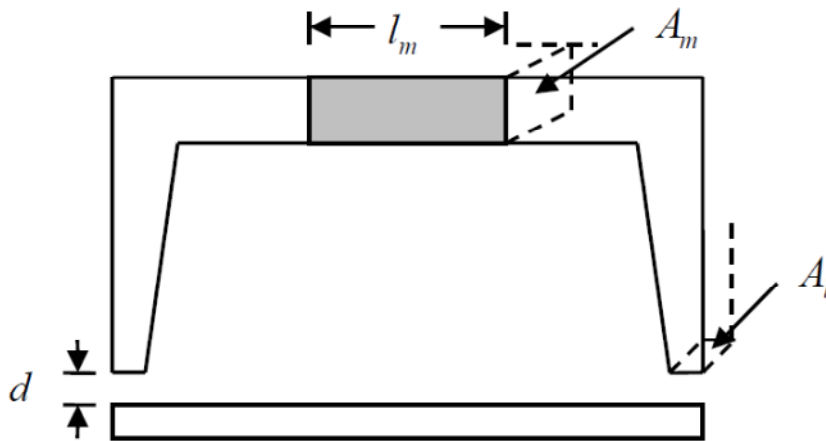


**Exercise 4: Permanent Magnet**

The arrangement shown, consists of a permanent magnet made of neodymium-iron-boron (NdFeB). For the magnet,  $l_m = 1 \text{ cm}$ ,  $A_m = 2 \text{ cm}^2$ . For the air gap,  $d = 1.25 \text{ mm}$  and  $A_l = 1 \text{ cm}^2$ . (The magnetic resistance of iron  $R_{Fe} \approx 0 \text{ A/Vs}$  (i.e.  $\mu_r = \infty$ )).



- Determine flux  $\phi$  in the air gap at an ambient temperature of  $\theta = 60 \text{ }^\circ\text{C}$ . (Use corresponding curves from the data provided below).
- What is the force  $F_l$  in the gap?
- How much is the force  $F_l$  at an ambient temperature of  $\theta = 150 \text{ }^\circ\text{C}$ ?
- What is the maximum permissible air gap length  $d$  so that, no irreversible demagnetization to the permanent magnet occurs at an ambient temperature of  $\theta = 150 \text{ }^\circ\text{C}$ ?

