

**Supplemental Problem A-7**

9/19/2007

Ch.E. 453 Fall 2002 Exam #2 Problem #4

**Solution Master**

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**Title :** 'hyper-pure' water purification

**Given :**

daily production	days/year	Annual water production
600560	300	180,168,000
lbs / day	days / year	= lbs / year

**Approach :** Use Functional Units = Hill's method(a) > 100 million lbs/yr  $I_{\text{fix}} = (\# \text{ Units}) * \$30,000 * [\text{capacity}/10,000,000 \text{ lb/yr}]^{0.6} * \text{M\&S Index}/185 * 5.7$ 

(b) Count flowsheet = 4 primary units, complexity = normal temperature &amp; pressure, 300 SST

**Computations :**

Units = 4  
M&S Index = 1383.6

Hill's method Fixed Capital Investment = **\$ 23,000,000** \$23,065,344

$I_{\text{fix}} = (4 \text{ Units}) * \$30000 * [180168000/10000000 \text{ lb/yr}]^{0.6} * 1100.7/185 * 5.7$

**Alt. Computations :**

Units = 5

Hill's method Fixed Capital Investment = **\$ 29,000,000** \$28,831,680

no correct solutions with 4 units

correct #5 answers: correct method:

4	6	
Median	Average	Std. Dev.
19.5	16.4	7.5

wrong methods:

8

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**Computations :**

Units = 4  
CE Index = 531.9

Zevnik & Buchanan method Fixed Capital Investment = **\$ 10,000,000** \$9,847,606

$$I_{fix} = (4 \text{ Units}) * \$1.5 * [ 180168000 \text{ lb/yr} ]^{0.6} * \text{CE Index}/102 * C_f$$

$$C_f = 2 * 10^{(f_T + f_P + f_M)} \quad 3.50$$

Temperature, K	373	f <sub>T</sub>	0.01	
Pressure, kPa	200	f <sub>P</sub>	0.03	2.00
Materials	SST 300	f <sub>M</sub>	0.20	

Use Functional Units = Zevnik & Buchanan method (or Hill's)

(a) > 100 million lbs/yr  $I_{fix} = (\# \text{ Units}) * \$1.5 * [ \text{capacity lb/yr} ]^{0.6} * \text{CE Index}/102 * C_f$

(b) Count flowsheet = 4 primary units, complexity = normal temperature & pressure, 300 SST

**Computations :**

Units = 5  
CE Index = 531.9  
Complexity =  $2 * 10^{0.24} = 3.504$   

	373	200	0.2
0.243513	0.01341	0.030103	0.2

Z&B method Fixed Capital Investment = **\$ 12,000,000** \$12,309,507

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