

3-15) a) Use Eqn (3.20)  $\lambda_m = 2.898 \times 10^{-3} \text{ m K}$

$$\lambda_m = \frac{2.898 \times 10^{-3} \text{ m K}}{2.7 \text{ K}} = 1.07 \times 10^{-3} \text{ m} = \underline{\underline{1.07 \text{ mm}}}$$

b)

$$f = \frac{c}{\lambda} \quad f_m = \frac{3 \times 10^8 \text{ m/s}}{1.07 \times 10^{-3} \text{ m}} = \underline{\underline{2.8 \times 10^{11} \text{ Hz}}}$$

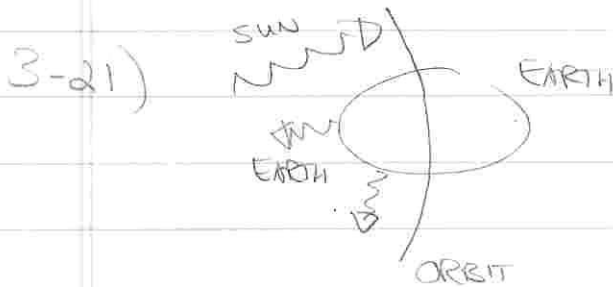
c)

$$R = \frac{c}{4} \frac{8\pi^5 k^4}{15 h^3 c^2} T^4 \equiv \sigma T^4$$

$$= 5.67 \times 10^{-8} \frac{\text{W}}{\text{m}^2 \text{K}^4} \cdot (2.7 \text{ K})^4 = \underline{\underline{3.01 \cdot 10^{-6} \frac{\text{W}}{\text{m}^2}}}$$

$$\text{AREA OF EARTH} \quad 4\pi R_E^2 = 4\pi \times (6.38 \times 10^6 \text{ m})^2$$

$$P = RA = \underline{\underline{1.54 \times 10^9 \text{ W}}}$$



$$P_{\text{ABS}} = P_{\text{EMIT}}$$

$$P_{\text{ABS}} = R_{\text{SOLAR}} \pi R_E^2$$

$$P_{\text{EMIT}} = \sigma T^4 4\pi R_E^2$$

$$\sim 4\sigma T^4 = R_{\text{SOLAR}}$$

$$T = \left( \frac{R_{\text{SOLAR}}}{4\sigma} \right)^{1/4} = \left( \frac{1.36 \times 10^{20} \frac{\text{W}}{\text{m}^2}}{4 \times 5.67 \times 10^{-8} \frac{\text{W}}{\text{m}^2}} \right)^{1/4} \text{ K}$$

$$= \underline{\underline{278 \text{ K}}}$$