Konstanter og uttrykk som kan være nyttige:

Lyshastigheten: $c = 3.00 \times 10^8$ m/s
Plancks konstant: $h = 6.626 \times 10^{-34}$ J s
Gravitasjonskonstanten: $G = 6.673 \times 10^{-11}$ N m^2/kg^2
Boltzmanns konstant: $k = 1.38 \times 10^{-23}$ J/K
Stefan Boltzmann konstant: $\sigma = 5.670 \times 10^{-8}$W/m^{2}K^4.
Elektronets hvilemasse: $m_e = 9.1 \times 10^{-31}$ kg
Protonets hvilemasse: $m_p = 1.6726 \times 10^{-27}$ kg
Nøytronets hvilemasse: $m_n = 1.6749 \times 10^{-27}$ kg
Wiens forskyvnigslov: $\lambda_{max} T = 0.0029$ m K
1 eV (elektronvolt) = 1.60×10^{-19} J
Massen til jorda: $M_j = 5.97 \times 10^{24}$ kg
Radien til jorda: $R_j = 6378 \times 10^3$ m
Solmassen: $M_\odot = 2 \times 10^{30}$ kg
Solradien: $R_\odot = 6.98 \times 10^8$ m.
Solas tilsynelatende magnitude: $m = -26.7$
Solas absolutte magnitude: $M = 4.83$
Solas luminositet: $L_\odot = 3.827 \times 10^{26}$W
Solas forventede levetid: $t_{life} = 10^{10}$år
Massen til Jupiter: 1.9×10^{27} kg
Temperaturen på solens overflate: 5780 K
Astronomisk enhet: 1AU = 1.5×10^{11} m
Hubblekonstanten: $H_0 = 71$ km/s/Mpc
lysår: 1 ly = 9.47×10^{15} m
parsec: 1 pc = 206 265 AU = 3.27 ly

Formler vi har brukt/utledet i kurset:

stråling/magnituder/avstander:

$$B(\nu) = \frac{2h\nu^3}{c^2}\frac{1}{e^{h\nu/(kT)}-1} \qquad I(\nu) = \frac{dE}{cos\theta d\Omega dA dt d\nu}$$
$$L = \frac{dE}{dt} \qquad F = \frac{dE}{dAdt}$$
$$F = \sigma T^4 \qquad v = H_0 d_p$$
$$m_1 - m_2 = -2.5\log_{10}\left(\frac{F_1}{F_2}\right) \qquad m - M = 5\log_{10}\left(\frac{d}{10\text{pc}}\right)$$
$$M_V = -2.81\log_{10} P_d - 1.43 \qquad \lambda_{\max} T = 0.0029\ m\ K$$

spesiell relativitetsteori:

$$\Delta s^2 = \Delta t^2 - \Delta x^2 \qquad \frac{\Delta\lambda}{\lambda} = \left(\sqrt{\frac{1+v}{1-v}} - 1\right) \qquad V_\mu = \gamma(1,\vec{v}) \qquad m^2 = E^2 - p^2$$

$$c_{\mu\nu} = \begin{pmatrix} \gamma_{\text{rel}} & -v_{\text{rel}}\gamma_{\text{rel}} & 0 & 0 \\ -v_{\text{rel}}\gamma_{\text{rel}} & \gamma_{\text{rel}} & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

stjerneutvikling, begynnelsen/hovedserien:

$$< E_K >= \frac{3}{2}kT \qquad N = \frac{M}{\mu m_H} \qquad M_J = \left(\frac{5kT}{G\mu m_H}\right)^{3/2}\left(\frac{3}{4\pi\rho}\right)^{1/2}$$
$$\rho(r)\frac{d^2r}{dt^2} = -\rho(r)g(r) - \frac{dP(r)}{dr} \qquad P = \frac{\rho kT}{\mu m_H} \qquad P_r = \frac{1}{3}aT^4$$
$$\rho_r = aT^4 \qquad < K >= -\frac{1}{2} < U >$$

generell relativitetsteori:

$$\Delta s^2 = \left(1 - \frac{2M}{r}\right)\Delta t^2 - \frac{\Delta r^2}{1-\frac{2M}{r}} - r^2\Delta\phi^2 \qquad \frac{M_{\text{m}}}{M_{\text{kg}}} = \frac{G}{c^2}$$
$$\Delta t_{\text{shell}} = \sqrt{1 - \frac{2M}{r}}\Delta t \qquad \Delta r_{\text{shell}} = \frac{\Delta r}{\sqrt{1-\frac{2M}{r}}}$$
$$\frac{E}{m} = \left(1 - \frac{2M}{r}\right)\frac{dt}{d\tau} \qquad \frac{L}{m} = r^2\frac{d\phi}{d\tau}$$
$$\Delta t = \frac{E/m}{\left(1-\frac{2M}{r}\right)}\Delta\tau \qquad \Delta\phi = \frac{L/m}{r^2}\Delta\tau$$
$$\Delta r = \pm\sqrt{\left(\frac{E}{m}\right)^2 - \left[1 + \left(\frac{L/m}{r}\right)^2\right]\left(1 - \frac{2M}{r}\right)}\Delta\tau \qquad \frac{V_{\text{eff}}(r)}{m} = \frac{1}{2}\frac{(L/m)^2}{r^2} - \frac{M}{r}$$
$$\frac{V_{\text{eff}}(r)}{m} = \sqrt{\left(1 - \frac{2M}{r}\right)\left[1 + \frac{(L/m)^2}{r^2}\right]} \qquad \Delta r = \pm\left(1 - \frac{2M}{r}\right)\sqrt{1 - \left(1 - \frac{2M}{r}\right)\frac{(L/E)^2}{r^2}}\Delta t$$
$$r\Delta\phi = \pm\frac{L/E}{r}\left(1 - \frac{2M}{r}\right)\Delta t \qquad b = \frac{L}{p}$$
$$V_{\text{eff}} = \frac{1}{r}\sqrt{1 - \frac{2M}{r}} \qquad b_{\text{crit}} = 3\sqrt{3}M$$
$$\Delta\phi = \frac{4M}{R} \qquad \theta_E = \sqrt{\frac{4M(d_{\text{source}} - d_{\text{lens}})}{d_{\text{lens}}d_{\text{source}}}}$$

kjernereaksjoner:

$U = -\frac{1}{4\pi\epsilon_0}\frac{Z_A Z_B e^2}{r}$	$\varepsilon_{AB} = \varepsilon_0 X_A X_B \rho^\alpha T^\beta$
$\varepsilon_{pp} \approx \varepsilon_{0,pp} X_H^2 \rho T_6^4$	$\varepsilon_{0,pp} = 1.08 \times 10^{-12}\mathrm{Wm^3/kg^2}$
$\varepsilon_{CNO} = \varepsilon_{0,CNO} X_H X_{CNO} \rho T_6^{20}$	$\varepsilon_{0,CNO} = 8.24 \times 10^{-31}\mathrm{Wm^3/kg^2}$
$\varepsilon_{3\alpha} = \varepsilon_{0,3\alpha} \rho^2 X_{He}^3 T_8^{41}$	$\varepsilon_{0,3\alpha} = 3.86 \times 10^{-18}\mathrm{Wm^6/kg^3}$

stjerners egenskaper/siste stadier i stjerneutvikling:

$L \propto M^4$	$t \propto 1/M^3$
$M \propto T_{\mathrm{eff}}^2$	$E_F = \frac{h^2}{8m_e}\left(\frac{3n_e}{\pi}\right)^{2/3}$
$\frac{T}{n_e^{2/3}} < \frac{h^2}{12 m_e k}\left(\frac{3}{\pi}\right)^{2/3}$	$P = \left(\frac{3}{\pi}\right)^{2/3}\frac{h^2}{20 m_e} n_e^{5/3}$
$P = \frac{hc}{8}\left(\frac{3}{\pi}\right)^{1/3} n_e^{4/3}$	$< E_K > = \frac{3}{5}E_F$
$R_{\mathrm{WD}} \approx \left(\frac{3}{2\pi}\right)^{4/3}\frac{h^2}{20 m_e G}\left(\frac{Z}{A m_H}\right)^{5/3} M^{-1/3}$	$M_{\mathrm{Ch}} \approx \frac{\sqrt{3/2}}{2\pi}\left(\frac{hc}{G}\right)^{3/2}\left(\frac{Z}{A m_H}\right)^2 \approx 1.4 M_\odot$