Fluid Pressure

1) An automatic valve consists of a rectangular plate (with height $H = 9$ in and width $b = 12$ in) that is pivoted about a horizontal axis through $A$ located at a distance $h$ from the bottom surface, as illustrated below. The upper portion of length $L$ contains oil and the lower portion, water. The density of oil and water are $\rho_o = 900$ kg/m$^3$ and $\rho_w = 1000$ kg/m$^3$ respectively.

a) Determine the magnitude of the resultant hydrostatic force acting on the submerged rectangular plate
b) Determine the location of the resultant hydrostatic force acting on the submerged rectangular valve, measured from the bottom
c) Determine a symbolic expression for the horizontal reaction developed at $A$.
d) When $h = 3.6$ in and $L = 6$ in, determine the depth of water $d$ for which the valve will open.
Virtual Work

2) The gas pressure exerts the horizontal force $F$ on the piston. Assume the slide crank mechanism is in equilibrium and use the principle of virtual work to evaluate the moment $M$ acting on the crankshaft as a function of $\theta$ and $F$. 