Azeez Fuyin Bluna Andrew
15/Eng04/012
Elect - Elect.

Solution a

(i) = 44000 lux = E

(ii) 0.22 lux = E

reflection factor = 85%

Recall that $L = E/\pi$

$I = E/\pi \times R_f$ {Taking Reflection factor R_f into consideration}

$I = \frac{44,000}{\pi} \times 0.85$

$= 11.905 \times 10^3$ cd/m²

(ii) $L = \frac{0.22}{\pi} \times 0.85 = 59.52 \times 10^{-3}$ cd/m²

b $d = 2$mm

Luminous intensity = 120cp

Light Absorbed = 30%

① Determine luminance

Source flux emitted = $\phi = I \times \omega = 120 \times 4\pi$ lumen

flux emitted by globe = $120 \times 4\pi \times \frac{30}{100} = 144\pi$

$\therefore 120 \times 4\pi - 144\pi = 336\pi$ lumen

Luminance = $\frac{\text{Flux emitted}}{A} = \frac{336\pi}{\pi \times (0.22)^2} = 6942$ lm/m²

(ii) Candle power = $\frac{\text{lumen}}{\omega}$

$= \frac{336\pi}{4\pi} = 84$ cd

C. A = $75 \times 10^{-4} m^2 = 75 cm^2$ = Area

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

$A\theta = 80 - 30 = 60°C$

time = 8min

permittivity = 6.5

Specific heat = 0.255 cal/g·c

density = $0.559 g/cm^3 \times (75 \times 2) = 82.5 g$

PF = 0.04 & F = 20mHz

$$C = \frac{E_0 E_r A}{t} = \frac{8.85 \times 10^{-12} \times 6.5 \times 75 \times 10^{-4}}{2 \times 10^{-2}} = 21.57 \times 10^{-12} F$$

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

$\phi = 87.7$ ($\theta = \cos^{-1}(0.04) = P.F$

$\delta = 90 - \phi = 90 - 87.7 = 2.3°$

M $C\Delta\theta$ = heat required

$= 82.5 \times 0.255 (80 - 30)$

$= 1051.88$ cal

Total heat required $= 1051.88 \times \frac{85}{100} = 894.098$ cal

1 cal = 4.186 (w.s)

894.898 cal 7x

Power input $= 894.098 \times 4.186 = 3742.7$ (w.s)

$P = \frac{\text{Energy}}{\text{time}} \quad \frac{3742.7}{8 \times 60} \quad 7.798$ (w)

$P_s = V^2 \omega C \tan\delta$

$7.797 = V^2 \times 125.664 \times 10^6 \times 2.157 \times 10^{-12} \times \tan 2.3$

$V^2 = \frac{7.797}{1.08868 \times 10^{-4}}$

$V = \sqrt{\frac{7.797}{1.08868 \times 10^{-4}}}$

$V = 267.62V$

$P = IV\cos\theta$

$I = \frac{P}{V\cos\theta}$

$I = \frac{7.797}{267.62 \times 0.4}$

$I = 0.7284A$