Schedule

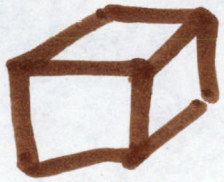
- Today :
- Thursday :
- Dec 21 :
- Dec 23 :

Surface tension of water:

75 mN/m

string: tension: force

volume: Pressure



force/area

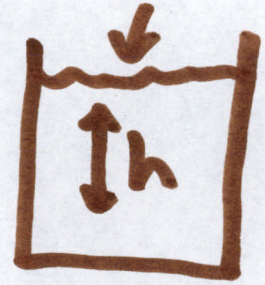
air

gauge pressure

drop of water

fog: $R \sim \mu m$

heavy rain: $R \sim mm$



physicist

1. energy
2. calculus — differentials

area: $4\pi R^2 = \frac{d}{dR}\underbrace{\left(\frac{4\pi}{3}R^3\right)}_{y(R)}$

$\frac{dy}{dR}$

increase radius by $\Delta R \rightarrow$ increase area by ΔA

$$A = 4\pi R^2 \qquad \underbrace{\frac{dA}{dR} = 8\pi R}$$

$$\Delta A = 8\pi R \Delta R$$

change area change R

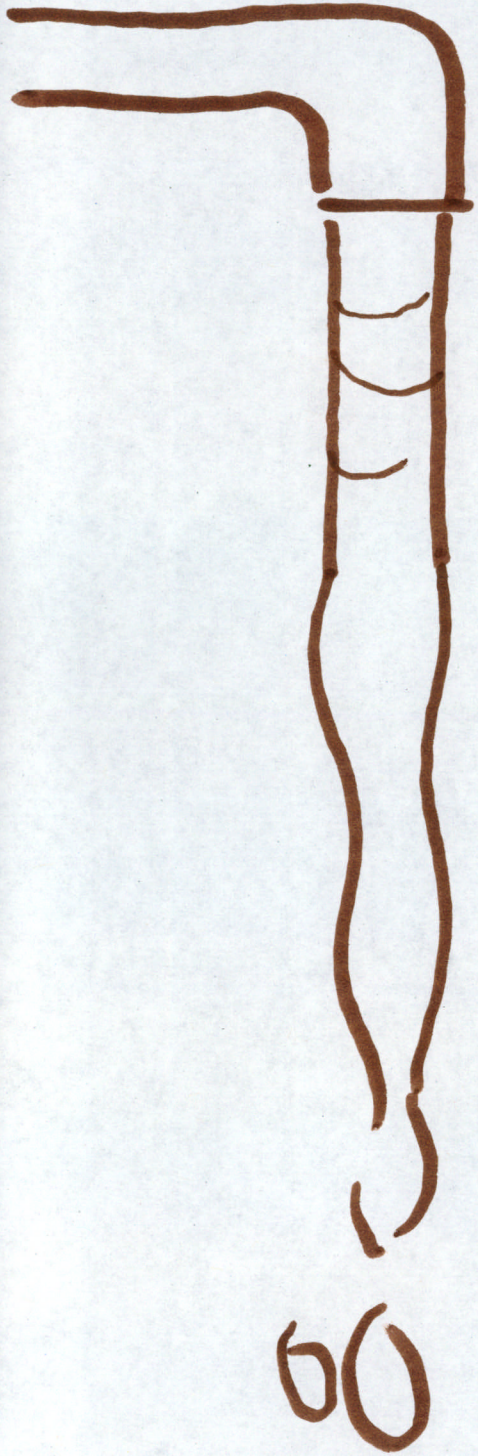
$\underline{\Delta A}$ requires <u>work</u> b/c there is a surface tension (force/length) σ

S.T.

$$\Delta W = \sigma \Delta A$$

$$\Delta W = T \Delta l \qquad \Delta W = P \Delta V$$

guitar string work intensive extensive



spheres have the smallest surface-area-to-volume ratio

what happens if we <u>expand</u> a drop of water by ΔR?

- stretch surface – $\Delta W = \sigma \cdot \Delta A$
- "uncompress" the water
  - ↳ <u>water</u> <u>is</u> <u>incompressible</u>
    - ↳ not exactly true!
      - ↳ approximation
  - ↳ get work $\Delta W = P \Delta V$

in equilibrium: $\sigma \Delta A = P \Delta V$