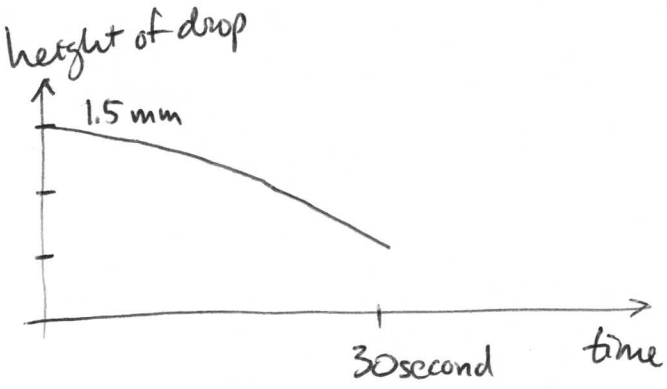
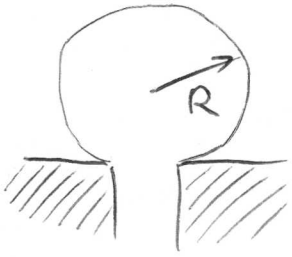
PASSIVE PUMPING

See Fig 3
of Berthier et al.
LoC I 1475 (2007)





when $R = 1mm$ drop volume is $\frac{4}{3}\pi R^3$

$\approx 4 \cdot 10^{-9}\ m^3$

and $P = \frac{2\gamma}{R} = 140\ \frac{N}{m^2}$

The flow resistance of Berthier's pipe was

$$K_w = \frac{8\eta L_o}{L_D^3 L_h} = \frac{8 \cdot 10^{-3} \cdot 35 \times 10^{-3}}{(0.2 \times 10^{-3})^3 \cdot (0.1 \times 10^{-3})}$$

$$= 2.5 \times 10^{11}\ \frac{Pa}{m^3/s}$$

Expected flow rate

$$Q = \frac{P}{K_w} = \frac{140}{2.5 \times 10^{11}} = 0.5 \times 10^{-9}\ \frac{m^3}{s}$$

Time for volume of drop to be transported

$$\Delta t = \frac{\text{Volume}}{Q} = \frac{4 \times 10^{-9}}{0.5 \times 10^{-9}} \approx 10 \text{ seconds.}$$