High Energy Astrophysics 2022

Open Questions

Please, answer in the most complete and clear way. Do not forget units in cgs. When you define a quantity try to give a complete definition: words + formula + units

1. The radiative transfer equation is :$dI(\nu)/ds = -\alpha(\nu)\, I(\nu) + j(\nu)$. What is the solution for an idealised medium that can only absorb light rays?

2. The solution of the radiative transfer equation when the Source function is constant is $I(\nu) = I(\nu,0)\exp(-\tau(\nu)) + S(\nu)\,(1-\exp(-\tau(\nu)))$, where $\tau(\nu)$ is the optical depth.
   Consider an optically thick medium and take $\tau(\nu) \rightarrow \infty$. Which of the following three options is correct? Motivate your answer.
   1) $I(\nu) \rightarrow 0$;
   2) $I(\nu) \rightarrow S(\nu)$ (Source function) ;
   3) $I(\nu) \rightarrow S(\nu)R$(Source function times source size R) .

3. The Electric field of a moving charge “q” is composed of two terms: what are they and how do they depend on the distance to the charge?

4. What does Larmor's formula describe? What are its proportionalities to charge and acceleration.

5. When the charge is accelerated by the Coulomb force, its emission is called Bremsstrahlung. Can you draw the spectrum (specific intensity as a function of frequency), assuming that there is a frequency ν_a below which the medium is optically thick and that $h\nu_a << kbT$ (T is the temperature of the medium

6. For what particular situation does the Bremsstrahlung spectrum become a Black Body spectrum?