P34.7 (a) Since the light from this star travels at 3.00×10^8 m/s

the last bit of light will hit the Earth in $\dfrac{6.44 \times 10^{18}\text{ m}}{3.00 \times 10^8\text{ m/s}} = 2.15 \times 10^{10}\text{ s} = 680$ years.

Therefore, it will disappear from the sky in the year $2004 + 680 = \boxed{2.68 \times 10^3\text{ C.E.}}$.

The star is 680 light-years away.

(b) $$\Delta t = \frac{\Delta x}{v} = \frac{1.496 \times 10^{11}\text{ m}}{3 \times 10^8\text{ m/s}} = \boxed{499\text{ s}} = 8.31\text{ min}$$

(c) $$\Delta t = \frac{\Delta x}{v} = \frac{2(3.84 \times 10^8\text{ m})}{3 \times 10^8\text{ m/s}} = \boxed{2.56\text{ s}}$$

(d) $$\Delta t = \frac{\Delta x}{v} = \frac{2\pi(6.37 \times 10^6\text{ m})}{3 \times 10^8\text{ m/s}} = \boxed{0.133\text{ s}}$$

(e) $$\Delta t = \frac{\Delta x}{v} = \frac{10 \times 10^3\text{ m}}{3 \times 10^8\text{ m/s}} = \boxed{3.33 \times 10^{-5}\text{ s}}$$

P34.8 $$v = \frac{1}{\sqrt{\kappa\mu_0\epsilon_0}} = \frac{1}{\sqrt{1.78}}c = 0.750c = \boxed{2.25 \times 10^8\text{ m/s}}$$

P34.9 (a) $f\lambda = c$

or $f(50.0\text{ m}) = 3.00 \times 10^8\text{ m/s}$

so $\boxed{f = 6.00 \times 10^6\text{ Hz} = 6.00\text{ MHz}}$.

(b) $\dfrac{E}{B} = c$

or $\dfrac{22.0}{B_{\max}} = 3.00 \times 10^8$

so $\mathbf{B}_{\max} = \boxed{-73.3\hat{\mathbf{k}}\text{ nT}}$.

(c) $k = \dfrac{2\pi}{\lambda} = \dfrac{2\pi}{50.0} = 0.126\text{ m}^{-1}$

and $\omega = 2\pi f = 2\pi(6.00 \times 10^6\text{ s}^{-1}) = 3.77 \times 10^7$ rad/s

$$\mathbf{B} = \mathbf{B}_{\max}\cos(kx - \omega t) = \boxed{-73.3\cos(0.126x - 3.77 \times 10^7 t)\hat{\mathbf{k}}\text{ nT}}.$$

P34.15 $S = I = \dfrac{U}{At} = \dfrac{Uc}{V} = uc$ $\qquad \dfrac{\text{Energy}}{\text{Unit Volume}} = u = \dfrac{I}{c} = \dfrac{1\,000\text{ W/m}^2}{3.00 \times 10^8\text{ m/s}} = \boxed{3.33\ \mu\text{J/m}^3}$

P34.19 Power output = (power input)(efficiency).

Thus, $\qquad \text{Power input} = \dfrac{\text{Power out}}{\text{eff}} = \dfrac{1.00 \times 10^6\text{ W}}{0.300} = 3.33 \times 10^6\text{ W}$

and $\qquad A = \dfrac{\wp}{I} = \dfrac{3.33 \times 10^6\text{ W}}{1.00 \times 10^3\text{ W/m}^2} = \boxed{3.33 \times 10^3\text{ m}^2}.$

P34.23 (a) $\vec{E}\cdot\vec{B} = (80\hat{i}+32\hat{j}-64\hat{k})\cdot(0{,}2\hat{i}+0{,}08\hat{j}+0{,}29\hat{k})\times10^{-6}$

$= (16+2{,}56-18{,}56)\cdot10^{-6} = \boxed{0}$

(b) $\vec{S} = \frac{1}{\mu_0}\vec{E}\times\vec{B} = \frac{1}{4\pi\times10^{-7}}\begin{bmatrix} \hat{i} & \hat{j} & \hat{k} \\ 80 & 32 & -64 \\ 0{,}2 & 0{,}08 & 0{,}29 \end{bmatrix}\times10^{-6}$

$= \frac{1}{4\pi\times10^{-7}}\left(14.4\hat{i} - 56.0\hat{j} + 0\hat{k}\right)\times10^{-6}$

$= \boxed{(11.5\hat{i} - 28{,}6\hat{j})\ W/m^2}$

$|S| = 30.9\ W/m^2$ at -68.2 from the $+x$ axis

P34, 29 $P = \frac{S}{c} = \frac{25}{3\times10^8} = \boxed{83{,}3\ nPa}$

P34.59 Think of light going up and being absorbed by the bead which presents a face area πr_b^2.

The light pressure is $P = \frac{S}{c} = \frac{I}{c}$.

(a) $F_\ell = \frac{I\pi r_b^2}{c} = mg = \rho\frac{4}{3}\pi r_b^3 g$ and $I = \frac{4\rho g c}{3}\left(\frac{3m}{4\pi\rho}\right)^{1/3} = \boxed{8.32\times10^7\ \mathrm{W/m^2}}$

(b) $\mathscr{P} = IA = \left(8.32\times10^7\ \mathrm{W/m^2}\right)\pi\left(2.00\times10^{-3}\ \mathrm{m}\right)^2 = \boxed{1.05\ \mathrm{kW}}$