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) Reflector factor $= 0.85$

Since it is a perfect diffuser, its Candle Power (CP) will be 1

$\omega = 4\pi; I = \phi/\omega$

$$E = \frac{\phi}{A} = \frac{CP \times \omega}{4\pi r^2} = \frac{1 \times 4\pi}{4\pi r^2} = \frac{1}{r^2}$$

$$\therefore E = \frac{1}{r^2}$$

$$L = \frac{I}{\pi r^2} = \frac{\phi}{\omega \times \pi r^2} = \frac{CP \times \cancel{\omega}}{\cancel{\omega} \times \pi r^2} = \frac{1}{\pi r^2}$$

$$\therefore L = \frac{1}{\pi r^2}$$

$$E = \frac{1}{r^2} = \frac{1}{\pi r^2} \times \pi = \pi L$$

Thus, $E = \pi L$; $L = \frac{E}{\pi}$

because of the Reflector factor E is multiplied by 0.85. $E = 44000$ lux

$$L = \frac{E}{\pi} \times 0.85 = \frac{44000}{\pi} \times 0.85 = 11904.79 \text{ candela/m}^2 \text{ or } 1.19 \times 10^4 \text{ cd/m}^2$$

$E = 0.22$ lux

$$L = \frac{0.22}{\pi} \times 0.85 = 0.0595 \text{ candela/m}^2 \text{ or } 5.95 \times 10^{-2} \text{ cd/m}^2$$

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b) Luminous intensity (I) = 120 CP

Diameter = 22 cm

~~Radius = 11cm = 0.0~~

If 30% of the light emitted by the lamp is absorbed by the globe, then 70% is emitted by the globe

flux emitted by the globe(Φ) = $0.7 \times CP \times \omega$

$= 0.7 \times 120 \times 4\pi$

$= 1055.58$ lumens

i. Luminance (L) of the globe $= \frac{\Phi}{A} = \frac{1055.58}{\pi \times 0.22 \times 0.22} = 6942.18\ cd/m^2$

ii Candle power of globe in any direction $= \frac{\Phi}{\omega} = \frac{1055.58}{4\pi} = 84\ CP$

or

70% of 120 CP $= 0.7 \times 120\ CP = 84\ CP$

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(c) Area $= 75cm^2 = 75 \times 10^{-4} m$

thickness $= 2cm = 2 \times 10^{-2} m$

$\theta_1 = 30, \theta_2 = 80; \Delta\theta = 50$

time $= 8$ mins $= 480$ secs

$\varepsilon_r = 6.5$

Specific heat, $C = 0.255 cal/g^\circ C$

$p = 0.55 g/cm^3$

$\cos\phi = 0.04$

$f = 20 MHz = 20 \times 10^6 Hz$

Useful heat $= 85\%$

$$C = \frac{\varepsilon_0 \varepsilon_r A}{t} = \frac{8.85 \times 10^{-12} \times 6.5 \times 75 \times 10^{-4}}{2 \times 10^{-2}} = 21.57 \times 10^{-12} F$$

$\omega = 2\pi f = 2\pi \times 20 \times 10^6 = 125.664 \times 10^6$ rad/s

$\cos\phi = 0.04$

$\phi = \cos^{-1}(0.04) = 87.7^\circ$

$\delta = 90^\circ - 87.7^\circ = 2.3^\circ$

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

mass of slab $= 75 \times 2 \times 0.55 = 82.5g$

Heat required $= 82.5 \times 0.255 \times 50 = 1051.875$ cal

Total heat required $= 0.85 \times 1051.875 = 894.095$ cal

Recall 1 Cal $= 4.186 J$

Therefore, energy input $= 894.095 \times 4.186 = 3742.677 J$

$$P = \frac{\text{Energy input}}{\text{time}} = \frac{3742.677}{480} = 7.797 W$$

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Recall, $P_d = V^2 \omega C \tan \delta$

$7.797 = V^2 (125.664 \times 10^6)(21.5 \times 10^{-12})(0.04)$

$$V^2 = \frac{7.797}{125.664 \times 10^6 \times 21.5 \times 10^{-12} \times 0.04}$$

$V^2 = 72146.99$

$V = 268.60V$

$$I = \frac{P}{V\cos\phi} = \frac{7.797}{268.60 \times 0.04} \simeq 0.726\ A$$

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