Question 1A: Diffusion of component "A" through stagnant "B" in gas phase

Consider a cylinder with inside area S containing pure liquid component "A". Above the opening flows gas "B" so that at z = L, $y_A = 0$. Such an apparatus is called an "Arnold Diffusion Cell."

Assumptions/Comments:

1) Constant temperature and pressure
2) A and B behave as ideal gases (when in the gas phase)
3) Gas B is insoluble in liquid A
4) The bottom of cylinder is attached to a large reservoir so that the liquid height remains fixed. Thus, the diffusion of A is at steady-state.
5) Boundary conditions are:

$$z = 0 \quad y_A = y_{A0}$$
$$z = L \quad y_A = 0$$

Find:

i) Φ_A at z = L
ii) c_A at z = L/2
iii) molar flow of A out of cylinder; $\dot{n}_A$ at z = L