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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
(TAKE HOME)
SEMESTER II
SESSION 2019/2020**

COURSE NAME	:	TECHNOLOGY OF REFRIGERATION AND AIR-CONDITIONING
COURSE CODE	:	BBA 20203
PROGRAMME CODE	:	BBG
EXAMINATION DATE	:	JULY 2020
DURATION	:	24 HOURS
INSTRUCTION	:	ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

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S1 One experiment has been conducted to represent the thermos-dynamic cycle of the heat pump in the Mollier diagram using the measured data as shown in Figure 1 and Table 1. The labeling with numbers refer to the location of the temperature and pressure sensor.

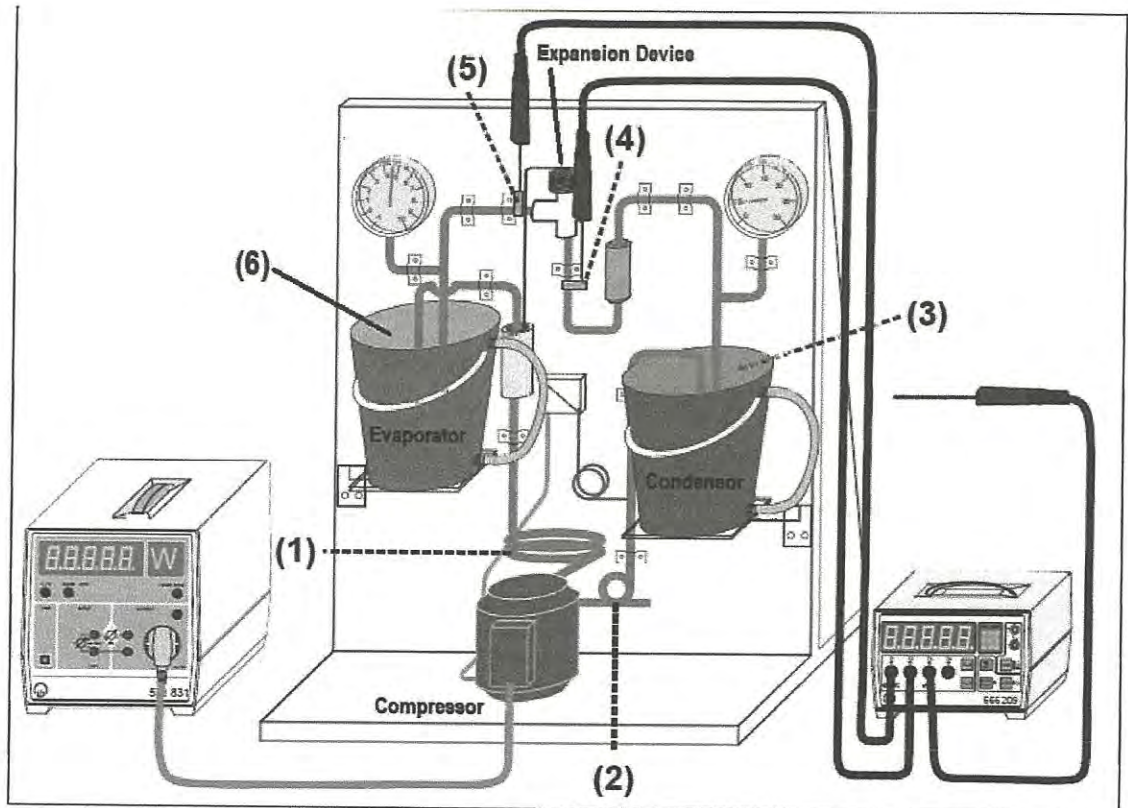


Figure 1: Experimental setup with temperature measuring points

Table 1: Measuring results

Measuring Point	Pressure (p)	Temperature (t)
(1)	$p_1 = 2.6 \text{ bar}$	$T_1 = 10^\circ\text{C}$
(2)	$p_2 = 9.0 \text{ bar}$	$T_2 = 60^\circ\text{C}$
(3)		$T_3 = 32^\circ\text{C}$
(4)		$T_4 = 20^\circ\text{C}$
(5)		$T_5 = 1^\circ\text{C}$
(6)		$T_6 = 2^\circ\text{C}$

- (a) By referring to the data given, plot the data into the Mollier diagram (Figure 2), and draw the characteristic line of the circular process.

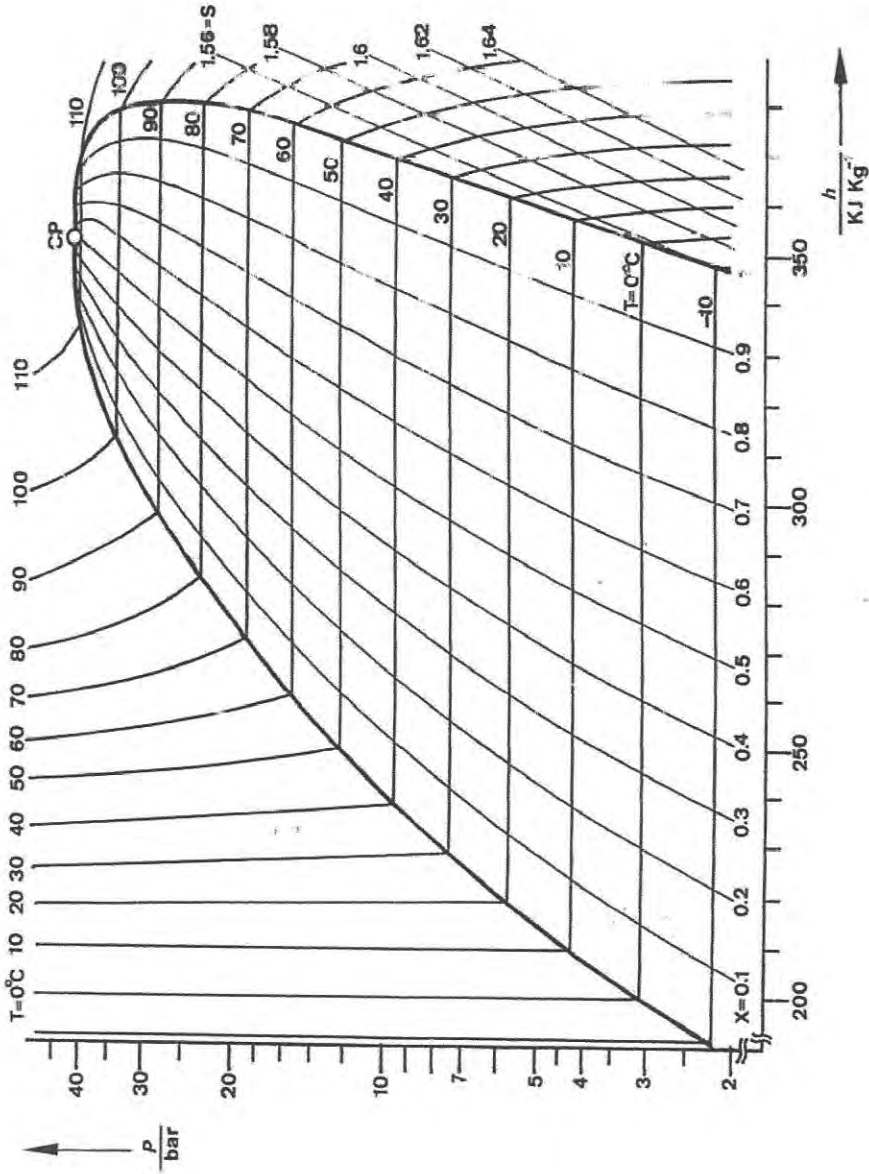


Figure 2: Simplified $lg(p)$ - h diagram according to Mollier

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(10 marks)

(b) Complete the table given for each point.

Table 2: Circulation of the Coolant in the Heat Pump

Measuring point	State	Process	Pressure	Temperature	Enthalpy
(1)	Only gas	before entering compressor	$p_1 = 2.6 \text{ bar}$	$T_1 = 10^\circ\text{C}$	
(2)			$p_2 = 9.0 \text{ bar}$	$T_2 = 60^\circ\text{C}$	
(3)				$T_3 = 32^\circ\text{C}$	
(4)				$T_4 = 20^\circ\text{C}$	
(5)				$T_5 = 1^\circ\text{C}$	
(6)				$T_6 = 2^\circ\text{C}$	

(20 marks)

(c) Evaluate the data given in Table 2 from Q1(b) by explaining what happen to the refrigerant from point 1 to point 6 considering the process, temperature, pressure, and state of phase at each points.

(10 marks)

(d) Based on the data given in Table 2 from Q1(b), calculate;

- i) Heat of compression
- ii) Refrigeration effect



- iii) Total heat rejection at condensor
- iv) Compression ratio
- v) Degree of sub-cooling at condensor
- vi) Degree of superheat at evaporator

(10 marks)

S2 (a) A window air conditioning unit is turned on when the room is at room temperature 33°C dry bulb temperature and 70% relative humidity.

(i) How much moisture is in the room?

(2 marks)

(ii) After a few hours the air conditioning unit is turned on, the room temperature change to 27°C dry bulb temperature and 50% relative humidity. How much have air moisture remove from the room?

(3 marks)

(b) Using a psychrometric chart, find the required values in the space below;

	Dry bulb temperature	Wet bulb temperature	Relative humidity	Dewpoint temperature	Humidity Ratio
A	30	18			
B	24		50		
C	35				14
D		18		10.6	
E		20	100		

(5 marks)

- END OF QUESTIONS -