

## Homework 9

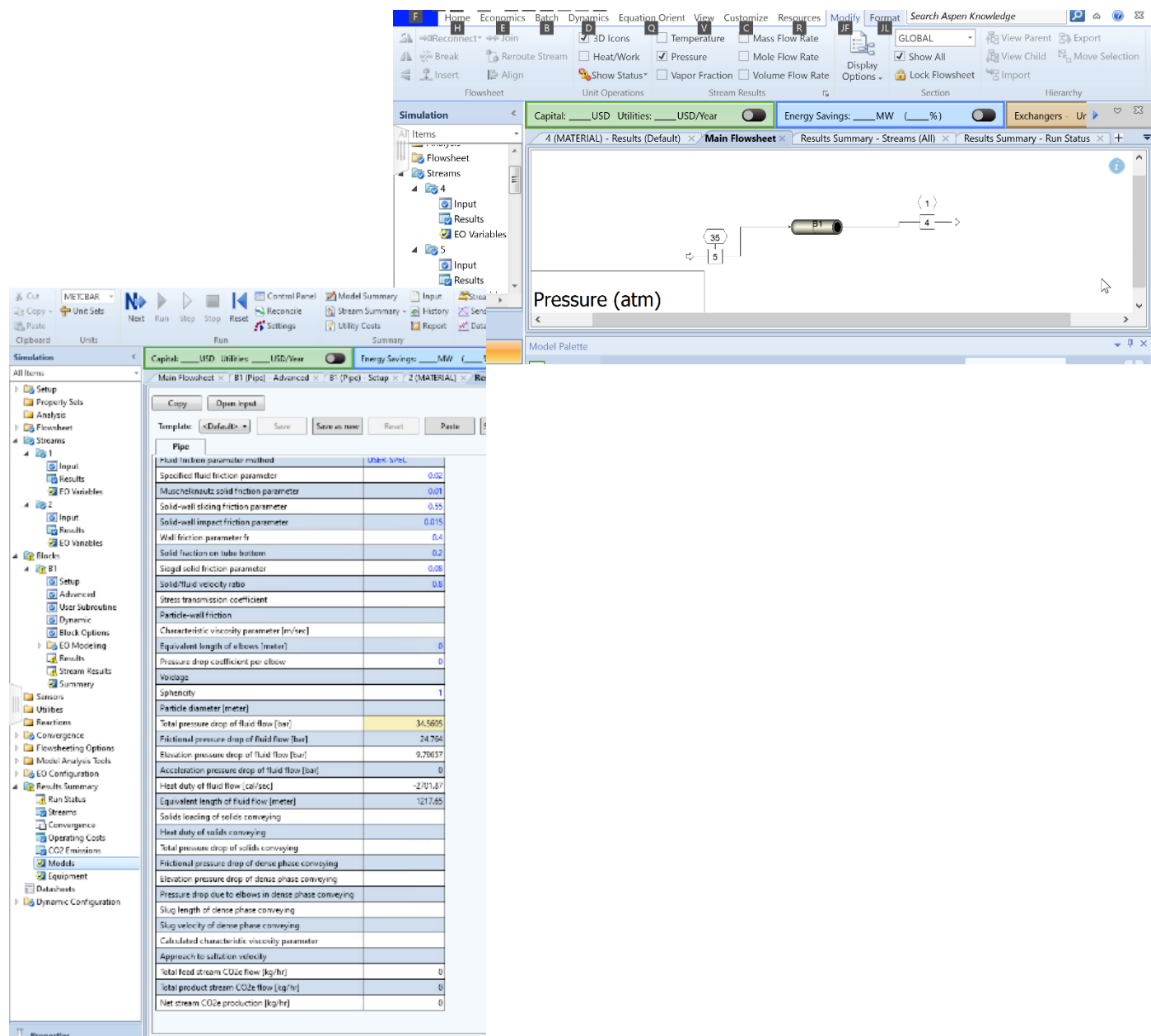
### Problem 1

Using:

$$\sum K = 11.1$$

$$\epsilon = 0.26 \text{ mm}$$

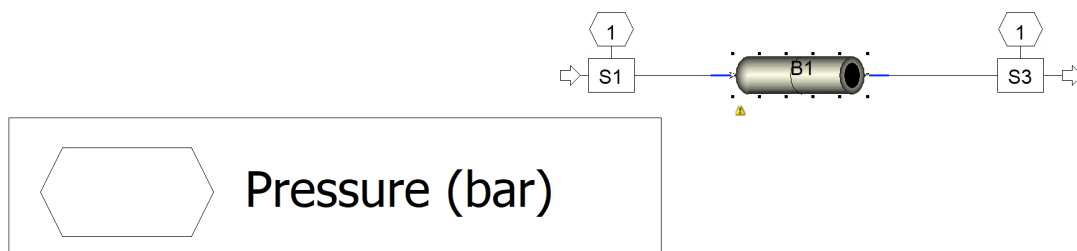
The inlet pressure was calculated by Aspen to be 35.1 atm



## Problem 2

$$H_{\text{pump}} = 450 \text{ ft}$$

$$P = \frac{1.94 \times 32.2 \times 3 \times 450}{.75} = 112200 \longrightarrow 112200/550 = 204 \text{ hp}$$



Capital: \_\_\_ USD Utilities: \_\_\_ USD/Year ☐ Energy Savings: \_\_\_ MW (

B1 (Pipe) - Setup x Results Summary - Run Status x Main Flowsheet x **Result**

Copy Open Input

Template: <Default> Save Save as new Reset Paste

**Pipe**

Total pressure drop of fluid flow [bar]	-0.00647493
Frictional pressure drop of fluid flow [bar]	9.83977
Elevation pressure drop of fluid flow [bar]	-9.84624
Acceleration pressure drop of fluid flow [bar]	0
Heat duty of fluid flow [cal/sec]	-19965.8
Equivalent length of fluid flow [meter]	609.6
Solids loading of solids conveying	

### Problem 3

Using  $k=4.5$ :

$Re = 12000$ , Flow is Turbulent

Total head drop =  $36 \times 12 = 432$  ft



Pressure (bar)

Next Run Step Stop Reset Reconcile Stream Summary - History Sensitivity  
Utility Costs Report Data Fit

Run

Copy Open Input

Template: <Default> Save Save as new Reset Paste Send to

Pipe

Consider initial acceleration	YES
Fluid friction parameter method	USER-SPEC
Specified fluid friction parameter	0.02
Muschelknautz solid friction parameter	0.01
Solid-wall sliding friction parameter	0.55
Solid-wall impact friction parameter	0.015
Wall friction parameter fr	0.4
Solid fraction on tube bottom	0.2
Siegel solid friction parameter	0.08
Solid/liquid velocity ratio	0.8
Stress transmission coefficient	
Particle-wall friction	
Characteristic viscosity parameter (m/sec)	
Equivalent length of elbows (meter)	0
Pressure drop coefficient per elbow	0
Voidage	
Sphericity	1
Particle diameter (meter)	
Total pressure drop of fluid flow (bar)	-0.191957
Frictional pressure drop of fluid flow (bar)	1.77522
Elevation pressure drop of fluid flow (bar)	-1.96717
Acceleration pressure drop of fluid flow (bar)	0
Heat duty of fluid flow (cal/sec)	-224.293
Equivalent length of fluid flow (meter)	41.8492
Solids loading of solids conveying	
Heat duty of solids conveying	
Total pressure drop of solids conveying	
Frictional pressure drop of dense phase conveying	
Elevation pressure drop of dense phase conveying	
Pressure drop due to elbows in dense phase conveying	
Slug length of dense phase conveying	
Slug velocity of dense phase conveying	
Calculated characteristic viscosity parameter	
Approach to saltation velocity	
Total feed stream CO2e flow (kg/hr)	0
Total product stream CO2e flow (kg/hr)	0
Net stream CO2e production (kg/hr)	0

Model Palette

Mixers/Splitters Separators Exchangers Columns Reactors

Simulation Main Flowsheet Results Summary - Streams (All) Results Summary - Models S1 (MATERIAL) S2 (MATERIAL) B1 (P)

Material	Heat	Load	Work	Vol.% Curves	Wt.% Curves	Petroleum	Polymers	Solids
Pressure	bar							
Molar Vapor Fraction								
Molar Liquid Fraction								
Molar Solid Fraction								
Mass Vapor Fraction								
Mass Liquid Fraction								
Mass Solid Fraction								
Molar Enthalpy	cal/mol	-80630.1						
Mass Enthalpy	cal/gm	-2443.83						
Molar Entropy	cal/mol-K	-58.1403						
Mass Entropy	cal/gm-K	-1.76218						
Molar Density	mol/cc	0.0554085						
Mass Density	gm/cc	1.82811						
Enthalpy Flow	cal/sec	-2.34792e+07						
Average MW		32.9934						
+	Mole Flows	kmol/hr	1048.31					
+	Mole Fractions							
+	Mass Flows	kg/hr	34587.2					
+	Mass Fractions							
Volume Flow	I/min	315.328						
-	Liquid Phase							
Molar Enthalpy	cal/mol	-80630.1						
Mass Enthalpy	cal/gm	-2443.83						
Molar Entropy	cal/mol-K	-58.1403						
Mass Entropy	cal/gm-K	-1.76218						
Molar Density	mol/cc	0.0554085						
Mass Density	gm/cc	1.82811						
Enthalpy Flow	cal/sec	-2.34792e+07						
Average MW		32.9934						
+	Mole Flows	kmol/hr	1048.31					
+	Mole Fractions							
+	Mass Flows	kg/hr	34587.2					
+	Mass Fractions							
Volume Flow	I/min	315.328						
Reynolds number	meter	12213.2						
<add properties>								

Properties

Simulation Safety Analysis Energy Analysis

Model Palette

Mixers/Splitters Separators Exchangers Columns Reactors Pressure Changers Manipulators

MATERIAL Pump Compr MCompr Valve Pipe Pipeline