ME371 Thermodynamics I
Air Conditioning Laboratory

Location SEM Room 306

Due Date Turn in the specified calculations at the end of the laboratory period if possible. Calculations will not be accepted after the *beginning* of class on the *Monday after all labs have been performed.*

Grading notes This exercise is worth 2% of the course grade. Grading is based 50% on laboratory participation (punctuality, cooperation with the lab instructor, working to finish calculation in the lab) and 50% on the calculations each individual turns in. No one will receive credit for this laboratory unless he/she participates in the measurements.

Turn in the following measurements, plots and calculations

1. Perform the measurements indicated in the Table 1.
2. Plot the moist air process path on the provided psychrometric chart. Label points for stations A, B, C and D.
3. Calculate is the mass flow rate of the moist air using the equation

$$\dot{m}_a = 0.0504\sqrt{\frac{z}{v_D}} \quad \text{(kg/s)}$$

   where z is the manometer pressure drop in mm H_2O and v_D is the moist air specific volume in m^3/kg at station D.
4. What is the rate of heat transfer away from the moist air stream from point B to C, Q_{MA}?
5. Plot the refrigerant process path on the provided R-12 property chart. Label points for stations 1, 2, 3 and 4.
6. Touch the two ends of the expansion valve with your finger. Can you feel a significant temperature difference?
7. What is the mass flow rate of refrigerant R-12 m_R in kg/sec?
8. What is the rate of heat transfer to the refrigerant from point 4 to 1, Q_R?
9. What is the percent difference between the heat transferred to the refrigerant Q_R and that transferred away from the moist air Q_{MA}? Suggest reasons why these heat transfer levels are different.
10. How much work is done to the refrigerant stream by the compressor, W_C?
11. What is the coefficient of performance for the refrigerant cycle, COP_R?

A	Air Temperature at Fan Inlet	Dry	T_{Ad} (°C)	
		Wet	T_{Aw} (°C)	
B	Air Temperature after Pre-heater	Dry	T_{Bd} (°C)	
		Wet	T_{Bw} (°C)	
C	Air Temperature after Cooling	Dry	T_{Cd} (°C)	
		Wet	T_{Cw} (°C)	
D	Air Temperature after Re-heater	Dry	T_{Dd} (°C)	
		Wet	T_{Dw} (°C)	
1	R12 leaving Evaporator		P_1 (kPa)	
			T_1 (°C)	
2	R12 after Compressor		T_2 (°C)	
3	R12 before Expansion Valve		P_3 (kPa)	
			T_3 (°C)	
4	R12 entering Evaporator		T_4 (°C)	
Barometric Pressure			P_{ATM} (kPa)	
R12 Mass Flow Rate			m_R (g/s)	
Orifice Differential Pressure			z (mm H_2O)	

ASHRAE PSYCHROMETRIC CHART NO. 6

NORMAL TEMPERATURE ELEVATION: 1500 METRES

BAROMETRIC PRESSURE 84.556 kPa

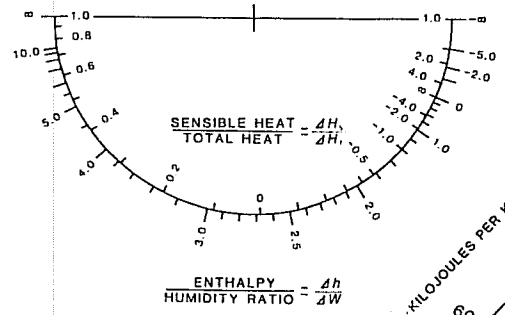

Chart 1H*b*

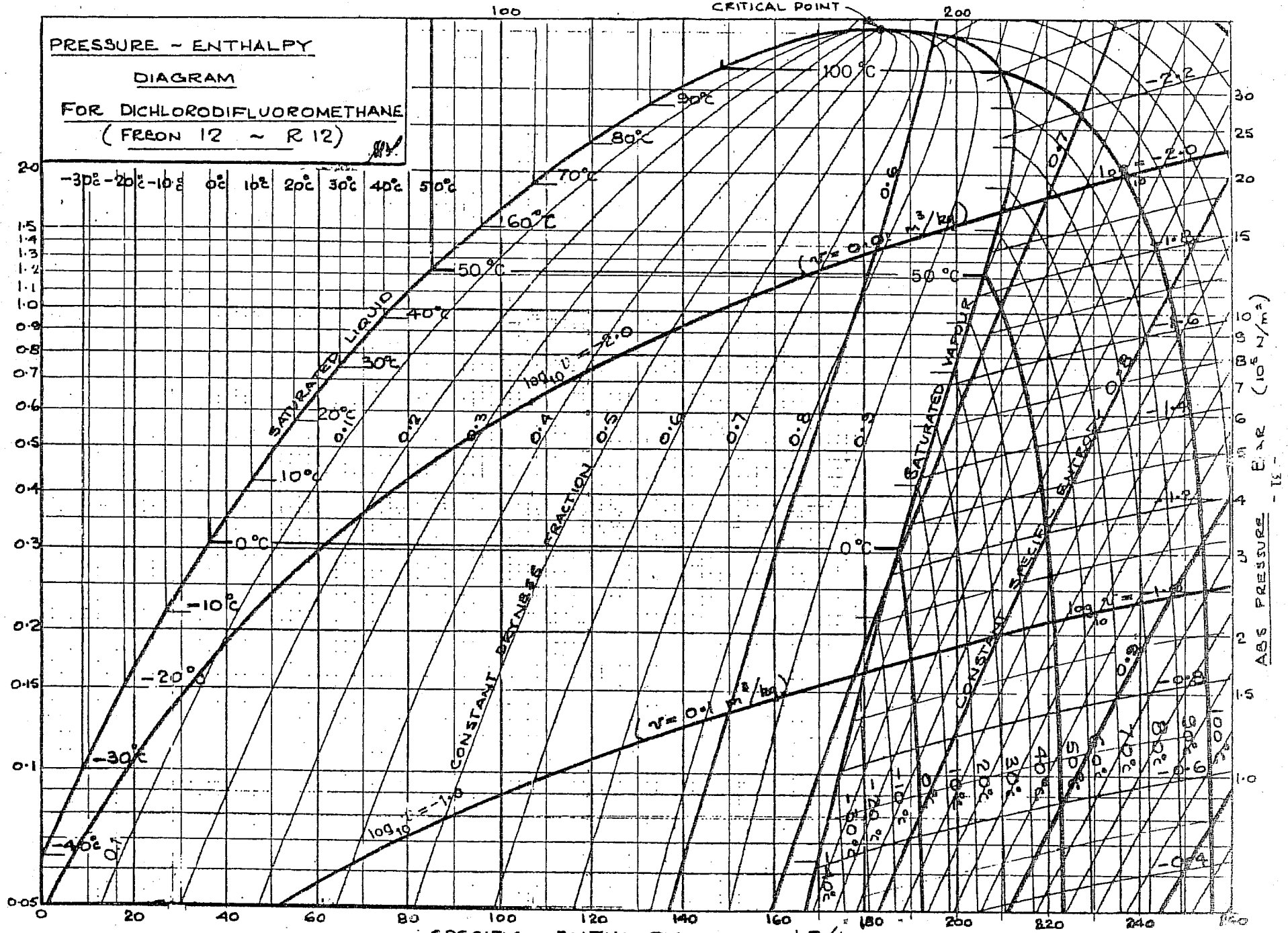
PRESSURE - ENTHALPY
DIAGRAM
FOR DICHLORODIFLUOROMETHANE
(FREON 12 ~ R 12)
CRITICAL POINT
SATURATED LIQUID
SATURATED VAPOUR
CONSTANT DENSITY
CONSTANT ENTROPY
ABS. PRESSURE MPa or MN/m²
ABS PRESSURE (10⁵ N/m²)
ENTHALPY kJ/kg
-30°C
-20°C
-10°C
0°C
10°C
20°C
30°C
40°C
50°C
60°C
70°C
80°C
90°C
100°C

FIG. I

Air Conditioning Laboratory Unit A573