Galaxies

Tutorial Sheet 3: Questions

1)
a) Write an expression down for the total number of galaxies per Mpc^3 given a set of Schechter function parameters ? [HINT: look at how J is defined].
b) What is the implication for $\alpha < -1$. Given $\alpha \approx -1.2$ how do we reconcile this implication.

2) Given Schechter function parameters of $\phi_* = 0.001\text{Mpc}^{-3}$, $M_* = -21$ mags and $\alpha = -1.5$. Calculate the total number of galaxies in a redshift survey with an apparent magnitude limit of 19.5 mags over a 50 sq degree area [HINT: $(\frac{L}{l})^{\frac{3}{2}} = (\frac{L_*}{l})^{\frac{3}{2}}(\frac{L}{L_*})^{\frac{3}{2}}$] ?

3) For the above numbers calculate the local baryon density assuming $\frac{M}{L} = 10\frac{M_{Solar}}{L_{Solar}}$? Given that the theory of inflation predicts a local density of $\frac{3H_o^2}{8\pi G}$ what is the implied baryon-to-dark matter ratio ?

4) Assumming $L_z \propto L_o(1+z)^\beta$ and $\phi_z = \phi_0(1+z)^\gamma$ and that $\beta = 0.5$ and $\gamma = -0.7$ describe the evolution of the galaxy population, i.e., whats going on ? By how much has the luminosity density of the Universe changed from $z = 2$ to the presant day.

5) A galaxy at $z = 1$ has an apparent magnitude of 24 mags. Assumming zero dust extinction calculate what the absolute magnitude of the galaxy would be if it was:
i) a typical elliptical
ii) a typical spiral
iii) a typical irregular
iv) Discuss what this means for the correct calculation of a galaxy's absolute magnitude ?

6) High redshift supernovae data tell us that galaxies are 0.2 mag fainter than they should be at $z = 1$. If we decide to interpret this as caused by a uniform inter-galactic extintion what would be the A_v per Mpc ?

7) We want to look for elliptical galaxies with $M_v < -19$ mag in a rich cluster of galaxies at a redshift of $z = 0.5$. Assumming the appropriate K-correction and assumming that Galactic dust will attenuate 20% of the flux what apparent magnitude do we need to observe to ? Why do we not need to worry about an intrinsic dust correction for the elliptical galaxy itself ?