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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR

Malaysia France Institute

FINAL EXAMINATION

JANUARY 2014 SESSION

SUBJECT CODE	:	FCB 40902
SUBJECT TITLE	:	ABSORPTION SYSTEM
LEVEL	:	BACHELOR
TIME / DURATION	:	9.00 am - 12.00 noon (3 HOURS)
DATE	:	01 JUN 2014

INSTRUCTIONS TO CANDIDATES

1. This is an open book examination.
2. Please read the instructions given in the question paper CAREFULLY.
3. This question paper is printed on both sides of the paper.
4. Please write your answers on the answer booklet provided.
5. Answer should be written in blue or black ink except for sketching, graphic and illustration.
6. Answer all questions in English.

THERE ARE 4 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

Question 1

The operating temperatures of a single stage vapour absorption refrigeration system are: generator: **100°C**; condenser and absorber: **40°C**; evaporator: **0°C**. The system has a refrigeration capacity of **150 kW** and the heat input to the system is **190 kW**. The solution pump work is negligible.

a) Find the COP of the system and the total heat rejection rate from the system.

(5 marks)

b) An inventor claims that by improving the design of all the components of the system he could reduce the heat input to the system to **100 kW** while keeping the refrigeration capacity and operating temperatures same as before. Examine the validity of the claim.

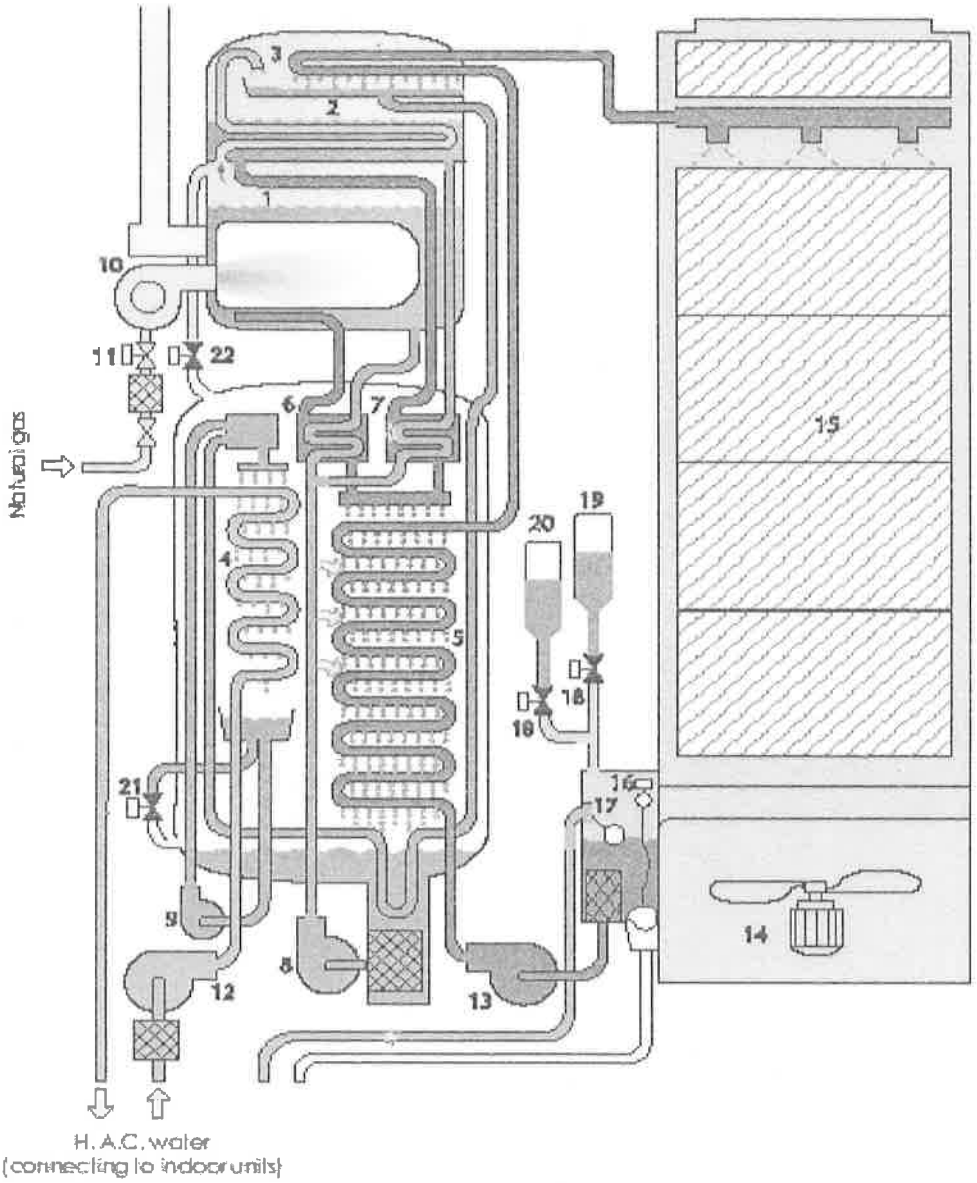
(5 marks)

Question 2.

Schematic of a direct fired $LiBr/H_2O$ absorption system is given in the Figure Q1.

Name the components marked 1, 2, 3, ... 15.

(15 Marks)



Question 3

For the Lithium bromide/water absorption refrigeration system shown below, determine:

(a) Calculate M_1, M_2, M_3, M_4 and M_5 in Table Q3 below,

(10 marks)

(b) Heat required at generator per ton of cooling,

(10 marks)

(c) COP,

(10 marks)

(d) Heat rejection ratio (Q*absorber* + Q*condenser*)/Q*evaporator*.

(10 marks)

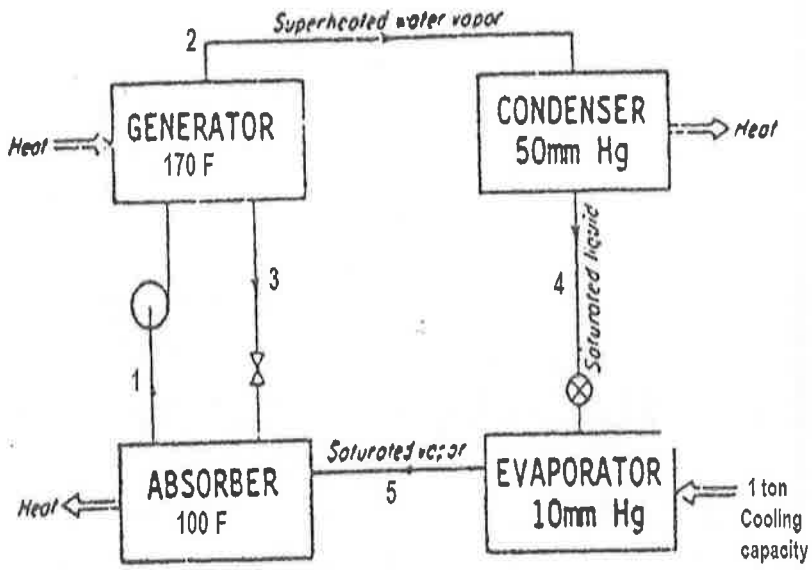


Figure Q3.An Absorption cycle

Table Q3

State	Pressure (mm Hg)	Temperature (°F)	X, concentration	Enthalpy, h (Btu/lbm)	Mass flow rate, m (lbm/min)
1	10	100	0.53	36.47	M_1
2	50	170	0	1133.85	M_2
3	50	170	0.565	75.26	M_3
4	50	101	0	69.03	M_4
5	10	52	0	1083.90	M_5

Question 4

(35 marks)

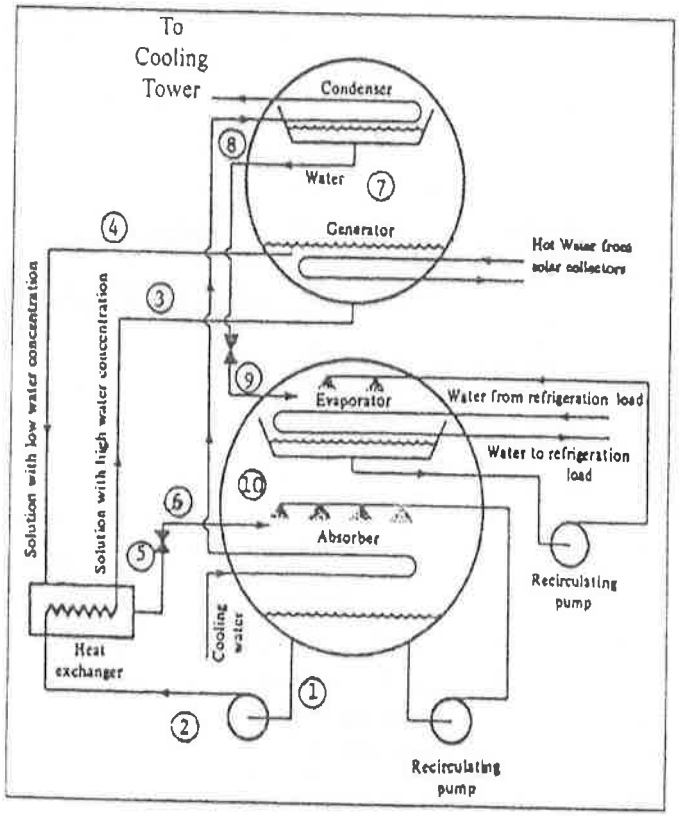


Figure Q4. An Absorption Unit.

A large LiBr absorption refrigeration system is rated at 700 kW of cooling. The unit operates with hot water from evacuated tube solar collectors and with a cooling tower that provides the cooling water for the absorber and condenser. The unit and operating conditions are shown in the figure below. Determine all energy quantities (Q*c*, Q*a*, Q*g*) and the COP.

Point	Temp. (°C)	Pressure	Concentration	h (kJ/kg)	m (kg/s)
1	25	0.87	0.495	50	1.367
2	-	4.24	0.495	50	1.367
3	53	4.24	0.495	117	1.367
4	80	4.24	0.630	210	1.074
5	35 *	4.24	0.630	125	1.074
6	-	0.87	0.630	125	1.074
7	80	4.24	0	2644	0.293
8	30	4.24	0	125.7	0.293
9	5	0.87	0	125.7	0.293
10	5	0.87	0	2511	0.293

* Minimum without crystallization

END OF QUESTION