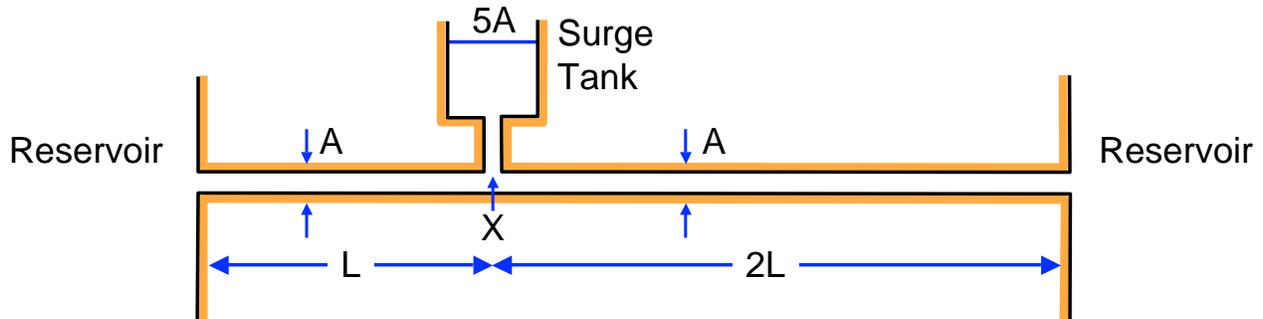


**Problem 210E**

One large reservoir of incompressible liquid is connected by a pipeline (cross-sectional area =  $A$ , length =  $3L$ ) to another large reservoir:



These reservoirs are sufficiently large that the fluctuations in the total head of the flow entering and leaving the pipeline are zero. A surge tank with a free surface area of  $5A$  is located at a point in the pipeline a distance  $L$  from the inlet. Determine the natural frequency of this hydraulic system in terms of  $L$  and the acceleration due to gravity,  $g$ .