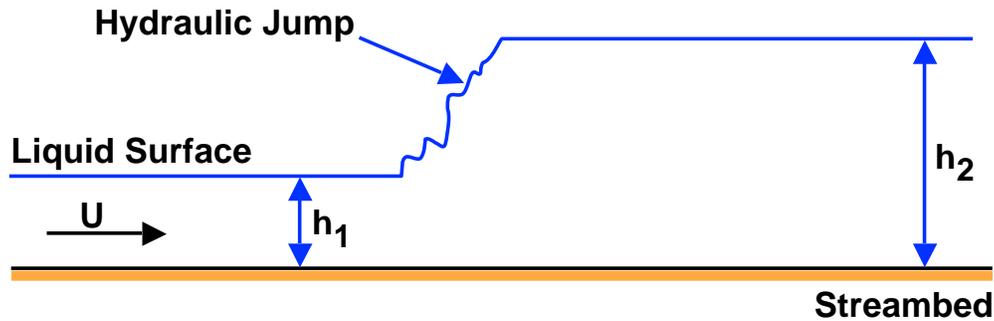


Problem 220F

A hydraulic jump is a sudden increase in the depth of a liquid stream (which in this case we assume is flowing over a horizontal stream bed with atmospheric pressure air everywhere above the liquid):



The depth increases suddenly from h_1 to h_2 downstream of the jump. The jump itself is often turbulent and involves viscous losses so that the total pressure downstream is less than that of the upstream flow. Find the ratio of the depths, h_2/h_1 , in terms of the upstream velocity, U , the depth, h_1 , and g , the acceleration due to gravity. Assume the flows upstream and downstream have uniform velocity parallel to the stream bed and that the shear stress between the liquid and the stream bed is zero. The liquid is incompressible.

What inequality on the value of $U/(gh_1)^{\frac{1}{2}}$ must hold for a hydraulic jump like this to occur?