(1) $\nu = \frac{c}{\lambda} = 5\times10^{14}$ Hz, $\frac{1}{\lambda} = 1.66\times10^{4}$ cm^{-1}, $E = 2.07$ eV

(2) Notes

(3) $B = \frac{dP}{dA\times d\Omega} = P\left(\frac{2}{\pi\lambda}\right)^2 = 1.53\times10^{8}$ W/cm^{2}sr, 10^6 times.

(4) (i) l_c (mercury lamp) $= \frac{c}{\Delta\nu} = \frac{1}{3} = 0.33$ m

(ii) l_c (He-Ne laser) $= \frac{c}{\Delta\nu} = 300$ m (1000 times so coherent)

(5) $l_t = \frac{r\lambda}{s} = 2$ mm, ~~(6) diam. $x_0 = 4.\lambda.\frac{f}{D}$ 5.064~~

(7). (a) $\frac{h\nu}{kT} >> 1$ for Spon. Em. $\frac{h\nu}{kT} << 1$ stimulated em.

(b) Rated frequency. microwaves have short freq.

(C) No, because population is not possible.

(d) $\frac{\text{Intensity}}{\text{unit solid angle}}$ = Brightness.

(e) $N_2 > N_1$, Yes.

(6). diameter at focus point

$x_0 = 4.\lambda.\frac{f}{D} = 4\times0.633\times10^{-6}\times\frac{5}{2.5}$ m

$= 5.064\times10^{-6}$ m

Intensity $= \frac{P}{A} = \frac{20\times10^{-3}}{\pi\times\left(\frac{5.064}{2}\right)^2\times10^{-12}}$ $\frac{W}{m^2}$

$= 0.99 \times 10^{9}\frac{W}{m^2} = \underline{1\,GW/m^2}$

$= \underline{0.1\,MW/cm^2}$

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