Profitability Homework **ChE 473 K** **Fall 2007**

Problem No. 1

The feed to a crude unit is 600,000 lb/hr at 100 F. One product stream from this unit is presently drawn off at 450 F at a rate of 300,000 lb/hr. This stream is cooled in an air-fin exchanger and sent to storage. You are assigned a project to determine if it would be feasible to heat-interchange this product stream with the incoming feed stream in order to save energy within the crude unit. You have collected the following data:

Heat capacity of all fluids = 0.50 BTU / lb F
Heat transfer coefficient in proposed exchanger = 60 BTU / hr ft^2 F based on LMTD
Value of energy in the process $ 0.30 / million BTU
Delivered cost (I_F) of proposed exchanger of area "A"
(I_F) = 80,000 * (A ft^2 / 4000 ft^2) $^{0.8}$
Installed cost = 2.5 * delivered cost
Unit operates 8000 hrs / year
Neglect operating cost for proposed and existing exchanger.
The project has a 5 year life.

Determine: a) The project profitability (IRR).
b) Your recommendation for the project?

Problem No. 2

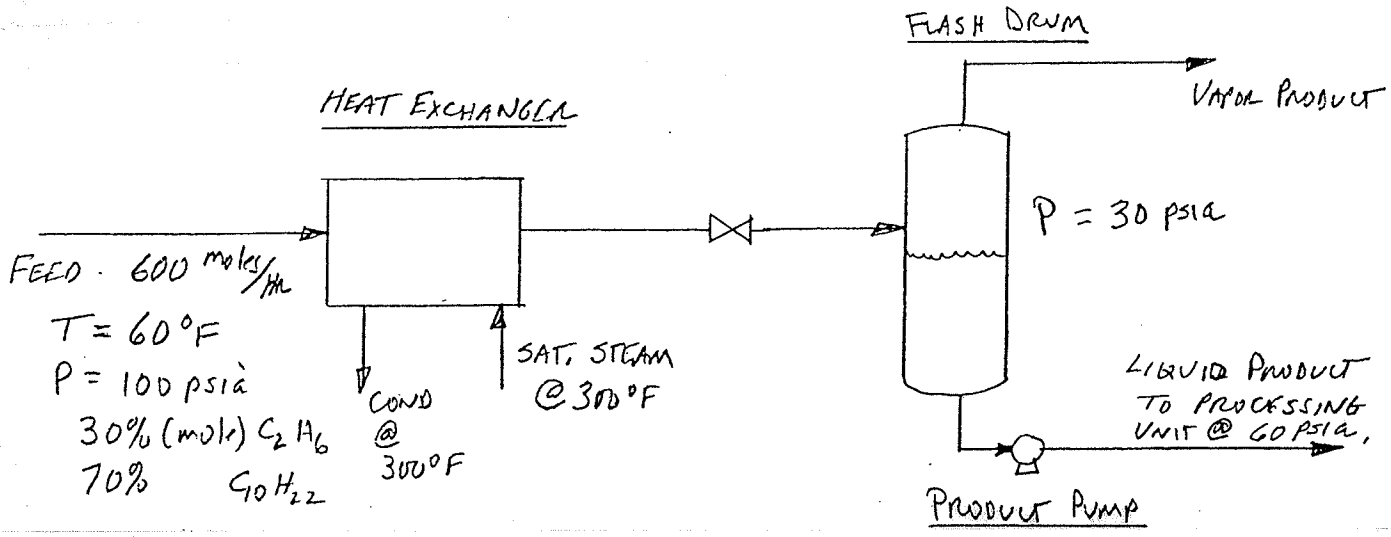
A planned separation facility is as shown in Figure P2. Simulations have verified that a "clean" split can be achieved in a single stage flash (I.E. only negligible amount of C_{10} in the vapor and a negligible amount of C_2 in the liquid). A portion of a flash for the C_2 / C_{10} system is attached for your use. Other data which you may need are:

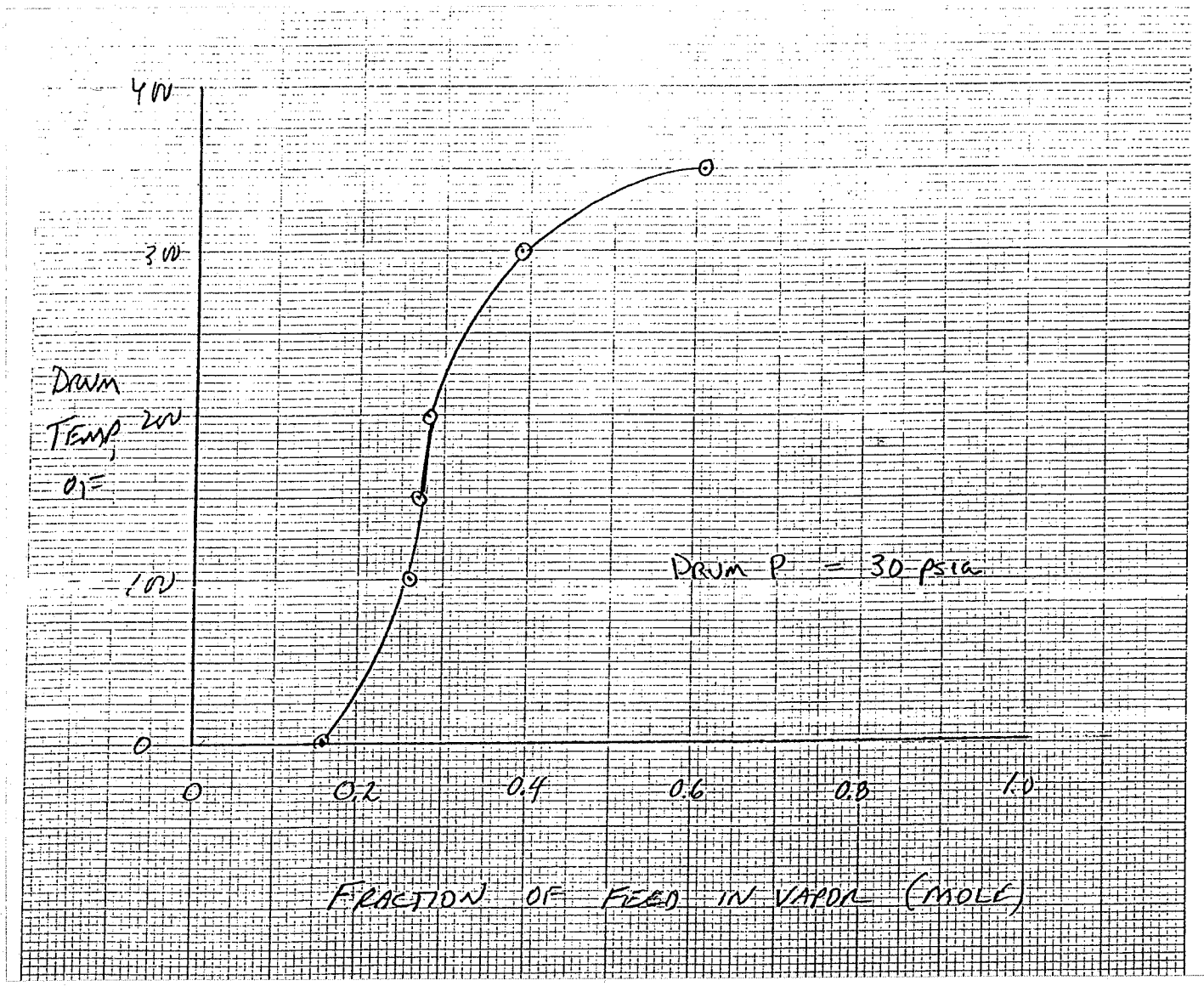
Specific gravity of decane (C10) = 0.73

	Cp : BTU / lbmol F		Heat of vaporization at 60 F BTU / lbmol
C_2H_6 gas	12.3	C_2H_6	6,300
C_2H_6 liquid	27.8		
$C_{10}H_{22}$ gas	54.5	$C_{10}H_{22}$	16,900
$C_{10}H_{22}$ liquid	74.0		

a) Determine the capital cost for the facility in mid-2007 dollars – give source of cost data.
b) Determine the steam cost for the facility, $ / year based on $ 4.50 / 1000 lb steam.
c) Determine the power cost for the pump, $ / year based on $ 0.06 / kwh.

Figure P2


FLASH DRUM
HEAT EXCHANGER
VAPOR PRODUCT
P = 30 psia
FEED · 600 moles/hr
T = 60°F
P = 100 psia
30% (mole) C_2H_6
70% $C_{10}H_{22}$
COND @ 300°F
SAT. STEAM @ 300°F
LIQUID PRODUCT TO PROCESSING UNIT @ 60 psia,
PRODUCT PUMP


400
300
200
100
0
DRUM TEMP, °F
DRUM P = 30 psia
0
0.2
0.4
0.6
0.8
1.0
FRACTION OF FEED IN VAPOR (MOLE)