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

**Surface tension of water:**

75 mN/m

- String: tension: force
- Volume: pressure
- Force/area

Surface of drop of water
drop of water
fog: $R \sim \mu m$"

heavy rain: $R \sim mm$

1. Energy
2. Calculus - differentials.

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

increase radius by $\Delta R \rightarrow$
increase area by $\Delta A$
\[ A = 4\pi R^2 \]
\[ \frac{dA}{dR} = 8\pi R \]

\[ \Delta A = 8\pi R \Delta R \]

\( \Delta A \) requires work b/c there is a surface tension \((\text{force/length})\) \(\sigma\)

\[ \Delta W = \sigma \Delta A \]

\[ \Delta W = T \Delta l \quad \Delta W = P \Delta V \]

\(\text{guitar string work intensive} \quad \text{work extensive}\)
Spheres have the smallest surface area-to-volume ratio.
what happens if we expand a drop of water by $\Delta R$?
- Stretch surface: $\Delta W = \sigma \cdot \Delta A$
- "incompressible" the water

$b$ water is incompressible
$\Rightarrow$ not exactly true!
$\Rightarrow$ approximation

$\Rightarrow$ get work: $\Delta W = P \Delta V$

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