



UNIVERSITY OF RUHUNA
FACULTY OF AGRICULTURE
Third Examination in BSc Green Technology- (Part I)
April - 2021
EN 3104 Post Harvest Technology – (Compulsory)

TIME: 1 ½ Hours

INDEX NUMBER

STRUCTURED AND ESSAY TYPE

Answer all questions in PART-A within the spaces provided.
 Use given answer book to answer question of part B.
 Only non-programmable calculators are permitted.
 Mobile phones are not allowed.

PART A: STRUCTURED TYPE - Answer all questions

1. (A) Post harvest supply chain of a grain was given in the Figure 1.

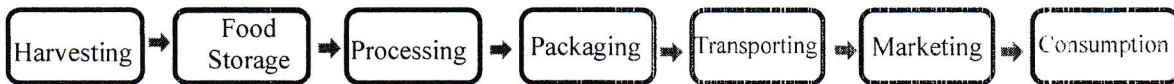


Figure 1

(i). Give reasons for food losses during the food storage?

- 1.....
- 2.....
- 3.....
- 4.....
- 5.....

(10Marks)

(ii) a. What is the step to be followed just after harvesting the paddy?

.....

b. What are the main principles used in the above operation? Give example for each.

Principle	Example
1.	
2.	
3.	

(15 marks)

(iii) Enlist main steps in paddy processing / milling.

.....

(10 marks).

(iv) a. Food waste happens at which stage/s of the above chain?

b. Give your suggestion to reduce food waste.

- 1.....
- 2.....
- 3.....

(10 marks)

(B) Solar dryer for chili drying is given in Figure 2.

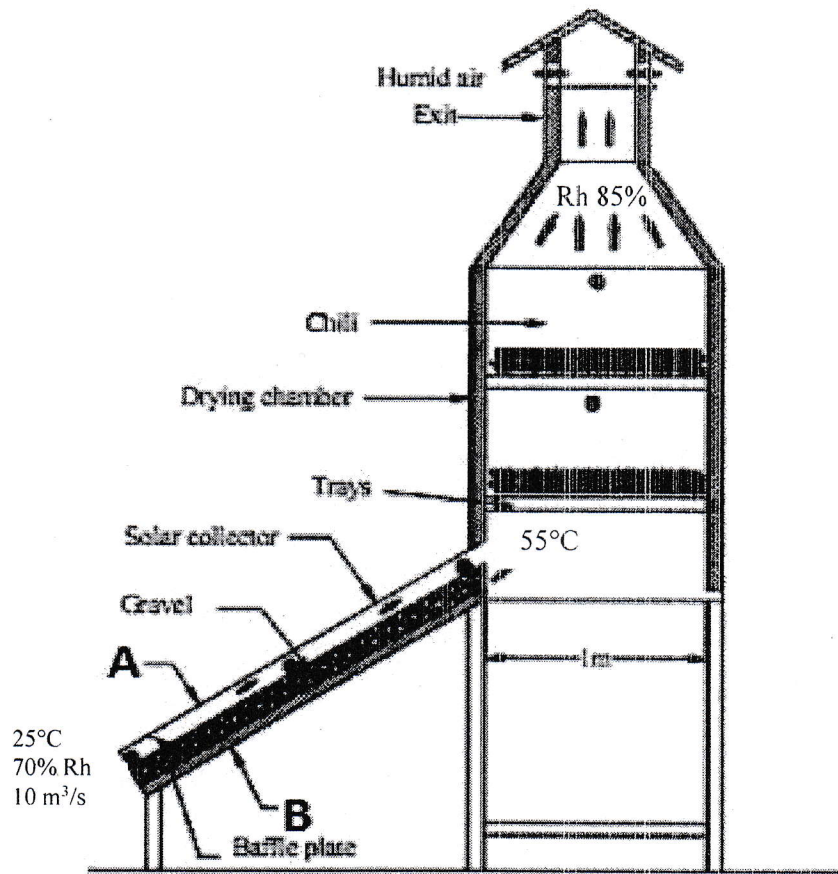


Figure 2

(i) What are the properties of material used to construct part A & B?

A-.....

B-.....

(5 marks)

(ii) Thermodynamic properties of drying air at different stages are given in the Figure 2. Visualize the changes of psychrometric properties of above process using arrows in the given Figure 3.

(5 marks)

Psychrometric Chart

SI (metric) units
 Barometric Pressure 101.325 kPa (Sea level)
 based on data from
 Carrier Corporation Cat. No. 794-001, dated 1975

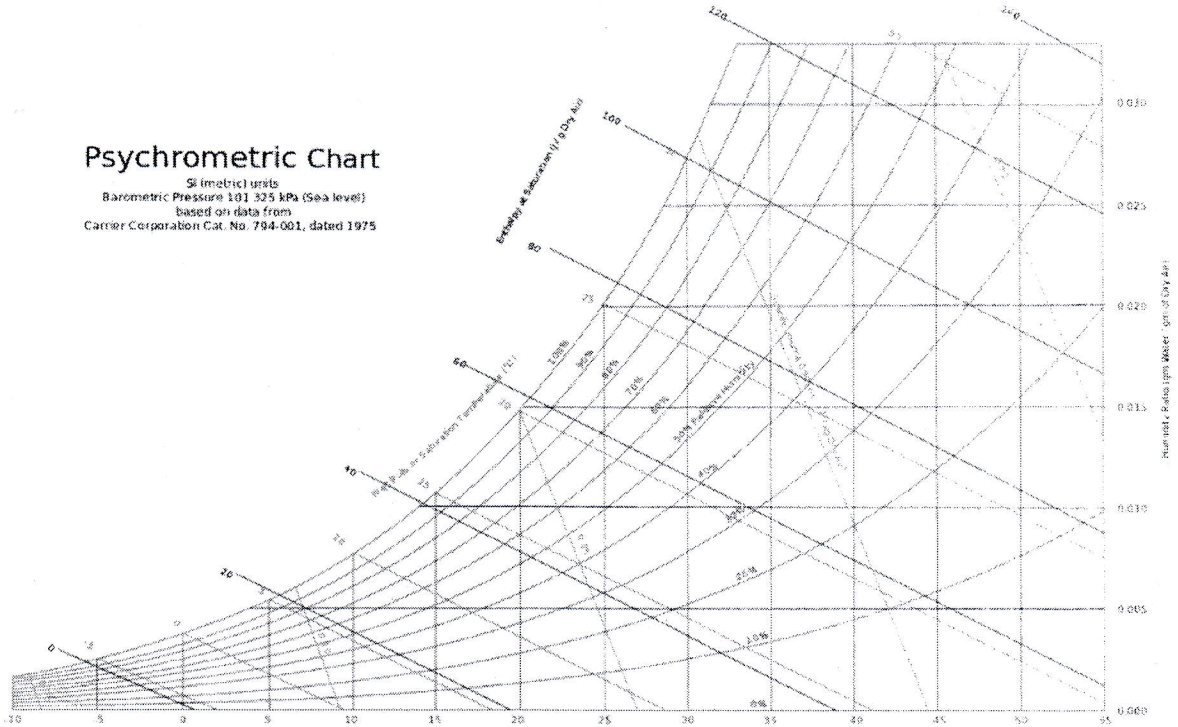


Figure 3

(iii) Calculate the required heat energy for 1 hr duration.

.....

.....

.....

.....

.....

.....

(15 marks)

(iv) Calculate the rate of moisture removal from the chili crop.

.....

.....

.....

.....

.....

.....

(15 marks)

(C) Phase diagram of water is given in Figure 4.

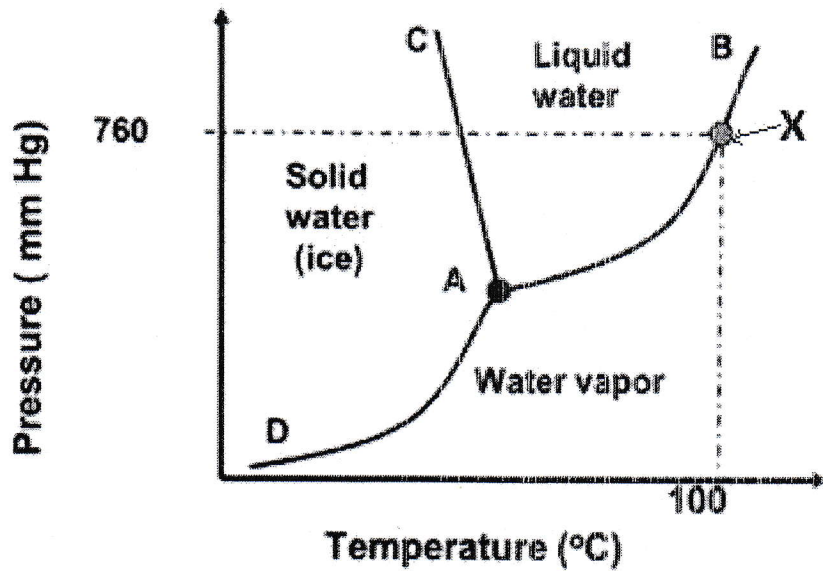


Figure 4

- (i) Draw the phase changes of water in the Figure 4 using arrows during
- Freeze drying (using dot line)
 - air drying (using straight line).

(5 marks)

- (ii) a. Name the following lines in the Figure 4

AD-.....

AC-.....

AB-.....

- b. What is the phase of water at point;

A-.....

X-.....

(10 marks)

Part B - Essays

Answer only 2 questions.

1. (a) Describe the application of green technology in post harvest managements toward food security. (15 marks)
- (b) Differentiate the followings.
- a. Microwave drying and infrared drying (15 marks)
- b. Conventional air drying and vacuum drying (15marks)
- (c) a. Explain the mechanism of ultrasound dehydration (10 marks)
- b. Describe the different phases in freeze drying cycle (10 marks)
- (d) If you were asked to prepare a proposal to estimate the post-harvest losses of a particular crop explain the procedure to be followed in post-harvest system approach. (20 marks)
- (e) What is the importance of physiological factors of agricultural product to prevent the post-harvest losses? (15 marks)
2. (a) What are the main factors should be considered when selecting a refrigerant today. (10 Marks)
- (b) (i) Draw a pressure Enthalpy chart and name its main parts. (15 Marks)
- (ii) Explain the process of refrigeration cycle using Pressure/ Enthalpy chart (25 Marks)
- (c) Data of the refrigeration cycle in R-22 refrigerant are given in Table 1

Table 1

Criteria	Value
Evaporating Temperature	-30°C
Evaporating Pressure	1.52 Bars
Condensing Temperature	10°C
Condensing Pressure	6.89 Bars
Subcool	-10°C
Superheat	20°C

- (i) Draw a refrigeration cycle of R-22 refrigerant in given p/h chart using data given in Table 1 (25 Marks)
- (ii) Calculate the Coefficient of performance of this cycle. Discuss the efficiency of this refrigeration cycle. (25 Marks)

3. (a) (i) Describe the parboiling principle. (10 marks)
- (ii) What is the benefit of it to rice industry? (15 marks)
- (b) (i) Describe the application of the psychrometry in post harvest technology of agricultural products. (15 marks)
- (ii) Describe the advantages of using the psychrometric chart. (10 marks)
- (c) (i) Air at 52°C and 10% RH is blown through a continuous dryer from which it emerges at a temperature of 35°C. Estimate the quantity of water removed per kg of air passing, and the volume of drying air required to remove 20 kg water per hour. (20 Marks)
- (ii) A flow of 1800 m³ h⁻¹ of air initially at a temperature of 18°C and 50% RH is to be used in an air dryer. It is heated to 50°C and passed over a set of trays in a shelf dryer, which it leaves at 60% RH. It is then reheated to 50°C and passed over another set of trays which it leaves at 60% RH again. Estimate the energy necessary to heat the air and the quantity of water removed per hour. (30 marks)
- Psychrometric chart are provided. Make your assumptions.

@@@@@@@@@@@@@@@@



PSYCHROMETRIC CHART

NORMAL TEMPERATURES

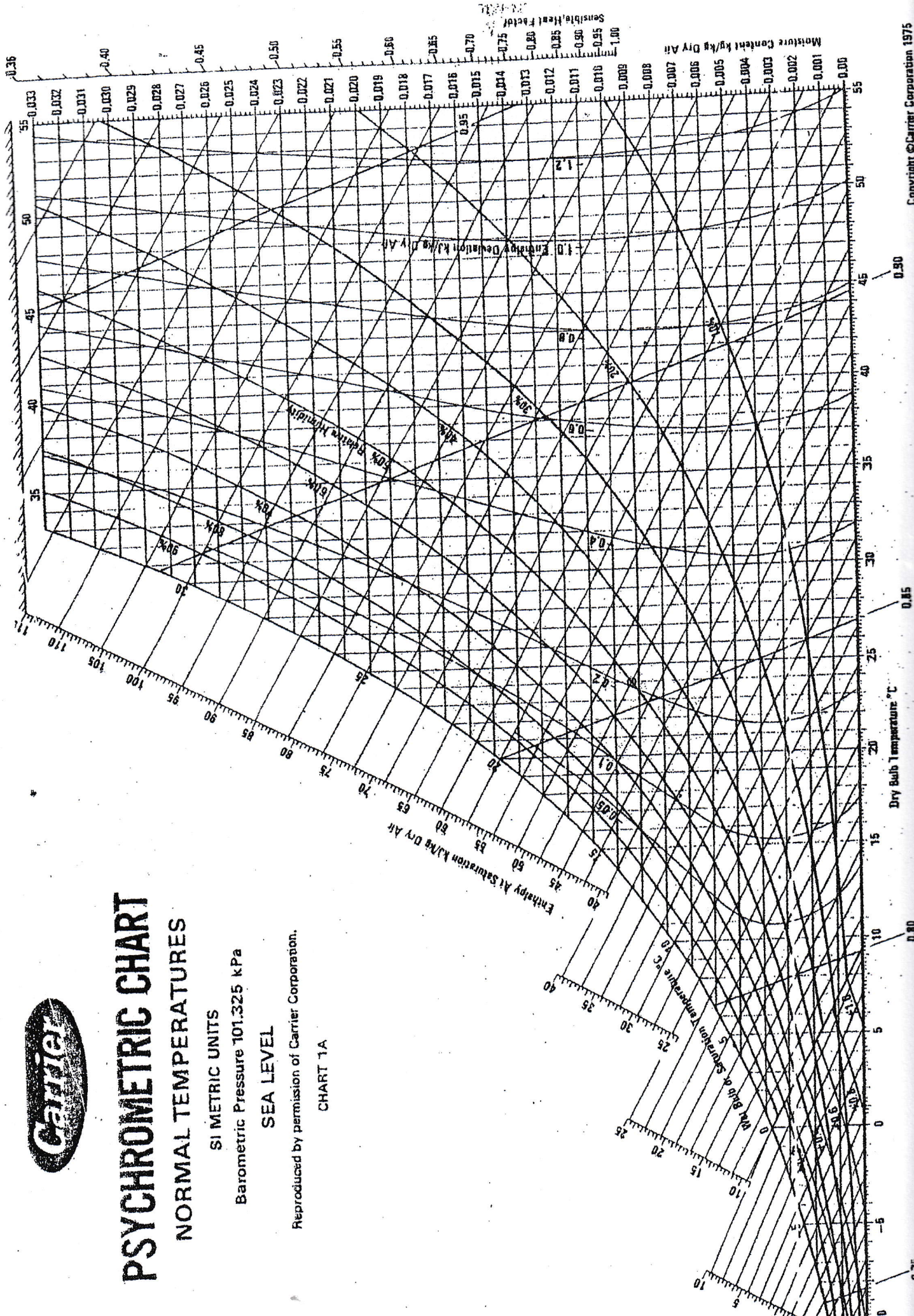
SI METRIC UNITS

Barometric Pressure 101.325 kPa

SEA LEVEL

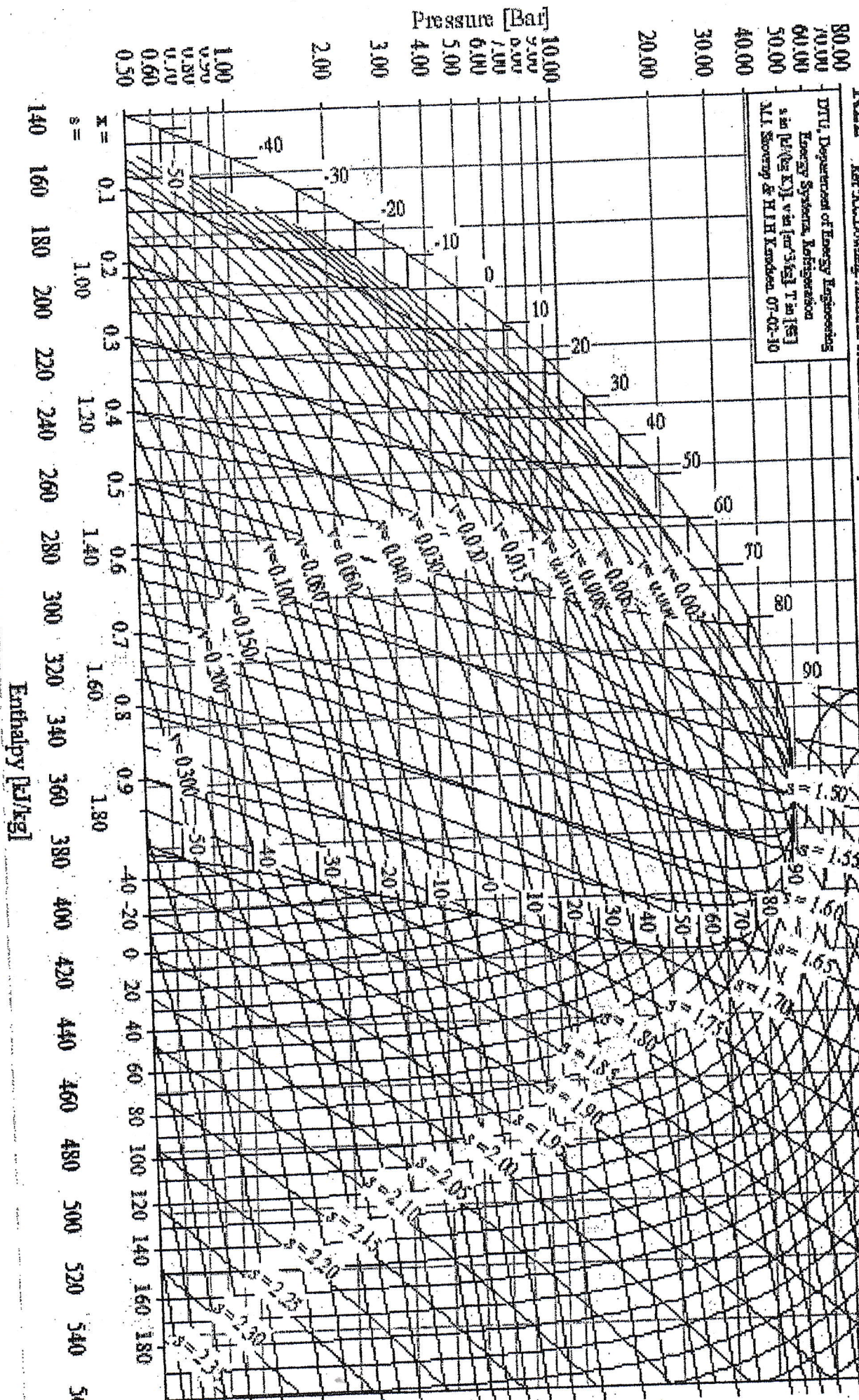
Reproduced by permission of Carrier Corporation.

CHART 1A



R22 Ref: A.C. Downey, ANSRAP Transactions 1974, Paper No. 2311

DTU, Department of Energy Engineering
 Energy Systems Refrigeration
 s in [kJ/kg K] via [m³/kg] T in [°C]
 All Symbols & Units as per ASHRAE 1974-10



Enthalpy [kJ/kg]