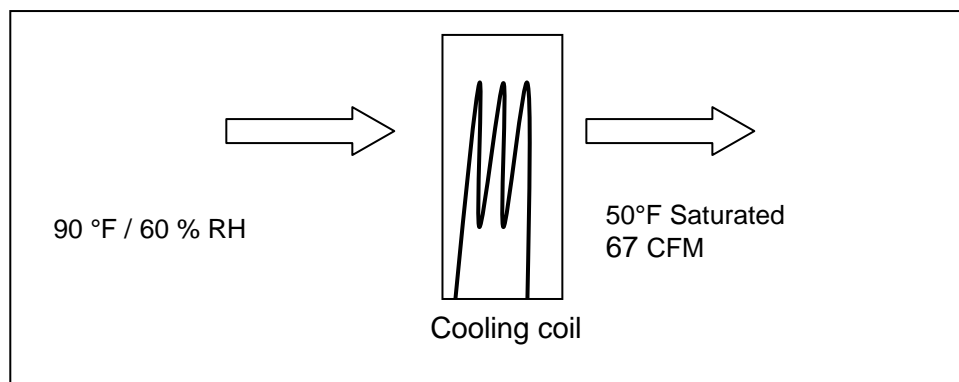


Figure Q4 : Cooling coil passing through Air Handling unit (AHU)

Question 4

A basic Refrigeration system uses R-134a as refrigerant which the cycles without pressure drop at refrigerating capacity is 40 kW measured data such as:

- Low pressure : 2 bar G
- Suction Temperature: 5 °C
- High Pressure: 10 bar G
- TXV Temperature: 35 °C
- Entropy Constant

(a) Draw the Refrigeration cycle diagram using Mollier chart (**Appendix 3**)

(7 marks)

(b) Determine the sub cool and the superheat

(4 marks)

(c) Calculate the :

- i. Compression ratio
- ii. Flash gas
- iii. Refrigerant Effect
- iv. Circulation rate of refrigerant
- v. Power at compressor
- vi. COP
- vii. Volume flow rate at Compressor

(14 marks)

END OF QUESTION