Q- The intensity of sunlight striking the earth's upper atmosphere (called the solar constant) is 1.35 kW/m^2.

(a) Find E_{rms} and B_{rms} due to the sun at the upper atmosphere of the earth.

The intensity of electromagnetic waves at a point is given by

$$I = \frac{1}{\mu_0 C} E^2{}_{rms}$$

Gives $E_{rms} = \sqrt{(I*\mu_0 c)} = \sqrt{(1.35*10^3*4\pi*10^{-7}*3*10^8)} = 713.4$ V/m

And $B_{rms} = E_{rms}/c = 713.4/(3*10^8) = 2.38*10^{-6}$ T

E_{rms} = 713.4V/m

$B_{rms} = 2.38*10^{-6}$ μT

(b) Find the average power output of the sun.

The average power output of the sun P is given by the power acquired by the whole sphere round the sun, of radius equal to the distance between the sun and earth. Hence

$$P = I * 4\pi R_{ES}^2$$

Or $P = 1.35 * 10^3 * 4 * 3.14 * 1.5 * 10^{11}$

Or $P = 3.8*10^{26}$ W

(c) Find the intensity at the surface of the sun.

If the radius of the sun is R_S then intensity at the surface of the sun will be

$$I_s = \frac{P}{4\pi R_S^2} = (3.8*10^{26})/[4*3.14*(6.96*10^8)^2] = 6.27*10^7 \text{ W/m}^2$$

(d) Find the radiation pressure at the surface of the sun.

The radiation pressure (the force per unit area) is the change in the momentum per unit area per unit time and as the momentum or the radiation is given by U/c it is given by the formula I/c. hence the radiation pressure at the surface of the sun will be

$$P = I_s/c = 6.27*10^7 /(3*10^8) = 0.209 \text{ Pa}$$