1. (a) National Weather Service WSR-88D radars emit radiation with a wavelength of about 10.7 cm. Calculate the frequency of this radiation.
(b) Passive remote sensing in the microwave part of the spectrum relies on radiation emitted by oxygen molecules at frequencies near 55 GHz. Calculate the wavelength and wave number of this radiation.

2. Consider a cloud that, when viewed from a point on the ground, occupies a portion of the sky given approximately (in spherical-polar coordinates) as: \( \frac{\pi}{3} < \theta < \frac{\pi}{2} \) and \( 0 < \phi < \frac{\pi}{8} \).
(a) What is the solid angle subtended by this cloud?
(b) Assuming a flat horizon, what percentage of the sky is covered by this cloud?

3. A body is emitting radiation with the following idealized spectrum of monochromatic flux density:

\[
\begin{align*}
\lambda < 0.35 \mu m & \quad F_\lambda = 0 \\
0.35 \mu m < \lambda < 0.55 \mu m & \quad F_\lambda = 1.0 \text{ Wm}^{-2}\mu\text{m}^{-1} \\
0.55 \mu m < \lambda < 0.75 \mu m & \quad F_\lambda = 0.5 \text{ Wm}^{-2}\mu\text{m}^{-1} \\
0.75 \mu m < \lambda < 1.00 \mu m & \quad F_\lambda = 0.4 \text{ Wm}^{-2}\mu\text{m}^{-1} \\
\lambda > 1.00 \mu m & \quad F_\lambda = 0
\end{align*}
\]

Calculate the flux density of the radiation.

4. Consider the top-of-atmosphere (TOA) incoming solar radiation at Albany, NY. For simplicity, neglect the eccentricity of Earth’s orbit.
(a) What is the TOA incoming solar flux density at solar noon (in [W m\(^{-2}\)]):
   - On the winter solstice in Albany?
   - On the summer solstice in Albany?
• On the spring equinox in Albany?

(b) BONUS: What is the total TOA incoming solar energy density received from 2 hrs before until 2 hrs after solar noon (in \(J \text{ m}^{-2}\))?

• On the winter solstice in Albany?
• On the summer solstice in Albany?
• On the spring equinox in Albany?