



**UNIVERSITI KUALA LUMPUR  
Malaysia France Institute**

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**FINAL EXAMINATION  
JANUARY 2010 SESSION**

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<b>SUBJECT CODE</b>	<b>: FRD 10103</b>
<b>SUBJECT TITLE</b>	<b>: REFRIGERATION FUNDAMENTAL &amp; TOOLS</b>
<b>LEVEL</b>	<b>: DIPLOMA</b>
<b>TIME / DURATION</b>	<b>: 12.30pm – 3.30pm ( 3 HOURS)</b>
<b>DATE</b>	<b>: 04 MAY 2010</b>

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**INSTRUCTIONS TO CANDIDATES**

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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 answer on the answer booklet provided.
  4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
  5. This questions paper consists of **TWO (2) sections. Section A and B. Answer ALL questions in Section A. For Section B, answer THREE (3) questions only.**
  6. Answer all questions in English.
  7. Mollier and Psychrometric chart is appended must be submitted together with question booklet.
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**THERE ARE 9 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.**

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**SECTION A (Total: 25 marks)****INSTRUCTION: Answer ALL questions.**

Please use the answer booklet provide

1. Which of these is not expressed as Atmospheric pressure?
  - A. 1.033 kgf/cm<sup>2</sup>
  - B. 760 mmHg
  - C. 14.7 lbf/in<sup>2</sup>(psi)
  - D. 14.7 Bar
  
2. Which of the aspects below are fundamental processes of a refrigeration cycle:
  - I. Expansion
  - II. Convection
  - III. Compression
  - IV. Evaporation
  - A. I, II and III
  - B. I, III and IV
  - C. II, III and IV
  - D. I, II, III and IV
  
3. Give the name of the instrument that measures the atmospheric pressure.
  - A. Barometer
  - B. Anemometer
  - C. Manometer
  - D. Thermometer
  
4. A Compound gauge is use to .....
  - A. show the highest and the lowest temperature reached
  - B. show pressure-temperature relationship
  - C. measure pressure (psig) and vacuum (in.Hg)
  - D. give accurate readings in the usual range and approximate readings over the wider range.
  
5. The correct location for TXV sensing bulb is :
  - A. at the condenser outlet.
  - B. at the condenser outlet
  - C. on the compressor side of the external equalizer tube
  - D. at the evaporator outlet

6. What is the name of the instrument to measure used the differential pressure?
- A. Manifold gauge
  - B. Barometer
  - C. Manometer
  - D. Anemometer
7. Convert 40 °F to Rankine.
- A. 500 R
  - B. 313 R
  - C. -420 R
  - D. 420 R
8. Sensible heat causes:
- A. A rise in a thermometer
  - B. A fall in a thermometer
  - C. No change in thermometer
  - D. Change from ice to melt
9. "..... a form of energy, it is related to the molecular motion or vibration." This is the definition for,
- A. Heat transfer
  - B. Temperature
  - C. Heat flow
  - D. Energy
10. One tone refrigeration is:
- A. 1200 Btu
  - B. 12,000 Btu/h
  - C. 120,000 Btu
  - D. 120,000 Btu/h
11. Which of the following are the two methods of classification by compression?
- I. Density Compression
  - II. Temperature Compression
  - III. Volumetric Compression
  - IV. Centrifugal Compression
- A. I and II
  - B. III and IV
  - C. II and III
  - D. I and IV

Question 12 and 13 refers to the figure 1

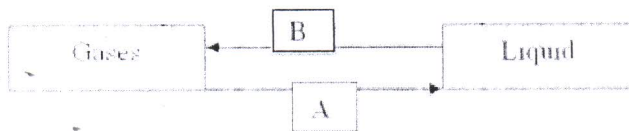


Figure 1: Changes of state

Figure 1 above shows the changes of state occurring at the same temperature and pressure. Give the name of the physical state for each of the process

12. At point A
  - A. Sublimation
  - B. Vaporization
  - C. Fusion
  - D. Condensation
13. At point B
  - A. Sublimation
  - B. Vaporization
  - C. Fusion
  - D. Condensation
14. Which of the following are the types of refrigerant flow control?
  - I. Capillary tube
  - II. Automatic expansion valve
  - III. Thermostatic expansion valve
  - IV. Band expansion valve
  - A. I, II and III
  - B. I, II and IV
  - C. II, III and IV
  - D. I, II, III and IV
15. A Multimeter is a common multi-purpose measuring equipment used to measure the following quantities except :
  - A. Ammeter
  - B. Vaporization
  - C. Voltmeter
  - D. Ohmmeter
16. The units of vacuum on compound pressure gauge are read in?
  - A. inches of air inches of water
  - B. inches of water
  - C. inches of ammonia
  - D. inches of mercury

17. Which of these Compressor types are not classified as volumetric compression method?
- A. Reciprocating type
  - B. Rotary type
  - C. Scroll type
  - D. Single type
18. Relative humidity can be measured by using
- A. Thermopyrometer
  - B. Sling psychrometer
  - C. Dry-bulb thermometer
  - D. Volt-ohmmeter
19. A Receiver tank is placed between
- A. Condenser and metering device
  - B. Compressor and Condenser
  - C. Evaporator and metering device
  - D. Evaporator and Compressor
20. Which two of the following belong to the Rotary compressor?
- I. Volute Castle
  - II. Rolling Piston
  - III. Sliding Vane
  - IV. Impeller Vane
- A. I, and II
  - B. III and IV
  - C. II and III
  - D. I and IV
21. What is the normal cause for a compressor's piston or roller to break
- A. Compressor compressing the refrigerant liquid
  - B. Compressor compressing the liquid refrigerant vapor
  - C. Compressor operating at high temperature
  - D. Condenser clogged with dirt



22. The low side of the refrigeration system includes:
- A. A metering device
  - B. Accumulator
  - C. Muffler
  - D. A receiver
23. The function of a check valve in air conditioning is .....
- A. to detect the moisture occur in refrigeration system
  - B. to allow the refrigerant to flow in one direction
  - C. to break up the pressure pulses which create noise
  - D. to prevent the liquid refrigerant to entering compressor.
24. Which items below are categorized as HFCs
- I. R11 ( $\text{CCl}_3\text{F}$ )
  - II. R410A ( $\text{CH}_2\text{F}_2/\text{C}_2\text{HF}_5$ )
  - III. R22 ( $\text{CHClF}_2$ )
  - IV. R134a ( $\text{CH}_2\text{FCF}_3$ )
- A. I, and II
  - B. I and III
  - C. II and IV
  - D. II and III
25. Figure 2 is a four way valve (reverse valve). The main reason for the U-pipe movable is due to the :

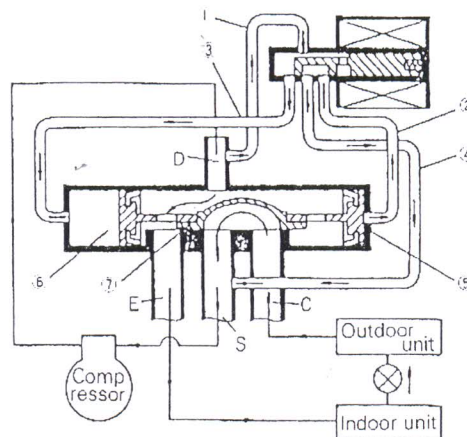


Figure 2 : On time constituting of refrigerant passage

- A. magnetic field electrified by the solenoid valve attract/push U-pipe
- B. high pressure of line4 pushes the U-pipe
- C. differential pressure created by solenoid valve between line 2 and line 3
- D. mechanical motion of compressor in reverse compression

**SECTION B (Total: 75 marks)**

**INSTRUCTION:** Answer THREE (3) questions only.

Please use the answer booklet provided only question 2 write the answer in the question booklet.

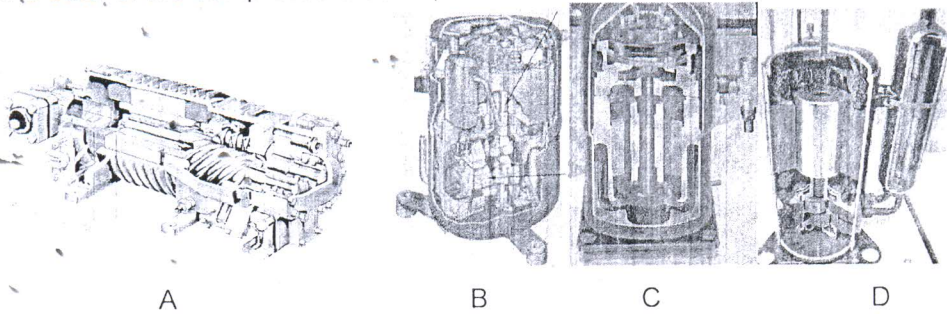
**Question 1**

a) Define the terms :

- i. Temperature
- ii. Heat

(6 marks)

b) Name each of the compressors below;



(4 marks)

c) What is a refrigeration cycle?

- i. Draw the simple refrigeration circuit including the major components

(7 marks)

- ii List and briefly explain the function of 4 major components in a refrigeration system.

(8 marks)

**Question 2**

(Detached this page and submit with the answer booklet).

- a) i. Fill the correct answer in table 1 below.

Nos	Unit	Convert to	answer
a.	500 g	kg	
b	20 kg	g	
c	100 kPa	psi	
d	250 psi	kPa	
e	25 °C	°F	
f	90 °F	°C	
g	-20 °C	K	
h	400 K	°C	
i	20 °F	R	
j	150 R	°F	

Table 1 : Conversion table

(10 marks)

- ii. Complete table 2 by using Psychrometric chart (**Appendix 1**)  
**(Please submit with the answer booklet)**

Dry Bulb (°C)	Wet Blub (°C)	Dewpoint (°C)	RH (%)	SpV (m <sup>3</sup> /kg)	Moisture (g/kg.da)	Enthalpy (KJ/kg)
35			50			
27	24					
26		20				

Table 2 : Read data from psychrometric chart

(15 marks)



**Question 3**

A basic system uses R-22 as refrigerant assuming the cycles without pressure drop, Refrigerating capacity is 30 kW such as:

- Low pressure : 75 psig
- Suction Temperature: 15 °C
- High Pressure : 250 psig
- Temperature before TXV : 35 °C
- Isentropic Constant

- a) Draw and plot on the Refrigeration cycle using Mollier chart. **(Appendix 2)**  
**(Please submit with the answer booklet)**

(7 marks)

- b) Determine and calculate the
- i. Discharge temperature,
  - ii. Sub cool and the
  - iii. Superheat
  - iv. Compression ratio
  - v. Flash gas
  - vi. Refrigerant Effect
  - vii. Circulation rate of refrigerant
  - viii. Power at compressor
  - ix. COP

(18 marks)

## Question 4

Figure 1 below shows the cooling coil passing through in Air Handling Unit (AHU) where the volume flow rate is 67 cfm which in that temperature entering is 90 °F(DB) /60%RH and leaving cooling coil is 50 °F(DB) saturated.

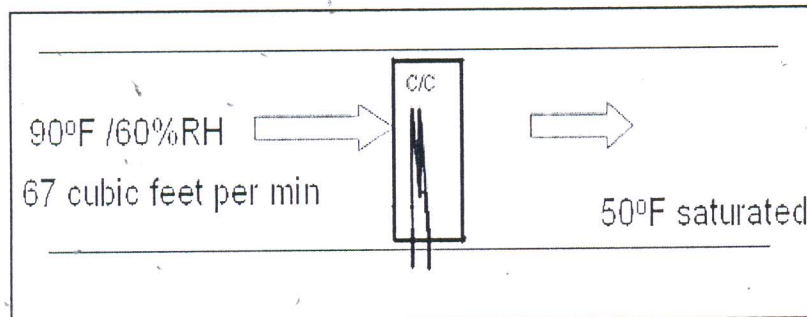


Figure 1: Air conditioning process at cooling coil

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

(Appendix 3) (Please submit with the answer booklet)

(10 marks)

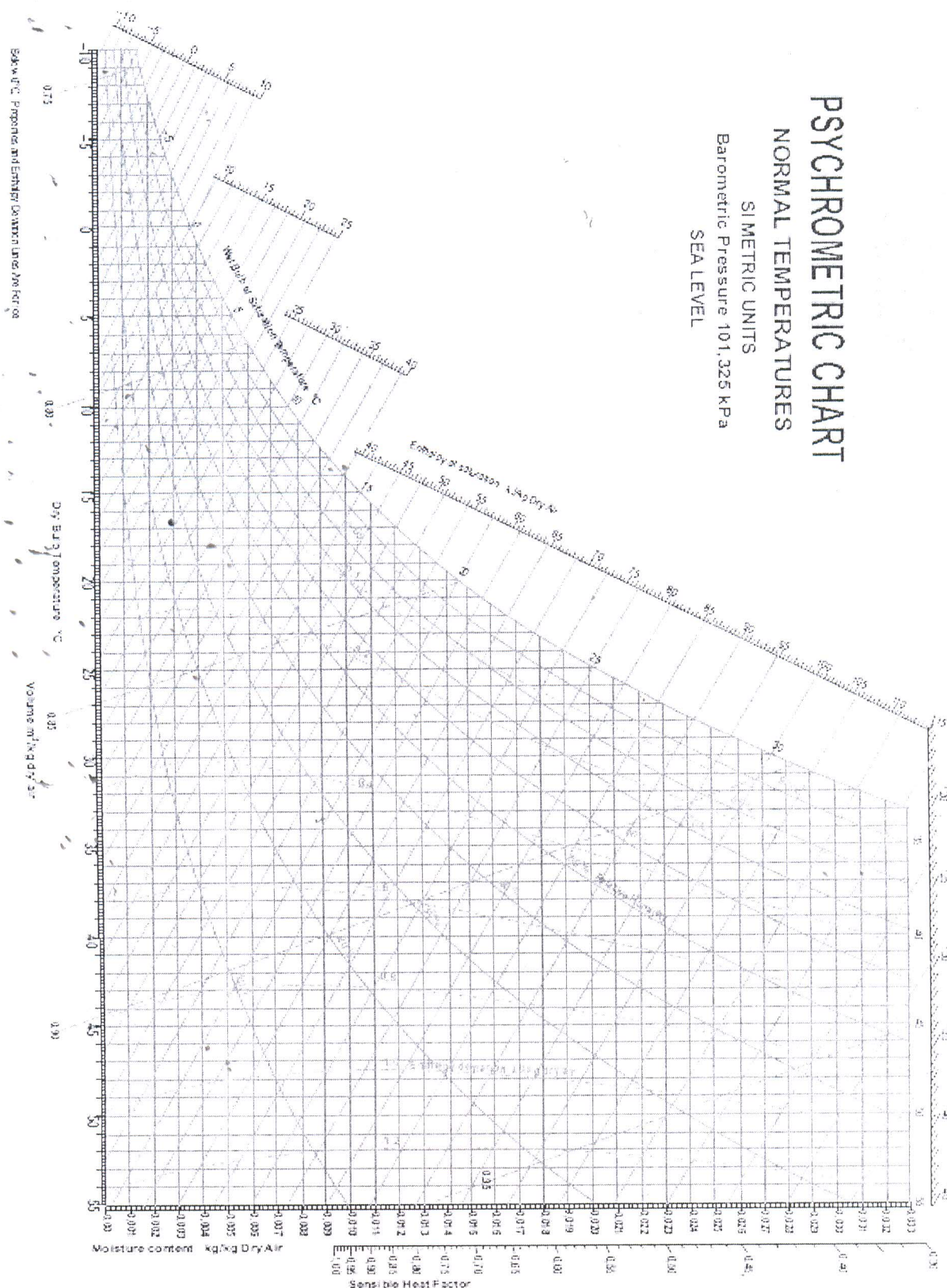
- b) Calculate:

- i. The heat added per pound,  $\Delta h$
- ii. The grain of moisture added,  $\Delta w$
- iii. Sensible heat, Btuh
- iv. Latent heat, Btuh
- v. Total heat, Btuh
- vi. Total heat (formula:  $4.5 \times \text{cfm} \times \text{Btuh}$ )
- vii. Compare between the total heat from question (v) and (vi) what is your opinion about this comparison?

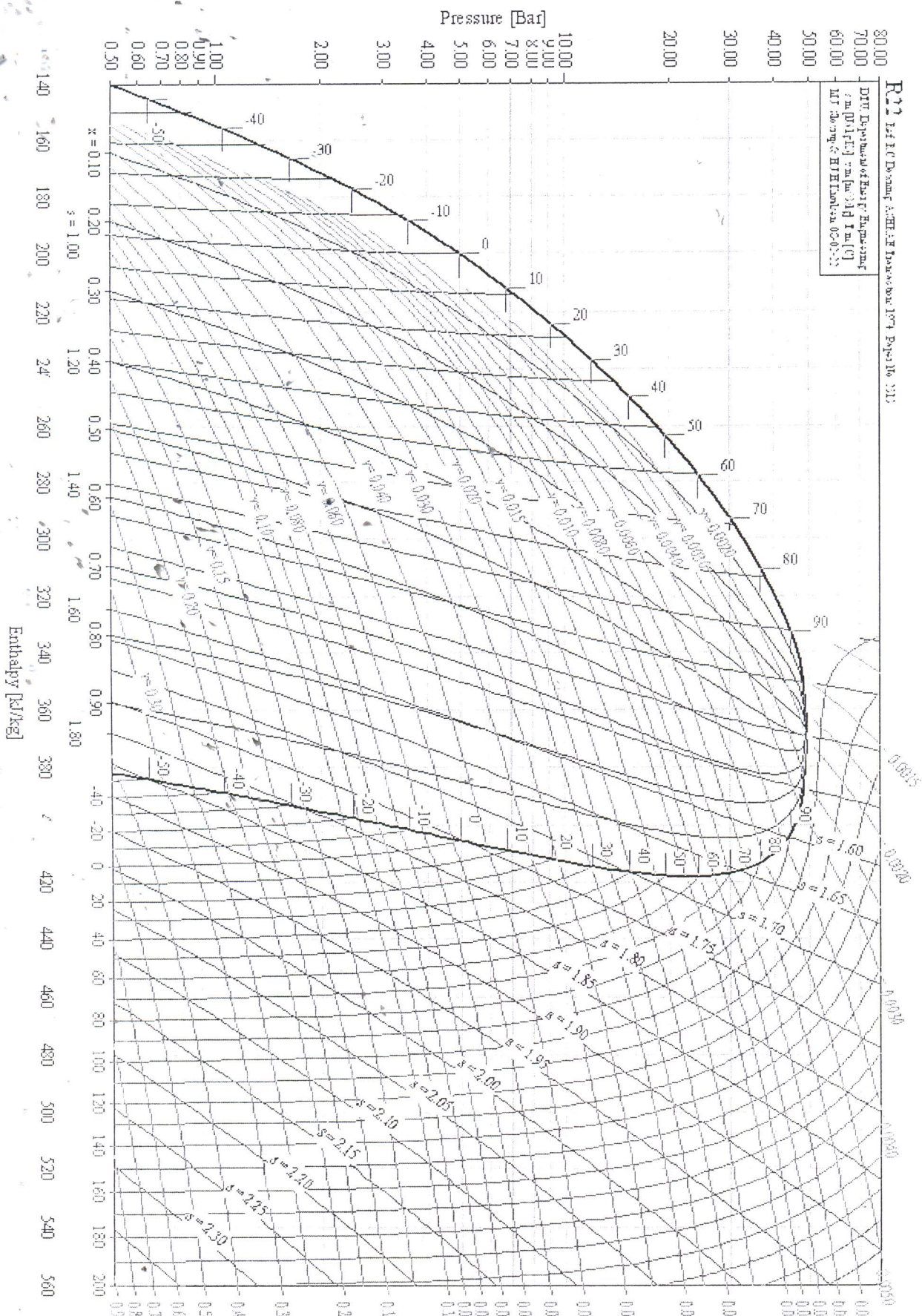
(15 marks)

END OF QUESTION

# APPENDIX

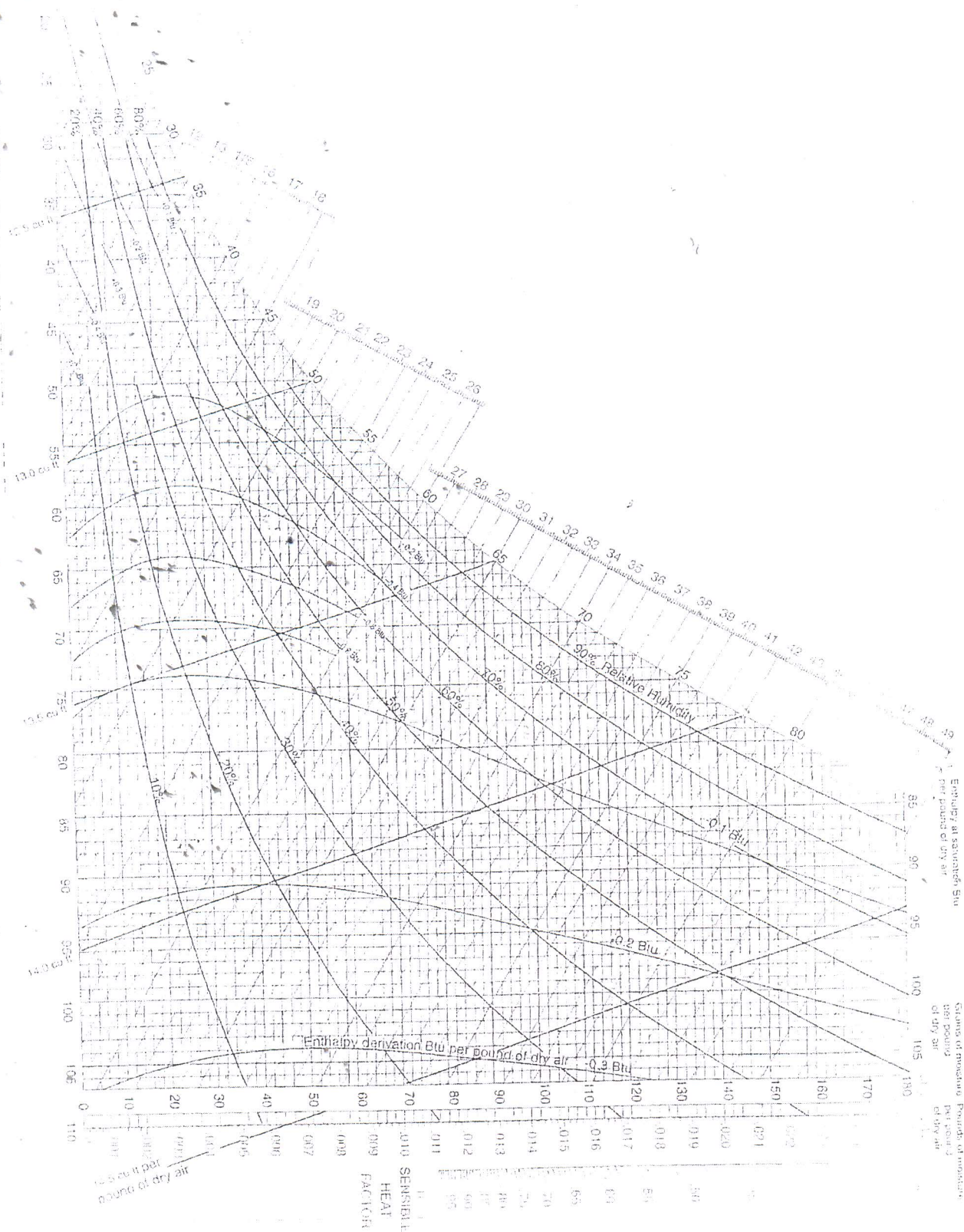








an M-20A of which in that registered context, of Corbin Corp. when



## FORMULA

### Mollier chart

- a. Compression ratio  
= High pressure / Low pressure
- b. Flash gas  
=  $(h_4 - h_4') / (h_1 - h_4')$
- c. Refrigerant effect  
=  $(h_1 - h_4)$
- d. Circulation rate of refrigerant  
= refrigerating capacity / refrigerant effect
- e. Power at compressor  
= circulation rate x  $(h_2 - h_1)$
- f. COP  
= Refrigerating capacity / Power at compressor
- g. COP  
=  $(h_1 - h_4) / (h_2 - h_1)$

### Psychrometric chart

- a. Volume flow rate = Area x Velocity
- b. Area = Length x Wide
- c. Q sensible =  $1.08 \times \text{cfm} \times \Delta t$
- d. Q latent =  $0.68 \times \text{cfm} \times \Delta w$
- e. Q total = Q sensible + Q latent