3.3. A perfectly mixed, isothermal CSTR has an outlet weir. The flow rate over the weir is proportional to the height of liquid over the weir, h_{ow}, to the 1.5 power. The weir height is h_w. The cross-sectional area of the tank is A. Assume constant density.

A first-order reaction takes place in the tank:

$$A \xrightarrow{k} B$$

Derive the equations describing the system.

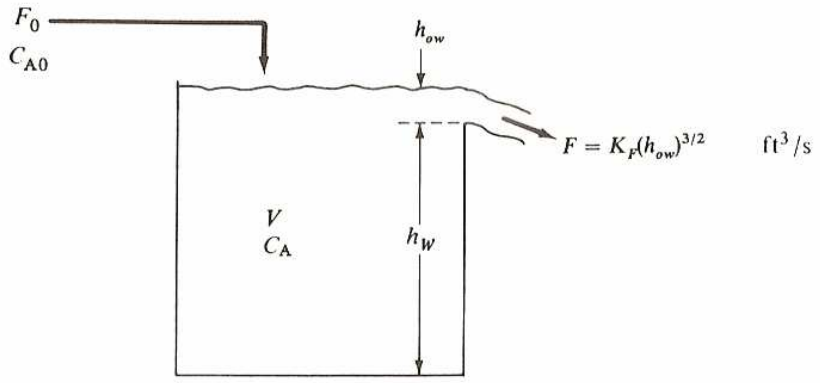

FIGURE P3.3

3.6. Consider the system that has two stirred chemical reactors separated by a plug-flow deadtime of D seconds. Assume constant holdups (V_1 and V_2), constant throughput (F), constant density, isothermal operation at temperatures T_1 and T_2, and first-order kinetics with simultaneous reactions:

$$A \xrightarrow{k_1} B \qquad A \xrightarrow{k_2} C$$

No reaction occurs in the plug-flow section.

Write the equations describing the system.

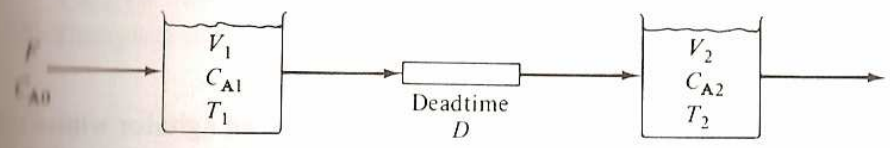

FIGURE P3.6

3.10. An isothermal, irreversible reaction

$$A \xrightarrow{k} B$$

takes place in the liquid phase in a constant-volume reactor. The mixing is *not* perfect. Observation of flow patterns indicates that a two-tank system with back mixing, as shown in the sketch below, should approximate the imperfect mixing.

Assuming F and F_R are constant, write the equations describing the system.

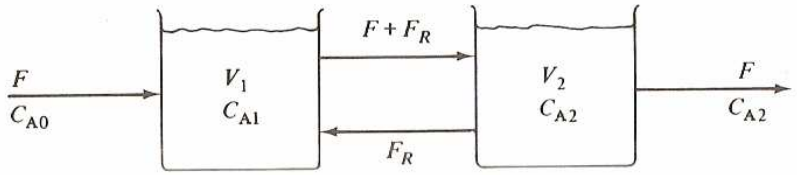

FIGURE P3.10