(1) (10 points) Hotter blackbodies emit energy at all wavelengths.

When they are hotter, the peaks of the radiation curve is at ________ wavelengths.
A. shorter     B. longer       C. the same

When they are hotter, the intensity of the energy at long wavelength (>2000nm) is ________.
A. stronger    B. weaker       C. the same

(20 points) If a spherical blackbody has radius 12cm and is at Kevin temperature T. At a distance of 100nm from the blackbody, the intensity of the electromagnetic radiation emitted by it (including all wavelengths) is measured to be 2.71 W/cm². Please calculate the value of T, and the value of the wavelength corresponding to the peak of the spectral radiancy curve. (Stefan–Boltzmann constant: 5.67 x 10⁻⁸ W/m² K⁴, Wien displacement law constant: 2.898 x 10⁶ nm K).

(2) (20 points) Explain Fluorescence and Phosphorescence processes. What’s the time scales for each processes?

(3) (50 points) We can consider Rayleigh scattering is a process in which electromagnetic radiation (including light) is scattered by moving molecules, such as vibrations. If we use \( E = E_0 \cos \omega t \) as the light wave (use long wavelength approximation), and use \( (R - R_e) = A \cos \omega \nu t \) as the vibrational movement, please calculated the intensity of the Rayleigh scattering.

(hints: The scattering is caused by induced dipoles of molecules \( p = \alpha \cdot E \))

Use your result to explain why the sky is blue, and why the sunset is red.