Exercise sheet 8

1. Binary system on circular orbits
Consider a binary system of two stars on circular orbits.
  a.) Calculate the quadrupole moments $I_{ab}$ using (9.68).
  b.) Find the amplitude of the gravitational wave $\tilde{h}_{\alpha\beta}(t, x)$ using (9.69).
  c.) Estimate the strength for a Galactic neutron star-neutron star binary with a separation of $r = 0.1$ AU.

2. Energy flux of a GW
The energy flux $\mathcal{F}$ of a GW is

$$\mathcal{F} = \frac{c^3}{32\pi G} \omega^2 (a^2 + b^2).$$

where $a$ and $b$ are the amplitudes of the two polarisation states.
  a.) Estimate the energy flux for the binary system in 1.
  b.) Estimate how much energy is dissipated if a GW crosses the interstellar or intergalactic medium: Which processes might be relevant? Use simple dimensional analysis for your estimate.