1. A star is identified as type G2 V based on the absorption lines in its optical spectrum. It also has apparent magnitudes $V = 16.00$ and $B = 17.05$.

(a) What is the color excess $E(B - V)$, also called selective extinction, to this star?

(b) What is the total extinction $A_V$ to this star? Assume that the ratio of $R$ of total to selective extinction is 3.1.

(c) What is the distance to this star?

(d) What distance would you have computed if you knew the spectral type and the $V$ magnitude only, and ignored extinction?

2. The typical interstellar medium (ISM) has on average 1 hydrogen atom and 0.1 helium atom per cubic centimeter, which account for 99% of the mass of the ISM. In addition there are dust grains that account for 1% of the mass of the ISM. Assume that the typical grain is a sphere of radius 0.1 µm, which has a density twice that of water.

(a) Compute the mass density of the gas-phase ISM (hydrogen plus helium).

(b) Compute the mass of one grain.

(c) How many grains are there per cubic kilometer?

(d) What is the average distance between dust grains?