Question 1

$$\text{Light energy produced} = \text{Total power input} \times \text{Efficiency} = 25\,\text{W} \times 0.20 = 5\,\text{W}$$

$$\text{Energy of a Photon} = \frac{h \cdot c}{\lambda}$$

$$E = \frac{(6.626 \times 10^{-34}) \cdot (3 \times 10^{8}}{500 \times 10^{-9}} \approx 3.98 \times 10^{-19}\,\text{J}$$

1 Watt = 1 Joule per second (1 W = 1 J/s)

$$\text{Total number of Photon per Second} = \frac{5}{3.98 \times 10^{-19}} \approx 1.26 \times 10^{19}$$

Question 2

The Radiant flux, (ϕ) can be calculated by:

$$\phi = 2.4\,\text{V} \times 0.7\,\text{A}$$

$$\phi = 1.68\,\text{W}$$

The Radiant intensity, (I) can be calculated by:

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

$$I = 0.133\,\text{W/sr}$$

The Radiant exitance, (M) can be calculated by:

$$M = \phi/\text{Area}$$

$$\text{Area} = 4\pi\,(0.005)^2$$

$$\text{Area} = 3.142 \times 10^{-4}$$

$$M = 5347\,\text{W}/m^2$$

Energy emitted in 5min can be obtained by multiplying the power (energy per second) by 300 seconds (5mins). The final answer is $504, J$

Question 3

$$\text{Irradiance (E)} = \frac{\text{Radiant Flux}}{4\pi \cdot \text{eye-distance}^2 \cdot \text{aperture-area}}$$

Now, we can calculate the aperture area:

$$A = \pi(0.003\,m)^2 \approx 2.827 \times 10^{-5}\,m^2$$

Now, we can calculate the irradiance at the eye:

$$E = \frac{1.68}{4\pi \cdot 2.827 \times 10^{-5}}$$

$$E = 4729\,\text{W}/m^2$$

Question 4

$$\text{Total Power Emitted} = \frac{P}{e} = \frac{200}{0.20} = 1000\,\text{W}$$

Now, calculate the irradiance (I) at the table using the formula:

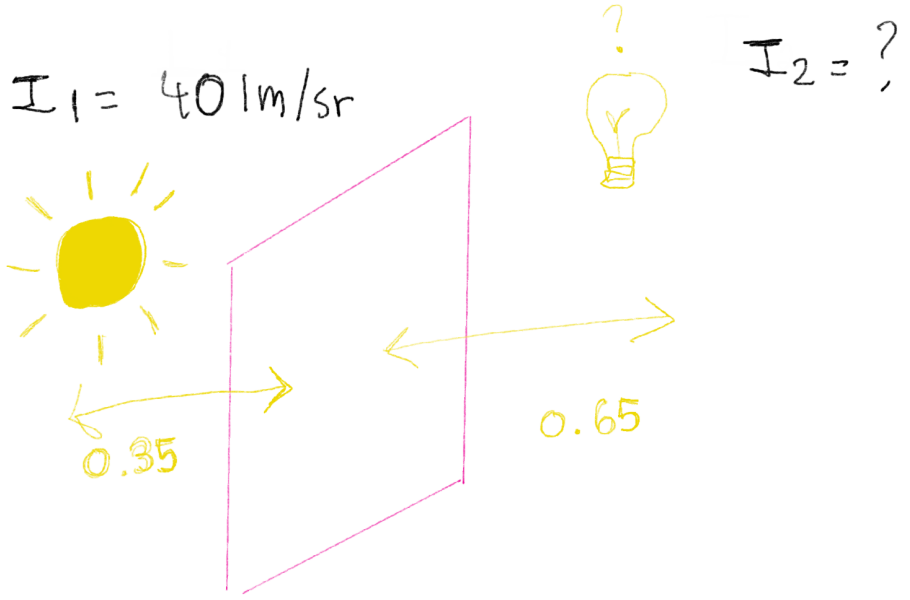
$$I = \frac{P}{4\pi r^2}$$

$$I = \frac{1000}{16\pi}$$

$$I \approx 19.98\,\text{W/m}^2$$

$$\text{illuminance} \approx 685 \cdot 0.1 \cdot 19.98 \approx 1369\,\text{lux}$$

Question 5



$$\frac{40}{0.35^2} = \frac{I_2}{0.65^2}$$

$$I_2 = 138 \text{ lm/sr}$$

Question 6

$$\text{Radiosity} = 5000 \times \pi \approx 15708\,\text{W/m}^2$$

$$\text{Energy emmited} = 15708 \times 0.01 = 157.1\,\text{W}$$