1) The distance between the Earth and the Sun is $1.50 \cdot 10^{11}$ m. How long does it take for light to cover this distance?

$$1.5 \cdot 10^{11} m = (3 \cdot 10^8 m/s) (\Delta t) \rightarrow \Delta t = 500 \text{ sec}$$

2) Consider a simple plane electromagnetic wave that is traveling vertically downward with its electric field pointing southward. Which direction does the magnetic field of this wave point at this instant?

a) North  

b) East  

c) West  

d) Upward

3) There are two categories of ultraviolet light. Ultraviolet A (UVA) has a wavelength ranging from 320nm to 400nm. It is not so harmful to the skin and is necessary for the production of vitamin D. UVB, with a wavelength range between 280nm and 320nm, is much more dangerous, because it causes skin cancer.

Find the frequency ranges of UVA and UVB.

Use the formula $c=\lambda f$.

UVA: $7.5 \cdot 10^{14} \text{ Hz} - 9.4 \cdot 10^{14} \text{ Hz}$  

UVB: $9.4 \cdot 10^{14} \text{ Hz} - 1.1 \cdot 10^{15} \text{ Hz}$

4) A 5.0 mW laser produces a narrow beam of light. How much energy is contained in a 1.0 m length of its beam?

The Power is 5mW, and that is spread over some cross-sectional area $A$.

Intensity is power/area. Using the relationship $\frac{\text{Power}}{\text{Area}} = c \cdot u_{\text{avg}}$, and

$u_{\text{avg}} = \frac{\text{energy}}{\text{volume}}$, we arrive at $\text{energy} = \frac{\text{Power}}{c} \cdot (1m)$. So Energy=$1.7 \times 10^{-11}$J.

5) How many photons are emitted per second from a He-Ne laser that emits 1.0 mW of power at a wavelength of 633 nm?

Each photon has energy $E = hf = \frac{hc}{\lambda} = \frac{(6.626 \times 10^{-34} \text{ J} \cdot \text{s})(3 \cdot 10^8 \text{ m/s})}{633 \times 10^{-9} \text{ m}} = 3.14 \cdot 10^{-19}$ J

Divide the power by this to get #photons per second:

$$\frac{1 \cdot 10^{-19} \text{ J}}{3.14 \cdot 10^{-19} \text{ J/photon}} = 3.18 \cdot 10^{15} \frac{\text{photons}}{s}$$