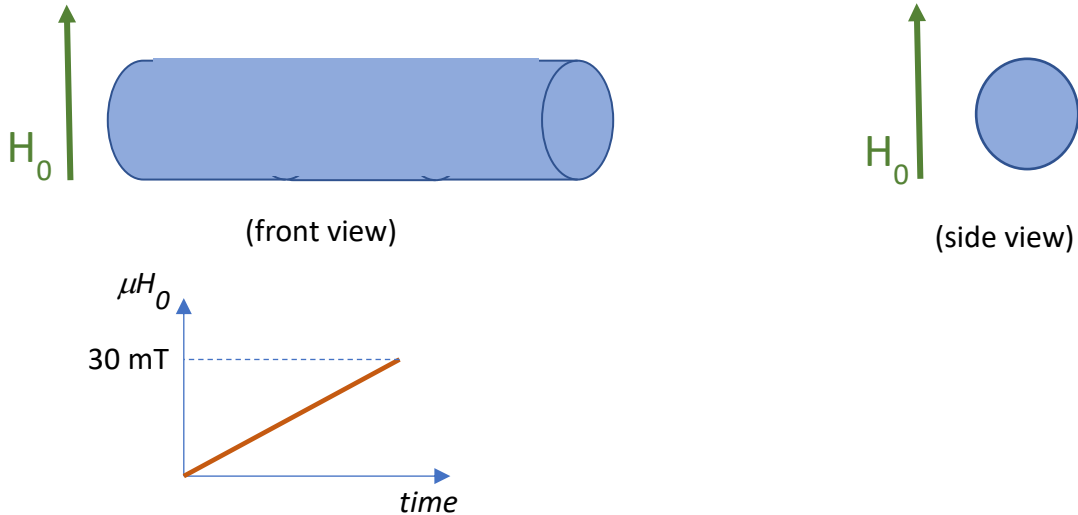


Problem 1 (4 points)

A cylindrical tin sample of radius R ($R \gg \lambda$) is cooled to 4.2 K, and then an external magnetic field is applied perpendicular to its axis and swept up from zero to 30 mT, as shown:



1. Plot magnetization curve $M(H)$ of the cylinder for this field sweep (3 pt)
2. A miniature magnetic field sensor is scanned along the cylinder surface to measure spatial variation of the normal field component during the ramp. Field is being held at 20 mT to perform a scan. What range of field variation can be seen by the sensor? (1 pt)

Problem 2 (4 points)

Homogeneous magnetic field of 1 T is applied along the axis of a NbTi wire of the diameter $d = 1$ mm at $T=4.2$ K. Estimate the net magnetic flux and amount of individual flux lines in the wire. Ignore the Meissner effect in this case.

Problem 3 (2 points)

Find the lower critical field of a superconducting specimen of NbTa superconductor if $H_{c2} = 0.4$ T and $\kappa = 3$.