MIDTERM EXAM

Chemical Process Analysis and Synthesis

Hangzhou April-June 2022

1. （20 points） Consider the following hot and streams

	supply T(°C)	target T(°C)	ΔH(MW)	F*Cp (MW/°C)
cold	20	180	32.0	0.2
hot	250	40	-31.5	0.15
cold	140	230	27.0	0.3
hot	200	80	-30.0	0.25

Use HRAT = 20°C and obtain the minimum utility. Show all the calculation steps.

2. （20 points） Draw the Grand Composite curve.

3. （20 points） Show the pinch matches above the pinch for this example.

4. （10 points） What is vertical heat transfer? It will help if you show a drawing, but describe it in words.

5. （10 points） Explain graphically, how do you obtain the minimum area of a network for a given HRAT.

6. （10 points） Explain briefly what is a spaghetti design ?

7. （10 points） The purpose of Supertargeting is
   a. Design a pinch design
   b. Obtain minimum utility for a given area
   c. Obtain the optimal HRAT
   d. Determine the minimum area
   e. None of above

FINALTERM EXAM

Chemical Process Analysis and Synthesis

Hangzhou April-June 2022

1. （10 points）Consider the following hot and streams. Use HRAT = 15℃ and obtain the minimum utility. Show all the calculation steps.

|	supply T(℃)	target T(℃)	F*Cp (MW/℃)
1	80	120	1.0
2	60	150	1.9
3	35	50	1.5
4	45	20	忘了

HRAT = 15℃.Give the minimum utility. Show all the calculation steps

2. （10 points）Design heat exchange network below the pinch.

3. （5 points）To choose cold utility, Can you use cooling water avaliable at 22℃？Only saying YES or NO is not enough，please give the reasons.

4. （10 points）The grand composite curve is shown below. Use furnace burning at 500℃.Draw furnace gases line and ambient line（30℃），calculate stack loss.

<center>（此处省略一张 GCC 图）</center>

5. （5 points）Explain what is vertical heat transfer? It will help if you give a graph，but ALSO describe it in words.

6. （5 points）Explain how to retrofit HEN by using Area Efficiency Method.

7. （20 points）Consider the following processes:

	Mass load of contaminant (kg/h)	C_{IN} (ppm)	C_{OUT} (ppm)
1	80	0	100
2	60	50	100
3	35	50	800
4	45	400	800

Obtain the minimum water consumption.Design the water reuse network（hint：）

8. （5 points）Why in refrigeration cycle the expander is substituted by a valve ?

9. （20 points） Consider the refrigerator listed:

(a)   (b)
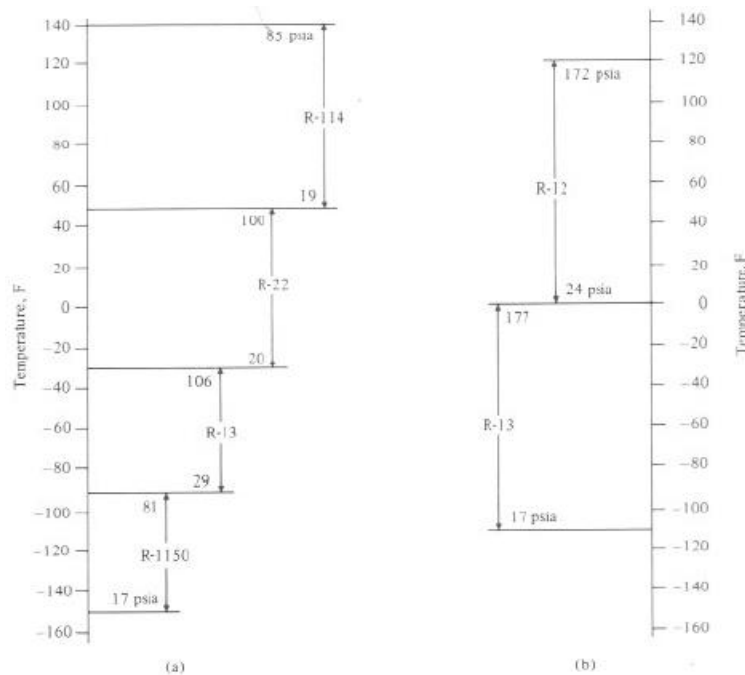
Now you want to freeze at -20°F. What refrigerators will you choose? If you are to exhaust heat using cooling water avaliable at 20°C, does one cycle enough? If is, draw the picture and estimate temperatures for each stream.If not, using 2 cycles. What two refrigerators will you choose? Draw picture and estimate temperatures for each stream.

10. （10 points） In producing LNG, why do CO2、H2S and water need to be excluded before to be liquified? List the reason for each of three components.