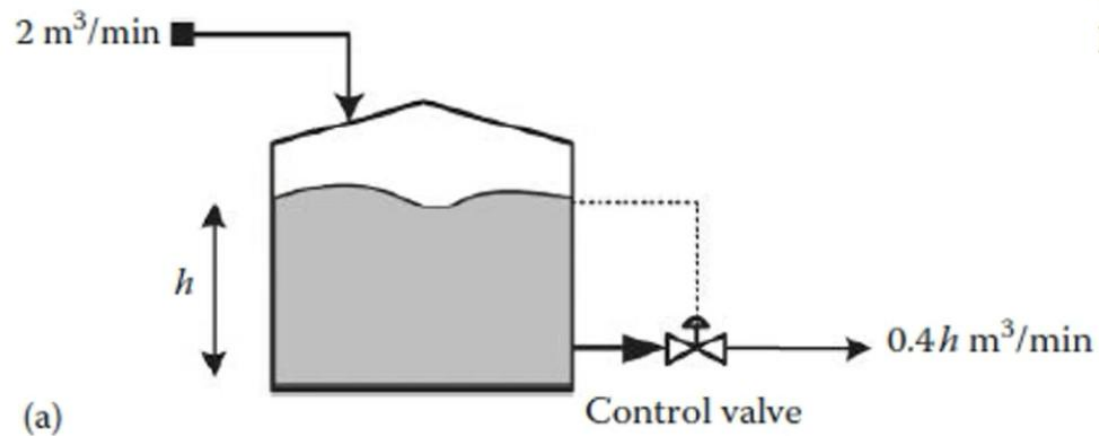

A series of tank

ChE 3230





Unsteady-state mass balance:

Neither generation nor consumption occurs in the process:

$$\frac{dm}{dt} = \dot{m}_{\text{in}} - \dot{m}_{\text{out}}$$

$$m = \rho V = \rho(Ah), \quad A = \pi D^2/4$$

$$\dot{m} = \rho \times \dot{V}$$

$$\frac{d(\rho Ah)}{dt} = \rho \dot{V}_{\text{in}} - \rho \dot{V}_{\text{out}}$$

$$A \frac{dh}{dt} = \dot{V}_{\text{in}} - \dot{V}_{\text{out}}$$

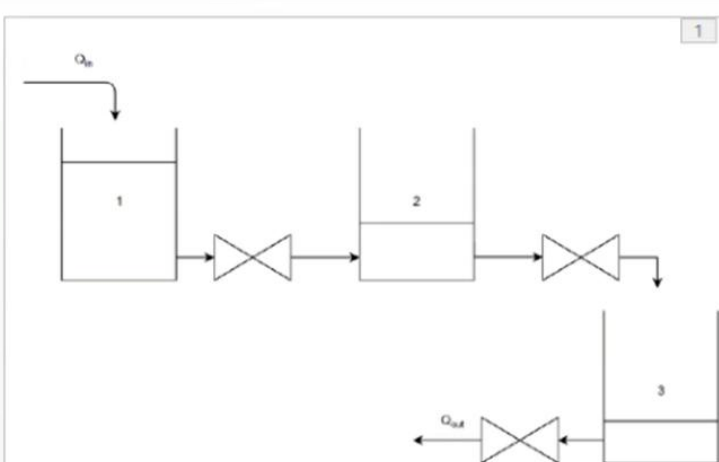


Presentation1.pptx - Microsoft PowerPoint

FILE HOME INSERT DESIGN TRANSITIONS ANIMATIONS SLIDE SHOW REVIEW VIEW EndNote 20

Preview Animation Advanced Animation Timing

1 All tanks have the following characteristics.
Height = 5 m, Diameter = 10 m and Valve coefficient = 5 m^{2.5}/min.
Outlet flowrates are proportional to the square root of the heights of the tanks.
Flow rate = valve coefficient*(height)^{0.5}
Initially all the tanks are empty. **The input flowrate is 4 m³/min at first and is then increased to 6 m³/min after 500 min.** Which of the tanks will overflow (if any)? In case of multiple tanks overflowing, which one will overflow first? What is the corresponding time?



2

$$\frac{dh_1}{dt} = \frac{Q_{in} - Q_1}{A}, \quad Q_1 = 5 \times h_1^{0.5} - 5 \times h_2^{0.5}$$

3

$$\frac{dh_2}{dt} = \frac{Q_1 - Q_2}{A}, \quad Q_2 = 5 \times h_2^{0.5}$$

4

$$\frac{dh_3}{dt} = \frac{Q_2 - Q_3}{A}, \quad Q_3 = 5 \times h_3^{0.5}$$

SLIDE 3 OF 3

NOTES COMMENTS

74%