PROBLEMS

More difficult problems are indicated with an asterisk.

1. A luminous flux of 320 lumens falls on a square 20 cm on a side. What is the illuminance of the square?

2. A luminous flux of 10 lumens is incident on a circle 15 mm in diameter. What is the illuminance of the circle?

3. A laser has a radiant flux of one half milliwatt at 640 nm wavelength. This energy is confined to a collimated beam of 2 mm diameter. What is the illuminance of a screen placed in the beam and perpendicular to it?

4. A collimated beam making an angle of 30° with the normal to a surface of 10 mm^2 area carries a luminous flux of 50 lumens to the surface. What is the illuminance of the surface?

5.* One thousand lumens falls on an ellipsoid with major axis two feet long and minor axis one foot long. What is the illuminance of the ellipsoid?

6. An illuminance meter reads one lumen/m^2. What would that illuminance be in (a) lm/cm^2, (b) lm/ft^2, (c) lm/in^2, (d) lm/acre, and (e) lm/hectare?

ANSWERS

1. $0.8\ \text{lm/cm}^2 = 8000\ \text{lm/m}^2$

2. $5.7 \times 10^4\ \text{lm/m}^2$

3. Luminous flux incident is
   $F = (0.5 \times 10^{-3}\text{watt})(683\ \text{lm/watt})(0.175) = 6 \times 10^{-2}\ \text{lm}$, and
   $A = \pi(10^{-3}\text{m})^2 = \pi \times 10^{-6}\ \text{m}^2$, hence
   $E = F/A = 6 \times 10^{-2}/\pi \times 10^{-6}\ \text{m}^2 = 19 \times 10^3\ \text{lm/m}^2$.

4. $5 \times 10^6\ \text{lm/m}^2$

5. $637\ \text{lm/ft}^2$

6. (a) $10^{-4}\ \text{lm/cm}^2$; (c) $6.45 \times 10^{-4}\ \text{lm/in}^2$