M R

Ahmed Mahdy

فيزياء	استاتيكا
دوائر كهربية	الكـــترونيات
ميكانيكا الانشائات	هيدروليكا

مدرس خصوصي

اونلاين حضوري

يحصل الطالب علي

- مقاطع فيديوهات لشرح المقرر بشكل وافي
- ملخص للمادة Pdf للمذكرة والمراجعة
- محاضرات مباشرة علي برنامج زووم

لمناقشة الأجزاء الغير مفهومة

- تواصل مستمر مع معلم المادة

للتواصل

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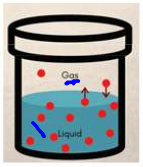
0565657741

4-Vapor Pressure

Definition: Vapor pressure is the pressure exerted by a vapor in thermodynamic equilibrium with the condensed phases (solid or liquid) at a given temperature in a closed system.

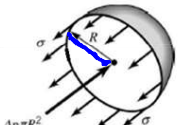


- At equilibrium, the evaporation rate equals the condensation rate.
- Evaporation and condensation occur at the liquid surface.
- Increasing temperature increases the rate of evaporation and increases vapor pressure.
- Molecules in vapor phase collide with the walls and lid of container, causing pressure.

5-Surface Tension (σ)

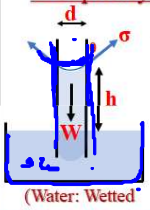
Definition: is the tendency of liquid surfaces at rest to shrink into the minimum surface area possible.

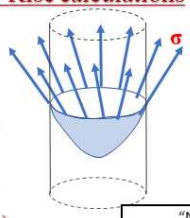
(Balance between adhesion and cohesion)



$$F_\sigma = 2\pi R\sigma$$

6-Capillary Rise calculations





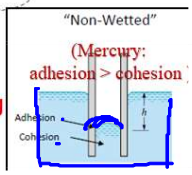
(Water: Wetted cohesion >adhesion)

σ "Surface tension force"

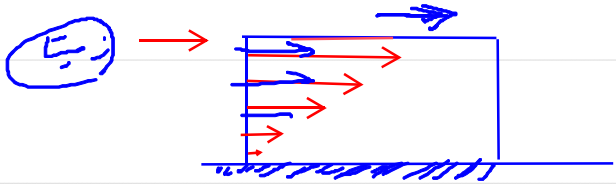
∑y=0

$\sigma.\cos\theta.\pi d = (\pi d^2/4).h.\rho.g$

$$h = \frac{4\sigma\cos\theta}{d.\rho.g}$$



6-Viscosity



6-Viscosity

Viscosity Types

Dynamic viscosity (μ) is expressed as the ratio of shear stress to shear strain.

$$\tau = \mu\frac{dv}{dy}$$

- **Units:** N.s/m² or kg/m.s (kg m⁻¹ s⁻¹)
  (Note that *m* is often expressed in Poise, *P*, where 10 *P* = 1 N.s/m²)
- **Dimensions:** $ML^{-1}T^{-1}$
- **Typical values:**
  Water =1.14(10^{-3}) Ns/m², Air =1.78(10^{-5}) Ns/m²
  Mercury =1.552 Ns/m², Paraffin Oil =1.9 Ns/m²

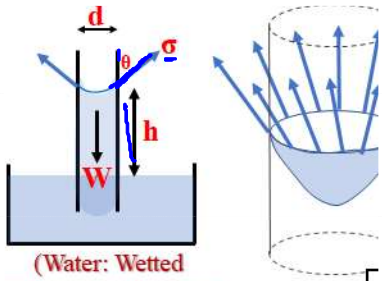
Kinematic viscosity (ν) is expressed as the ratio of fluid dynamic viscosity to its density.

$$\nu = \frac{\mu}{\rho}$$

- **Units:** m²/s
  (Note that ν is often expressed in Stokes, St, where 10^4 St = 1 m²/s)
- **Dimensions:** $ML^{-1}T^{-1}$
- **Typical values:**
  Water =1.14(10^{-6}) m²/s, Air =1.46(10^{-5}) m²/s,
  Mercury =1.145(10^{-4}) m²/s, Paraffin Oil =2.375(10^{-3}) m²/s

Example2

Water has a surface tension of 0.4 N/m. In a 3-mm diameter vertical tube, if the liquid rises 6 mm above the liquid outside the tube, calculate the wetting angle.



(Water: Wetted cohesion >adhesion)

σ "Surface tension force"

$\sum y=0$

$\sigma.\cos\theta.\pi d=(\pi d^2/4).h.\rho.g$

$$h=\frac{4\sigma\cos\theta}{d.\rho.g}$$

Solution:

$\sigma = 0.4\ N/m, \quad d = 3*10^{-3}\ m, \quad h = 6*10^{-5}\ m$

θ ??

$$\frac{h}{1}=\frac{4\sigma\cos\theta}{d\rho g} \Rightarrow \frac{4\sigma\cos\theta}{4\sigma}=\frac{h d\rho g}{4\sigma}$$

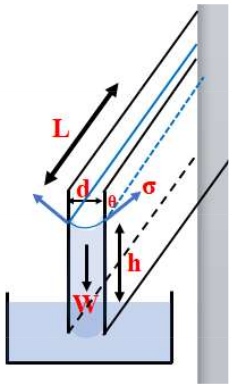
$$\cos\theta=\frac{6*10^{-3}*3*10^{-3}*1000*9.81}{4*0.4}=\dots\dots$$

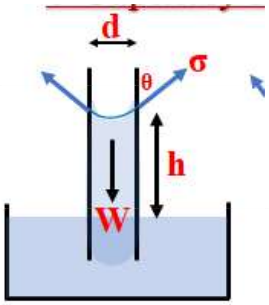
$$\theta=\cos^{-1}(\dots\dots)=83.7^\circ$$

Example3

Find: Capillary rise between two vertical glass plates 1 mm apart.

- $s = 7.3\times10^{-2}$ N/m





$$h=\frac{4\sigma\cos\theta}{d.\rho.g}$$