Formula

1. **Atomic structure**

$$E_{ph} = h \cdot f = \frac{hc}{\lambda}$$

$$\chi_M = \frac{1}{2}\left(I + E_{ea}\right)$$

$$\Delta = E_{bond,AB}(\exp) - E_{bond,AB}(theor., non-polar)$$

$$E_{bond,AB}^{non-polar} = \frac{E_{bond}^{A-A} + E_{bond}^{B-B}}{2}$$

$$0.104\sqrt{\Delta} = \left|\chi_A - \chi_B\right|$$

2. **Gas phase**

$$pV = \nu RT$$

$$\frac{1}{2}m\bar{v}^2 = \frac{3}{2}kT$$

$$\rho = \rho_0 e^{-\frac{mgh}{kT}}$$

$$p = p_0 e^{-\frac{mgh}{kT}}$$

$$n_i = n_0 e^{-\frac{\varepsilon_i - \varepsilon_0}{kT}}$$

$$k_{AB} = const. \cdot e^{-\frac{\varepsilon_{barrier} - \varepsilon_A}{kT}}$$

$$K = \frac{n_A}{n_B} = e^{-\frac{\varepsilon_A - \varepsilon_B}{kT}}$$

3. **Fluids**

$$F = \eta \cdot A \cdot \frac{\Delta v}{\Delta h}$$

$$\sigma = \frac{\Delta E}{\Delta A}$$

$$\cos\Theta = \frac{\sigma_{solid-air} - \sigma_{solid-liquid}}{\sigma_{liquid-air}}$$

$$\Delta E = \Delta A \cdot \sigma_{s-l} - \Delta A \cdot \sigma_{s-a} + \Delta A \cdot \cos\Theta \cdot \sigma_{l-a}$$

4. **Solids**

$$n_s = Ne^{-\frac{\varepsilon_s}{kT}}$$

$$n_f = \sqrt{NN'}e^{-\frac{\varepsilon_f}{2kT}}$$

4. **Methods for structure examination**

$$M = M_{obj} \cdot M_e = \frac{a \cdot d}{f_{obj} \cdot f_e}$$

$$\delta = 0.61\frac{\lambda}{n \cdot \sin\omega}$$

$$\delta \approx \frac{\lambda}{NA}$$

$$\Delta s = k \cdot \lambda$$

$$\Delta s = \left(1 + k/2\right) \cdot \lambda$$

$$\lambda = \frac{h}{m \cdot v} = \frac{h}{I}$$

$$d \cdot \sin\alpha = k \cdot \lambda$$

$$c_1 = \frac{m_1}{m_1 + m_2}100\%$$

$$c_1 = \frac{\upsilon_1}{\upsilon_1 + \upsilon_2}100\%$$

$$\frac{R}{R+S}, \frac{S}{R+S}$$

$$DP_n = X_n = \frac{M_n}{M_0}$$

5. **Deformation**

$$\sigma = \frac{F}{A_0}$$

$$\varepsilon = \frac{\Delta l}{l_0} = \frac{l - l_0}{l_0}$$

$$\sigma = E \cdot \varepsilon$$

$$\Theta = \frac{\pi}{4}R^4$$

$$\Theta = \frac{\pi}{4}\left(R_2^4 - R_1^4\right)$$

$$\Theta = \frac{1}{12}ab^3$$

$$\sigma = G \cdot \gamma$$

$$G = \frac{E}{2\left(1+\upsilon\right)}$$

$$M = G\frac{R^4\pi}{2l}\phi$$

$$w_r \approx \frac{1}{2}\sigma_r \cdot \varepsilon_r = \frac{1}{2}E\varepsilon_r^2 = \frac{1}{2E}\sigma_r^2$$

$$W = \frac{1}{2} D(\Delta l)^2$$

$$W_r = \frac{1}{2} E \cdot \frac{A}{l} \cdot (\Delta l)^2$$

$$W_r = \frac{1}{2} 3E \cdot \frac{\Theta}{l^3} \cdot s^2$$

$$\sigma_{shear} = \eta \cdot g_{speed}$$

$$\sigma = \sigma_0 \cdot e^{-\frac{t}{t_{rel}}}$$

$$t_{rel} = \frac{\eta}{G}$$

6. **Thermal properties**

$$C = \frac{\Delta Q}{\Delta T}$$

$$c_\nu = \frac{C}{\nu}$$

$$c = \frac{C}{m}$$

$$\frac{\Delta Q}{\Delta t} = -\lambda \cdot A \cdot \frac{\Delta T}{\Delta x}$$

$$D = \frac{\lambda}{c_p \cdot \rho}$$

$$\frac{\Delta l}{l_0} = \alpha \cdot \Delta T$$

$$l = l_0(1 + \alpha)\Delta T$$

$$\frac{\Delta V}{V_0} = \beta \cdot \Delta T$$

$$V = V_0(1 + \beta)\Delta T$$

7. **Optical properties**

$$c = f \cdot \lambda$$

$$c = \frac{c_0}{n}$$

$$J = \frac{\Delta P}{\Delta A}$$

$$\frac{\sin\alpha}{\sin\beta} = \frac{c_1}{c_2} = \frac{n_2}{n_1} = n_{21}$$

$$J = J_0 \cdot e^{-\mu x}$$

$$T = \frac{J_0}{J} 100\%$$

$$A = \lg \frac{J_0}{J}$$

$$\delta = \frac{1}{\mu}$$

$$D = \frac{\ln 2}{\mu}$$

$$A = \varepsilon(\lambda) \cdot c \cdot x$$

$$J = J_0 \cdot e^{-t/\tau}$$

8. **Electric properties**

$$W_{AB} = \sum F \cdot \Delta s = Q \cdot \sum E \cdot \Delta s$$

$$V = \frac{W_{AB}}{Q}$$

$$I = \frac{\Delta Q}{\Delta t}$$

$$R = \frac{V}{I}$$

$$\rho = \frac{R \cdot A}{l}$$

$$\sigma = \frac{1}{\rho}$$

9. **Biomechanics**

$$\kappa = \frac{F}{\Delta l} = \frac{EA}{L}$$

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$$\kappa = \frac{4\pi}{3} \frac{Er^4}{L^3}$$

$$\left\langle R^2 \right\rangle = Nl^2 = Ll$$

$$\frac{Fl}{k_B T} \sim \frac{R}{L}$$

10. **Statics**

$$\sum F_i = 0$$

$$M = r \cdot F$$

$$\sum M_i = 0$$

$$\frac{G}{F} = \frac{r_F}{r_G}$$

$$M = d \cdot F$$