16/EN/04/064

EE552

1a) $L = P$, $E = 44,000$, $\pi = 3.142$, $R.f = 85\% = 0.85$

$L_1 = \frac{E}{\pi} \times Rf = \frac{44,000}{3.142} \times 0.85 = 11,904.77 cd/m^2$

b.i) $I = 120cd$, $\phi = ?$ Luminous flux emitted by source

$\omega = 4\pi$, $\phi = I \times \omega$

$= 120 \times 4\pi = 1,507.96$ Lumen

Since globe absorbs 30%

$\frac{30}{100} \times 1,507.96 = 452.39$ lumen

Total flux emitted by globe: $1,507.96 - 452.39$

$= 1,055.57$ Lumen

Luminance $= \frac{\text{Flux emitted } \phi}{\text{Area}}$, Area $= \pi d^2 = \pi \times 0.22^2$

$= 0.152$

$\frac{1,055.59}{0.152} = 6,942.15$ lumen/m^2

ii) Candle power $= \frac{\text{Lumen}}{\omega} = \frac{\phi}{\omega} = \frac{1057.57}{4\pi} = 84cd$

c) density $= 0.55 g/cm^3 = \frac{\text{mass}}{\text{volume}} = ?$

$= \text{Area} \times \text{thickness}$

$= 75 \times 2 = 150$

Mass $= 0.551 \times 150 = 82.5g$

c. ε_0, A $= 8.552 \times 10^{-12} \times 6.5 \times 75 \times 10^{-4} = 3.47$

$\phi = 87.7° = 90 - 87.7 = 2.3°$

Heat required = $mc\Delta\theta$

$= 82.5 \times 0.255 \times 50 = 1051.88$ cal

If 15% of coal is wasted

$1051.88 \times \frac{15}{100} = 157.78$ cal

Heat used $= 1051.88 - 157.78$

$= 894.094$ cal

cal to J

$894.094 \times 4.186 = 3,742.684$

Power $= \frac{\text{energy}}{\text{time}} = \frac{3742.68}{8 \times 60} = 7.80$

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

$7.8 = V^2 \times 125.664 \times 10^6 \times 21.57 \times 10^{-12} \times \tan 23$

$V^2 = \frac{7.8}{5049.175.81 \times 21.57 \times 10^{-12}}$

$V = 267.61$ V

$I = \frac{P}{V\cos\theta} = \frac{7.8}{267.61 \times 0.004} = 0.785$