1 ton of TNT produces an explosion with an energy of $4.2 \times 10^9$ joules (1 ton = 907 kg). How much mass is converted into energy in such an explosion?

If the entire mass of the TNT in the last problem were completely converted into energy, how much energy would be released?

The Sun has a luminosity of $3.83 \times 10^{26}$ joules/sec. How much mass does the Sun lose each second?
The central star in a newly formed planetary nebula has a luminosity of 1000 \( L_\odot \) and a surface temperature of 100,000 K. How big is the star?

The energy-generation rate in a star depends sensitively on the core temperature. Use this fact to explain why a relation between a star’s mass and its luminosity should exist, and why it is not surprising that \( L \propto M^{3.5} \) rather than just \( L \propto M \).

How do astronomers know that the stars in globular clusters are old?