



**UNIVERSITI KUALA LUMPUR
Malaysia France Institute**

**FINAL EXAMINATION
JULY 2010 SESSION**

SUBJECT CODE : FRB10102
SUBJECT TITLE : REFRIGERATION FUNDAMENTALS
LEVEL : BACHELOR
TIME / DURATION : 12.30 pm – 2.30 pm
(2 HOURS)
DATE : 18 NOVEMBER 2010

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 three (3) question only.
6. Answer all questions in English.

THERE ARE 4 PAGES OF QUESTIONS AND 2 PAGES OF APPENDICES, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

a) Determine the process for **A, B, C, D, E** from Diagram Q1(a) below

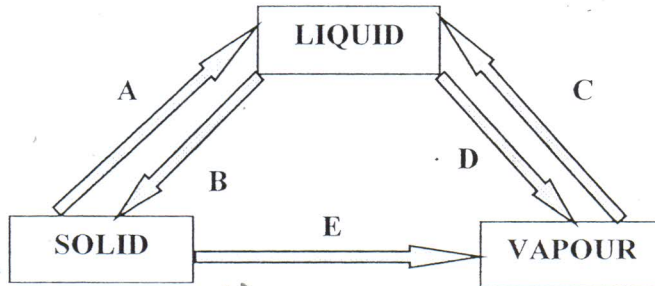


Diagram Q1(a)

(5 marks)

b) What is the differences and similarity between air-conditioning and refrigeration?

(5 marks)

Question 2

a) List down 3 method of heat transfer and explain it briefly

(6 marks)

b) On the refrigeration circuit of pressure of 1 bar is measured with pressure gauge and at temperature of 5°C, from the P-h diagram of R-22 in the appendix determine

i) State of the refrigerant

(1 marks)

ii) Saturation temperature, °C

(1 marks)

iii) Value of vapor saturated enthalpy, kJ/kg

(2 marks)

iv) Value of the liquid saturated enthalpy, kJ/kg

(2 marks)

v) Value of LV (Latent Heat Vaporization)

(3 marks)

Question 3

- a) Give 2 differences between latent heat and sensible heat in air-conditioning
(4 marks)
- b) Explain briefly the process of subcooling and superheating and why most of the refrigeration systems need this process?
(5 marks)
- c) Explain the term of DBT, WBT and RH
(6 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer THREE (3) questions only.

Please use the answer booklet provided.

Question 4

- a) List out 5 main properties for refrigerant R-134a
(5 marks)
- b) When selecting a refrigerant for certain application, which qualities of refrigerant that you are looking for? List 5 qualities
(5 marks)
- c) How can CFC and HCFC refrigerant can be hazardous to our ozone? Describe with chemical equation
(10 marks)

Question 5

At air 32°C and 80% relative humidity is passed through a cooling coil and leave as saturated. The heat extracted by the cooling coil from air is 12.5 kW and air flow rate is 39.5 m³/min. By using psychrometric chart in the appendix

- a) Determine the enthalpy, specific volume, specific humidity, DBT and WBT of the air leaving the cooling coil
(15 marks)
- b) Coil by pass factor
(5 marks)

Question 6

Air enters into a 50cm diameter simple heating section at 1 atm, 18°C and 30% relative humidity at 18m/s passes through a heating coil as shown in Figure Q6 below. The rate heat transfer during this heating section is 30kW. By using psychrometric chart in the appendix determine

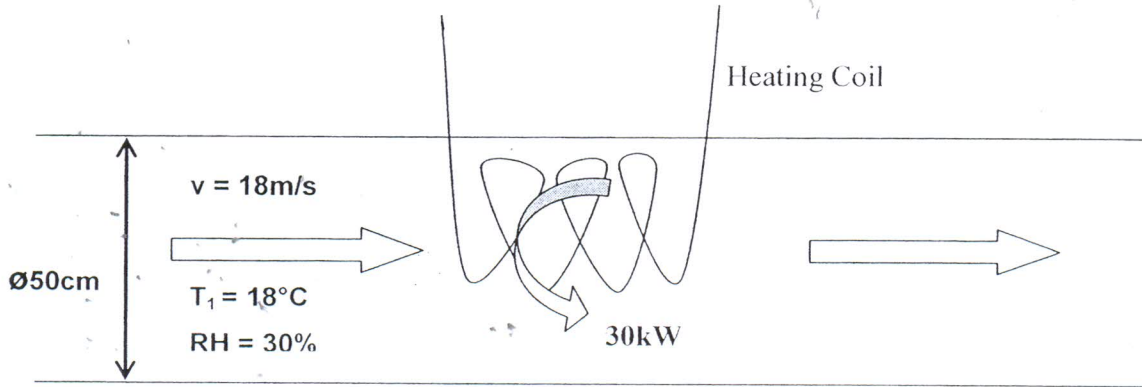


Figure Q6

- a) Exit temperature, °C (10 marks)
- b) Exit relative humidity of the air, % (5 marks)
- c) Exit velocity, m/s (5 marks)

Question 7

Figure Q7 below shows the basic refrigeration cycle on the P-h chart.

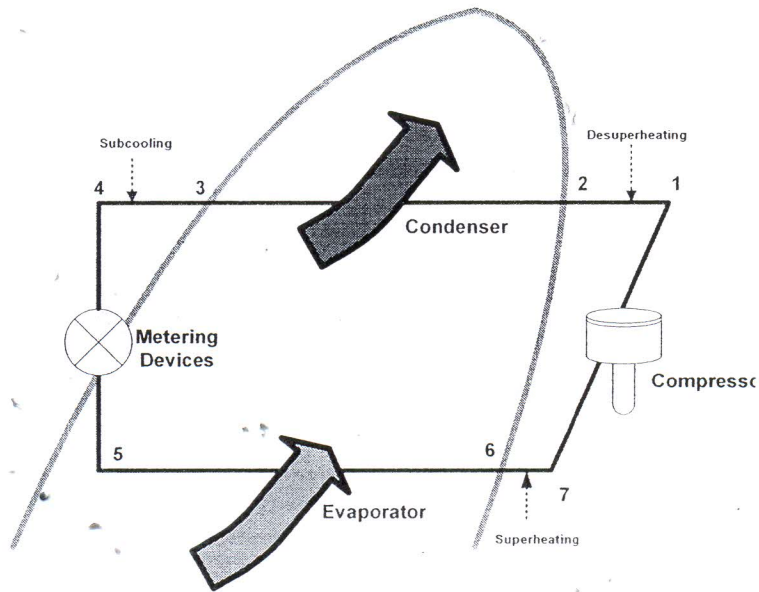
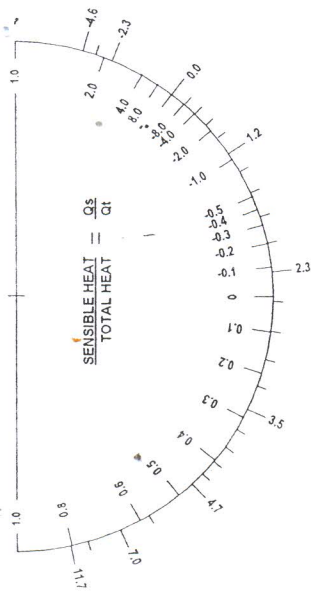


Figure Q7

- a) Explain the functions of Compressor, Condenser, Evaporator and Metering devices? (10 marks)
- b) List five types of compressors (5 marks)
- c) List five types of metering devices (5 marks)

END OF QUESTION

APPENDIX



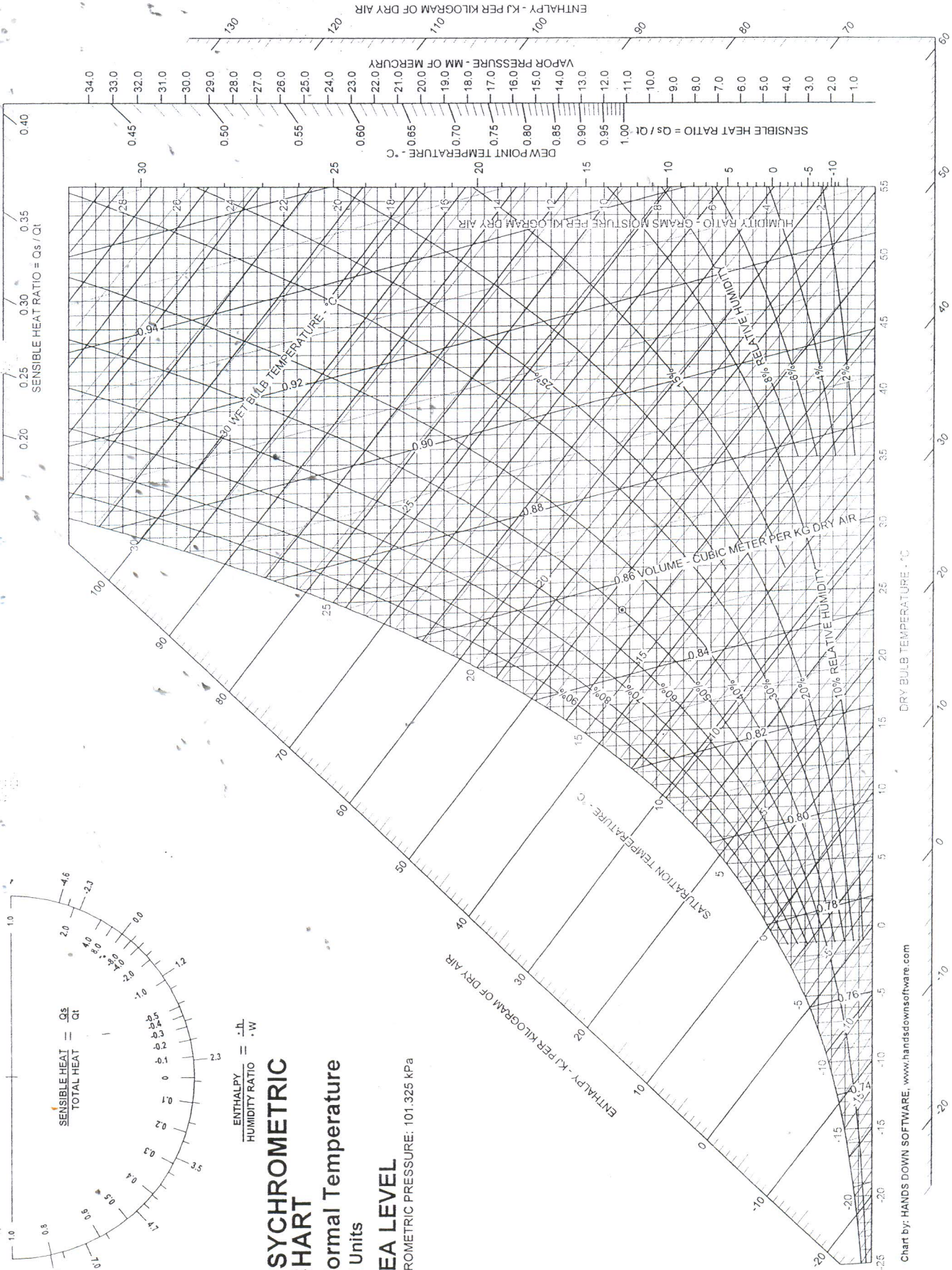
PSYCHROMETRIC CHART

Normal Temperature

SI Units

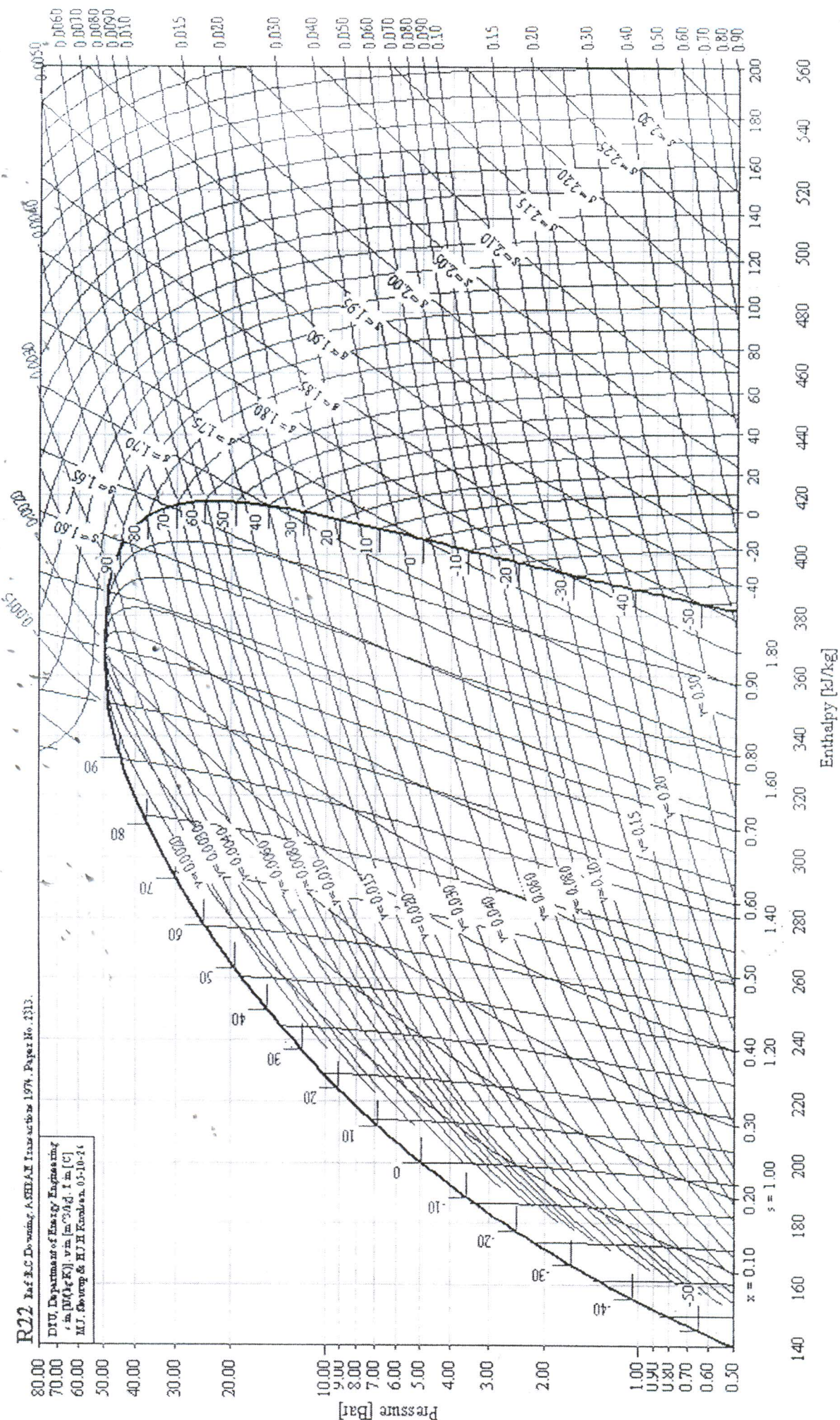
SEA LEVEL

BAROMETRIC PRESSURE: 101.325 kPa



R22 Ref. S.C. De Young, ASHRAE Transactions 1974, Paper No. 4313.

DTU, Department of Energy Engineering
 (in DWG/K), v.m. in °C and t in [C]
 M.J. Gwynne & H.J.H. Kankers, 03-10-21



Enthalpy [kJ/kg]

Pressure [Bar]

x = 0.10
s = 1.00