

## Exercises – Serie 2

### Equilibrium of a nucleus

1. Write the equilibrium condition for a spherical nucleus of radius  $R$ , containing gas and vapor, within a liquid at rest at the pressure  $p_\infty$ .
2. Assuming an isothermal transformation and a constant mass of gas, find the equation of the curve  $p_\infty(R)$  as a function of the parameters  $p_{g0}$  and  $R_0$ .
3. Find the radius  $R_c$  at which the curve  $p_\infty(R)$  is minimum. Compute the corresponding pressure at this minimum. This pressure is the critical pressure  $p_c$  (or Blake threshold pressure).
4. Let us consider 3 bubbles of radius  $R_0 = 1\text{mm}$ ,  $1\mu\text{m}$  and  $1\text{nm}$ , in equilibrium at  $p_{\infty 0} = 1\text{ bar}$ . Compute the corresponding pressure of the gas  $p_{g0}$  inside each bubble (we assume a temperature of  $20^\circ\text{C} \rightarrow p_v = 2300\text{ Pa}$ ,  $S = 0.072\text{ N/m}$ ).
5. Find the critical radius and the critical pressure corresponding to each bubble. Are the bubbles in a stable equilibrium?
6. The difference  $p_v - p_c$  represents the static delay to cavitation of a nucleus. Compute this quantity for each bubble. Sketch the general form of the curve representing the static delay to cavitation as a function of the critical radius.
7. Using *Matlab* or *Excel*, plot the curve  $p_\infty(R)$  corresponding to each bubble.