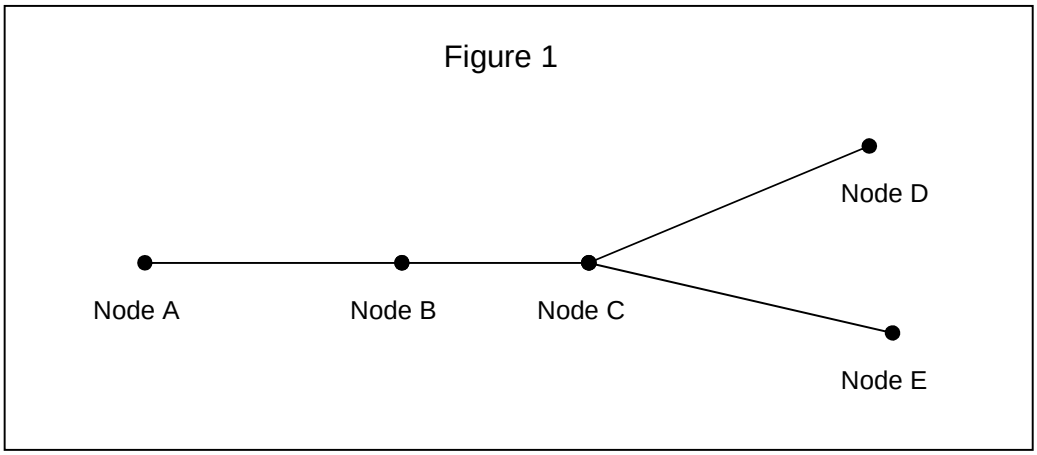
Hydraulic modeling assessment

Name:

Date:

Please answer the following questions with the complete piping configuration shown in Figure 1 below. Assume all flows are specified in standard volumes under steady state flow conditions. The fluid is natural gas with a specific gravity of 0.60.

Figure 1



1. Given flows passing in and out of the system through the nodes of: A @ 100, B @ -80, D @ -20, and E @ -30, what is the flow at C?

2. If the flows are: A @ 100, B @ -120, C @ -20, D @ -30, and E is unknown:

   A. Which node is the “null” point?

   B. What is the flow at Node E?

   C. The pressure at Node A compared to Node B is:
      a. Higher
      b. Lower
      c. The same
      d. Indeterminate

   D. Why?

   E. The pressure at Node A compared to Node C is:
      a. Higher
      b. Lower
      c. The same
      d. Indeterminate

F. Why?

G. What is the flow in the segment from Node B to Node C?

3. If the pressure is maintained at Node A at 800 with the flow unknown, flows of B @ -20, C @ 0, D @ -10, and E @ -10, segments A => B is 20 miles of 12", B => C is 15 miles of 12", C => D is 10 miles of 8", and C => E is 10 miles of 6":

   A. The pressure at Node D compared to Node E is:
      a. Higher
      b. Lower
      c. The same
      d. Indeterminate

   B. Why?

   C. If the segment from C => E is shortened to a length of 7.5 miles, the pressure at Node D compared to Node E is:
      a. Higher
      b. Lower
      c. The same
      d. Indeterminate

   D. Why?

   E. If the pressure at A is lowered to 600, the flow at A is now:
      a. Higher
      b. Lower
      c. The same
      d. Indeterminate

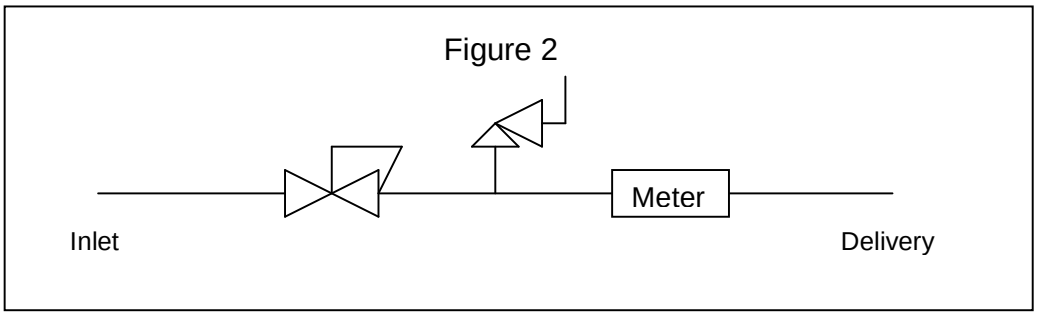
   F. Why?

   G. As the pressure is lowered at A, the velocity in segment C => D is:
      a. Higher
      b. Lower
      c. The same
      d. Indeterminate

H. Why?

Please answer the following questions for the regulator and meter facility shown in Figure 2 below. Assume steady state flow, an inlet MAOP of 800, an outlet MAOP of 60, an inlet pressure of 250, and a delivery pressure of 50 unless stated otherwise.

Figure 2



4. If the inlet pressure is raised from 250 to 350:

   A. The maximum regulator capacity:
      a. Increases
      b. Decreases
      c. Stays the same
      d. Is indeterminate

   B. Why?

   C. The relief capacity:
      a. Increases
      b. Decreases
      c. Stays the same
      d. Is indeterminate

   D. Why?

   E. The required relief capacity:
      a. Increases
      b. Decreases
      c. Stays the same
      d. Is indeterminate

   F. Why?

5. If the inlet pressure is 250 and the delivery pressure is lowered from 50 to 40:

   A. The meter temperature:
      a. Increases
      b. Decreases
      c. Stays the same
      d. Is indeterminate

   B. Why?

   C. The regulator capacity:
      a. Increases
      b. Decreases
      c. Stays the same
      d. Is indeterminate

   D. Why?

   E. The relief capacity:
      a. Increases
      b. Decreases
      c. Stays the same
      d. Is indeterminate

   F. Why?

   G. The required relief capacity:
      a. Increases
      b. Decreases
      c. Stays the same
      d. Is indeterminate

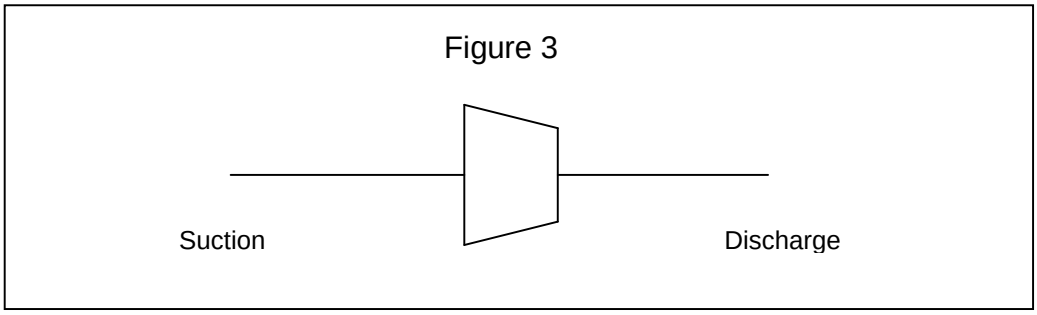
   H. Why?

I. The meter capacity:
   a. Increases
   b. Decreases
   c. Stays the same
   d. Is indeterminate

J. Why?

Please answer the following questions for the gas compressor shown in Figure 3 below. Assume steady state flow, a discharge pressure of 700.

Figure 3



6. If the flow increases from 150 to 200 and suction and discharge pressures are held constant:

   A. The power requirement:
      a. Increases
      b. Decreases
      c. Stays the same
      d. Is indeterminate

   B. Why?

7. If the suction pressure increases from 450 to 500 and flow is held constant:

   A. The discharge temperature:
      a. Increases
      b. Decreases
      c. Stays the same
      d. Is indeterminate

   B. Why?

C. The power requirement:
    a. Increases
    b. Decreases
    c. Stays the same
    d. Is indeterminate

D. Why?

E. If the compressor is centrifugal, the speed:
    a. Increases
    b. Decreases
    c. Stays the same
    d. Is indeterminate

F. Why?

G. Under the above conditions, the surge margin will:
    a. Increase
    b. Decrease
    c. Stay the same
    d. Is indeterminate

H. Why?

I. If the compressor above is driven by a gas turbine, the break specific fuel consumption will generally:
    a. Increase
    b. Decrease
    c. Stay the same
    d. Is indeterminate

J. Why?

K. If the compressor is reciprocating, the volumetric efficiency:
    a. Increases
    b. Decreases
    c. Stays the same
    d. Is indeterminate

L. Why?

M. If the compressor is reciprocating and the clearance is increased, how must the speed be changed to maintain the original flow:
    a. Increased
    b. Decreased
    c. Do not change the speed
    d. Is indeterminate

N. Why?

O. If the compressor is reciprocating and the clearance is increased and the speed is adjusted to maintain constant flow, the power will:
    a. Increase
    b. Decrease
    c. Stay the same
    d. Is indeterminate

P. Why?

Q. Given the conditions noted in question O above and the compressor is driven by a reciprocating engine, the fuel will generally:
    a. Increase
    b. Decrease
    c. Stay the same
    d. Is indeterminate

R. Why?