

2nd SEM.2009/2010



**UNIVERSITY OF SWAZILAND
SUPPLEMENTARY EXAMINATION PAPER**

PROGRAMME: BSC LWM (4)

COURSE CODE: LUM 406

TITLE OF PAPER: CROP PROCESSING AND STORAGE

TIME ALLOWED: TWO (2) HOURS

**SPECIAL MATERIAL REQUIRED: CALCULATOR &
 PSYCHROMETRIC
 CHART**

**INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO
OTHER QUESTIONS.**

**DO NOT OPEN THIS PAPER UNTIL PERMISSION HAS BEEN
GRANTED BY THE CHIEF INVIGILATOR**

SECTION ONE: COMPULSORY

QUESTION ONE

- (a) Define agricultural processing (4 Marks)
- (b) State four (4) benefits of processing agricultural produce. (6 Marks)
- (c) What is the significance of the following properties in grain handling and storage?
- a. Bulk density of grain (5 Marks)
 - b. Repose angle of grain (5 Marks)
- (d) A bin of grain is to be chilled with air at 100% RH, Tdb of 4.4 °C and an airflow rate of 1 699 m³/hr. The ambient air conditions are 29.4 °C (Tdb) and 21.1 °C (Twb). Using the heat equation given below and the psychrometric chart, determine the amount of heat that has to be removed per hour from the inlet air by a grain chilling unit.
[$H (kW) = R (m^3/s) \times T (°C) \times D (kg/m^3)$] (10 Marks)
- (e) A 500 gram sample of maize grain, at 35% moisture content, is accidentally mixed with 800 grams of maize grain at 25% moisture content. Calculate the resultant moisture content of the mixed grain. (10 Marks).

SECTION II: ANSWER ANY TWO QUESTIONS

QUESTION TWO

- (a) List the post-harvest challenges brought about by adopting modern crop production technologies such as use of hybrid seed, chemical fertilisers, irrigation etc. **(10 Marks)**
- (b) Write notes on maize physiological maturity **(10 Marks)**
- (c) Write the equations of grain moisture content expressed in wet (M_{cwb}) and dry basis (M_{cdb}). **(10 Marks).**

QUESTION THREE

- (a) Define Fineness Modulus **(3 Marks)**
- (b) In an attempt to classify a batch of milled grain, the following result was obtained in a sieve analysis.

Sieve Number	Weight of material retained above sieve (g)
2	0.0
4	22.8
8	26.8
14	94.0
28	33.6
48	141.2
100	26.0
Pan	55.6
Totals	400

- Determine the
 - (i) Percent retention for each sieve
 - (ii) Fineness modulus
 - (ii) Average grain size **(12 Marks)**
- (c) Give a full description of the oven method for determining grain moisture content. **(15 Marks)**

QUESTION FOUR

- (a) Define refrigeration (3 Marks)

- (b) In some parts of the world, temperature is still given in Fahrenheit (°F). In Swaziland we prefer to use express temperature in Celsius (°C). The formula to convert from Fahrenheit (°F) to Celsius (°C) is; $[^{\circ}\text{C}] = ([^{\circ}\text{F}] - 32) \times 5/9$. Develop a formula to convert from Celsius (°C) to Fahrenheit (°F). (5 Marks)

- (c) Figure 1 is a sketch of a Vapour Compression Refrigeration (VCR) cycle. Name the components indicated by letters A, B, C, and D and describe the thermodynamic state of the refrigerant in flow sections labeled 1, 2, 3, and 4. (16 marks)

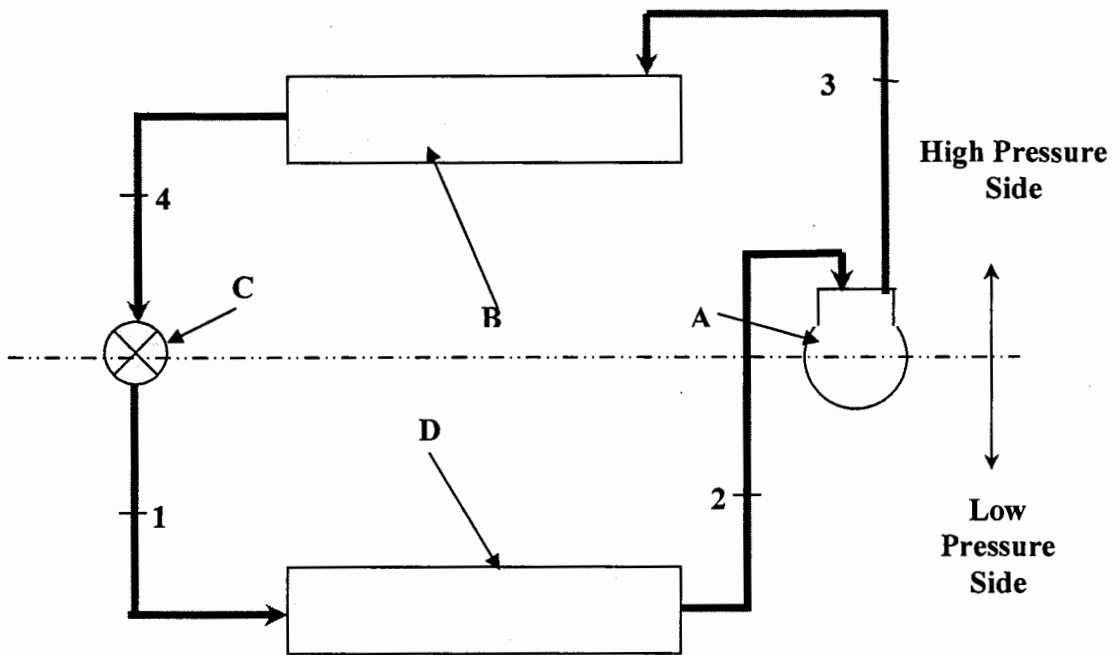
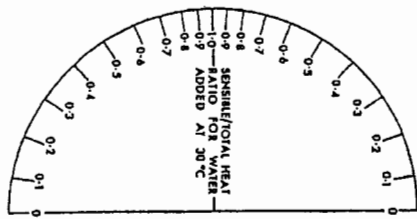
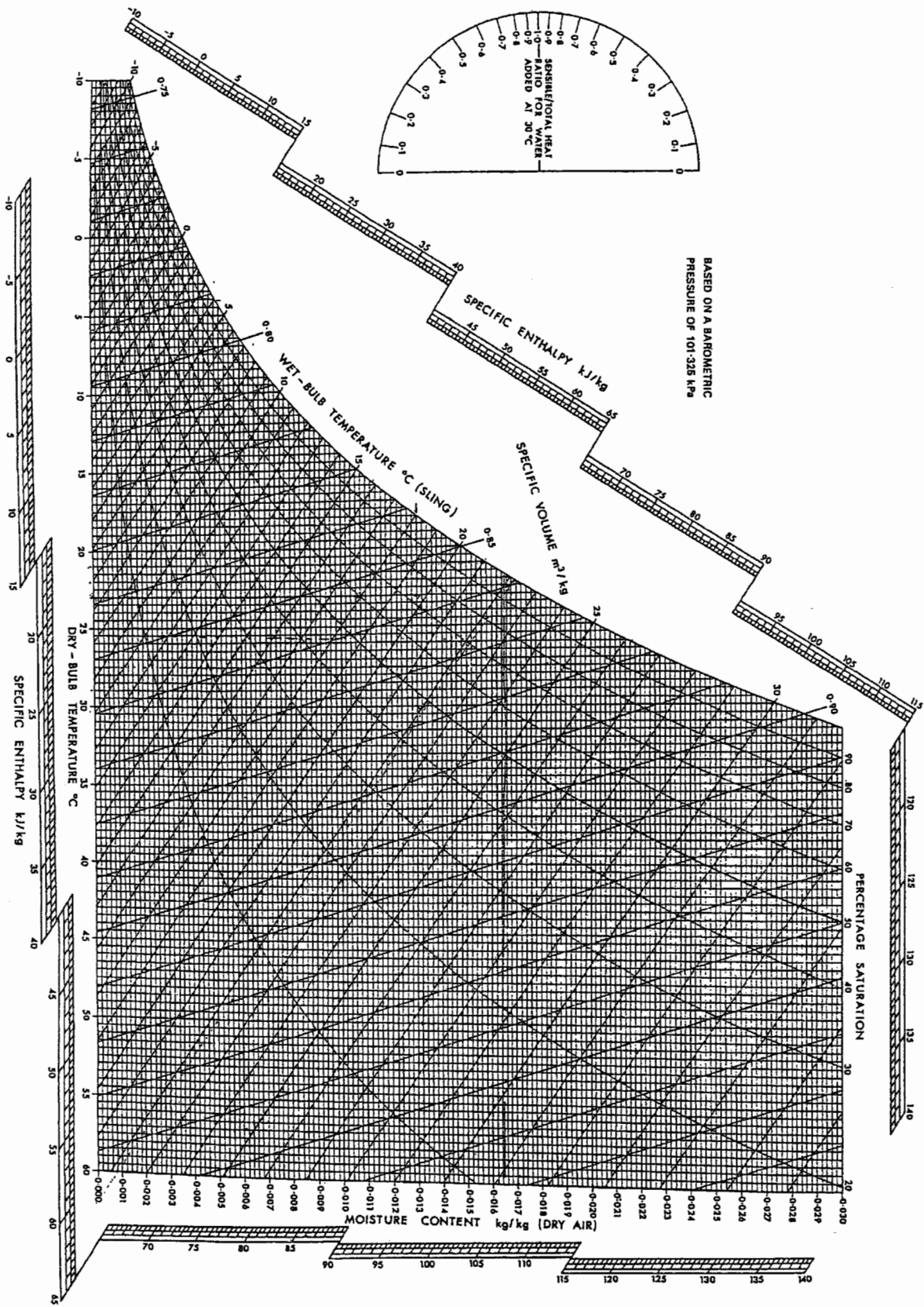


Figure 1. Vapour compression refrigeration cycle

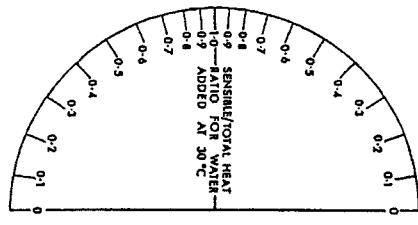
- (d) The efficiency of a maize crib depends on its dimensions, and orientation. Make a labeled sketch of a crib indicating the optimum dimensions and orientation. (4 Marks)



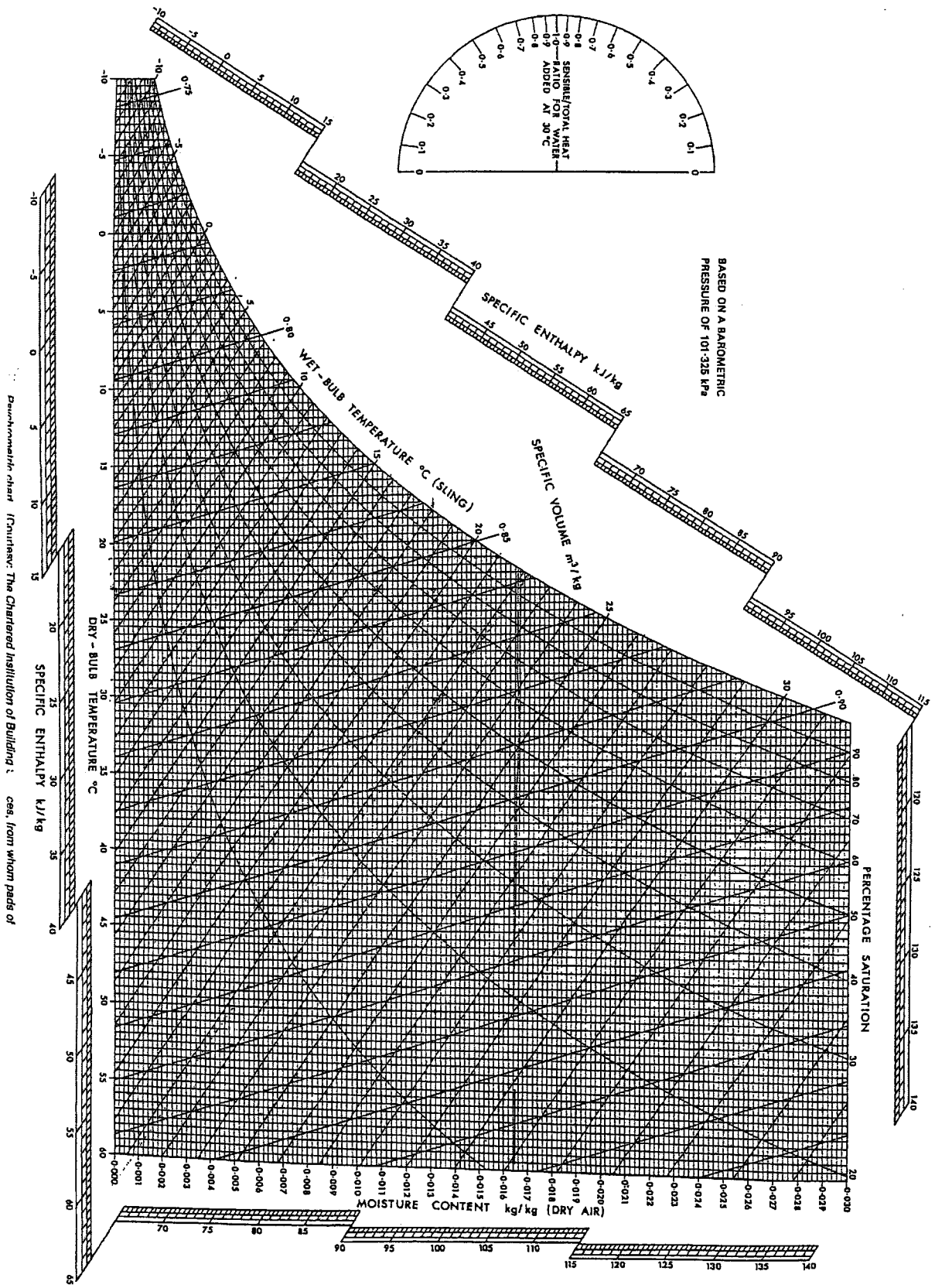
BASED ON A BAROMETRIC PRESSURE OF 101.325 kPa



Psychrometric chart (Courtesy: The Chartered Institution of Building Engineers)



BASED ON A BAROMETRIC
PRESSURE OF 101.325 kPa



Psychrometric chart (Revised: The Chartered Institution of Building Engineers, from whom parts of