Fysiske formler

Nedenfor er angivet en række formler, der måske kan være til hjælp. Bemærk, at nogle formler kun gælder under specielle forhold, der ikke nødvendigvis er angivet. Samme symboler kan optræde flere steder med forskellige betydninger. Formelsamlingen kan indeholde emner der ikke er relevant for denne eksamen.

Kinematik

$$v_x = v_{0x} + a_x t$$

$$x = x_0 + v_{0x} t + \tfrac{1}{2} a_x t^2$$

$$v_x^2 - v_{0x}^2 = 2a_x \left(x - x_0 \right)$$

$$x - x_0 = \left(\frac{v_{0x} + v_x}{2} \right) t$$

$$x = v_0 \cos\left(\alpha\right) t$$

$$y = v_0 \sin\left(\alpha\right) t - \tfrac{1}{2} g t^2$$

$$a_{\text{rad}} = \frac{v^2}{R}$$

$$a_{\tan} = \frac{dv}{dt}$$

$$\vec{r}_{A|B} = \vec{r}_{A|C} + \vec{r}_{C|B}$$

Partikelmekanik

$$\sum_i \vec{F}_i = m\vec{a}$$

$$\vec{F}_{A|B} = -\vec{F}_{B|A}$$

$$f_{\text{k}} = \mu_{\text{k}} n$$

$$f_{\text{s}} \le \mu_{\text{s}} n$$

$$W = \int_{x_1}^{x_2} F_x dx$$

$$W = \vec{F} \cdot \vec{s}$$

$$K = \frac{1}{2} m v^2$$

$$W_{\text{total}} = \Delta K = K_2 - K_1$$

$$P = \frac{dW}{dt}$$

$$P = \vec{F} \cdot \vec{v}$$

$$K_1 + U_1 = K_2 + U_2$$

$$K_1 + U_1 + W_{\text{andre}} = K_2 + U_2$$

$$U_{\text{grav}} = mgy$$

$$U_{\text{el}} = \frac{1}{2} k x^2$$

$$\vec{p} = m\vec{v}$$

$$\vec{J} = \int_{t_1}^{t_2} \vec{F} dt = \Delta \vec{p}$$

$$v_{B2x} - v_{A2x} = -\left(v_{B1x} - v_{A1x} \right)$$

$$\vec{r}_{\text{cm}} = \frac{\sum_i m_i \vec{r}_i}{\sum_i m_i}$$

$$\vec{P} = M\vec{v}_{\text{cm}}$$

$$\sum_i \vec{F}_{\text{ydre}} = M\vec{a}_{\text{cm}} = \frac{d\vec{P}}{dt}$$

Stive legemers mekanik

$$v = r\omega$$

$$a = r\alpha$$

$$I = \sum_i m_i r_i^2$$

$$K = \frac{1}{2} I \omega^2$$

$$I_P = I_{\text{cm}} + Md^2$$

$$\vec{\tau} = \vec{r} \times \vec{F}$$

$$K = \frac{1}{2} M v_{\text{cm}}^2 + \frac{1}{2} I_{\text{cm}} \omega^2$$

$$\sum \tau = I\alpha$$

$$\vec{L} = \vec{r} \times \vec{p}$$

$$\vec{L} = I\vec{\omega}$$

$$\sum \vec{\tau} = \frac{d\vec{L}}{dt}$$

Gravitation

$$F_g = \frac{G m_1 m_2}{r^2}$$

$$U = -\frac{G m_1 m_2}{r}$$

$$T = \frac{2\pi r^{3/2}}{\sqrt{Gm}}$$

Svingninger

$$a = -\omega^2 x$$

$$x = A\cos\left(\omega t + \varphi\right)$$

$$x = A\cos\left(\omega t\right) + B\sin\left(\omega t\right)$$

Fluider

$$p = \frac{F}{A}$$

$$p = p_0 + \rho g h$$

$$B = \rho V g$$

$$A_1 v_1 = A_2 v_2$$

$$\frac{dV}{dt} = Av$$

$$p_1 + \rho g y_1 + \tfrac{1}{2}\rho v_1^2 = p_2 + \rho g y_2 + \tfrac{1}{2}\rho v_2^2$$

Termodynamik

$$\Delta L = \alpha L_0 \Delta T$$

$$\Delta V = \beta V_0 \Delta T$$

$$Q = mc\Delta T$$

$$Q = nC\Delta T$$

$$Q = \pm mL$$

$$H = \frac{dQ}{dt} = kA\frac{T_H - T_C}{L}$$

$$pV = nRT$$

$$m_{\text{total}} = nM$$

$$M = N_{\text{A}} m$$

$$K_{\text{tr}} = \tfrac{3}{2}nRT$$

$$\tfrac{1}{2}m\left(v^2\right)_{av} = \tfrac{3}{2}kT$$

$$v_{\text{rms}} = \sqrt{\left(v^2\right)_{av}}$$

$$v_{\text{rms}} = \sqrt{\frac{3kT}{m}} = \sqrt{\frac{3RT}{M}}$$

$$W = \int p dV$$

$$\Delta U = Q - W$$

$$C_p = C_V + R$$

$$\gamma = \frac{C_p}{C_V}$$

$$W_{\text{adiabat}} = nC_V\left(T_1 - T_2\right)$$

$$W_{\text{adiabat}} = \frac{1}{\gamma - 1}\left(p_1V_1 - p_2V_2\right)$$

$$W_{\text{adiabat}} = \frac{C_V}{R}\left(p_1V_1 - p_2V_2\right)$$

$$p_1V_1^{\gamma} = p_2V_2^{\gamma}$$

$$T_1V_1^{\gamma-1} = T_2V_2^{\gamma-1}$$

$$\Delta U = nC_V\Delta T$$

$$e = \frac{W}{Q_H}$$

$$K = \frac{Q_C}{-W}$$

$$e_{\text{Carnot}} = 1 - \frac{T_C}{T_H}$$

$$K_{\text{Carnot}} = \frac{T_C}{T_H - T_C}$$

$$\Delta S = \int \frac{dQ}{T}$$

Elektromagnetisme

$$F = \frac{1}{4\pi\varepsilon_0}\frac{|q_1q_2|}{r^2}$$

$$\vec{F} = q\vec{E}$$

$$\vec{E} = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}\hat{r}$$

$$\vec{\tau} = \vec{p} \times \vec{E}$$

$$\Phi_E = \int \vec{E} \cdot d\vec{A}$$

$$\Phi_E = \int\limits_{\substack{\text{lukket}\\ \text{overflade}}} \vec{E} \cdot d\vec{A} = \frac{Q_{\text{encl}}}{\varepsilon_0}$$

$$U = \frac{q_0}{4\pi\varepsilon_0}\sum_i \frac{q_i}{r_i}$$

$$U = \frac{1}{4\pi\varepsilon_0}\sum_{i<j} \frac{q_iq_j}{r_{ij}}$$

$$V = \frac{U}{q_0} = \frac{1}{4\pi\varepsilon_0}\sum_i \frac{q_i}{r_i}$$

$$V = \frac{1}{4\pi\varepsilon_0}\int \frac{dq}{r}$$

$$V_a - V_b = \int_a^b \vec{E} \cdot d\vec{l}$$

$$E_x = -\frac{\partial V}{\partial x}, E_y = -\frac{\partial V}{\partial y}, \ldots$$

$$C = \frac{Q}{V_{ab}} = \varepsilon_0\frac{A}{d}$$

$$C = KC_0 = K\varepsilon_0\frac{A}{d}$$

$$\frac{1}{C_{\text{eq}}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \cdots$$

$$C_{\text{eq}} = C_1 + C_2 + C_3 + \cdots$$

$$U = \frac{Q^2}{2C} = \frac{1}{2}CV^2 = \frac{1}{2}QV$$

$$u = \frac{1}{2}\varepsilon_0 E^2$$

$$\vec{F} = q\vec{v} \times \vec{B}$$

$$\Phi_B = \int \vec{B} \cdot d\vec{A}$$

$$\Phi_B = \int\limits_{\substack{\text{lukket}\\ \text{overflade}}} \vec{B} \cdot d\vec{A} = 0$$

$$\vec{F} = I\vec{l} \times \vec{B}$$

$$\mu = IA$$

$$\vec{\tau} = \vec{\mu} \times \vec{B}$$

$$U = -\vec{\mu} \cdot \vec{B}$$

$$\vec{B} = \frac{\mu_0}{4\pi}\frac{q\vec{v} \times \hat{r}}{r^2}$$

$$B = \frac{\mu_0 I}{2\pi r}$$

$$\frac{F}{L} = \frac{\mu_0 II'}{2\pi r}$$

$$\int\limits_{\substack{\text{lukket}\\ \text{kurve}}} \vec{B} \cdot d\vec{l} = \mu_0 I_{\text{encl}}$$

Matematiske formler

$$\frac{d\left(f(x)+g(x)\right)}{dx} = f'(x)+g'(x)$$

$$\frac{d\left(f(x)-g(x)\right)}{dx} = f'(x)-g'(x)$$

$$\frac{d\left(f(x)g(x)\right)}{dx} = f'(x)g(x)+f(x)g'(x)$$

$$\frac{d\left(f(x)/g(x)\right)}{dx} = \frac{f'(x)g(x)-f(x)g'(x)}{g(x)^2}$$

$$\frac{df(g(x))}{dx} = f'\left(g(x)\right)g'(x)$$

$$\int x^n dx = \frac{1}{n+1}x^{n+1},\ n \neq -1$$

$$\int \frac{1}{x}dx = \ln|x|$$

$$\int \exp(ax)dx = \frac{1}{a}\exp(ax)$$

$$\cos\theta = \frac{a}{c}$$

$$\sin\theta = \frac{b}{c}$$

$$\tan\theta = \frac{\sin\theta}{\cos\theta} = \frac{b}{a}$$

$$\sin^2\theta + \cos^2\theta = 1$$

$$\frac{d\sin\theta}{d\theta} = \cos\theta$$

$$\frac{d\cos\theta}{d\theta} = -\sin\theta$$

$$\frac{d\tan\theta}{d\theta} = 1+\tan^2\theta$$

$$\frac{d^2u}{dt^2} + \omega^2 u = 0 \Rightarrow u(t) = A\cos(\omega t) + B\sin(\omega t)$$

$$x^n x^m = x^{n+m}$$

$$\frac{x^n}{x^m} = x^{n-m}$$

$$x^n y^n = (xy)^n$$

$$\frac{x^n}{y^n} = \left(\frac{x}{y}\right)^n$$

$$\left(x^n\right)^m = x^{nm}$$

$$\ln(xy) = \ln(x)+\ln(y)$$

$$\ln\left(x^n\right) = n\ln(x)$$

$$ax^2+bx+c=0,\ a\neq 0 \Rightarrow x = \frac{-b\pm\sqrt{b^2-4ac}}{2a}$$