2) Why do we think that the formation of ellitpticals is related to mergers.
There is direct signs of mergers in the structure of ellipticals e.g. as shown in the note 'shells' around some galaxies. Also to get the structure of ellipticals (e.g. very little rotation) To quote from page 267 of the text we see
in Section 7.1 that collisions between galaxies
increase the internal motion of the stars within them, causing them to expand and
become less tightly bound. If the most luminous ellipticals were produced by the
merger of two smaller systems, that could explain why their centers are more
diffuse." the movies shown in class of the formation of an elliptical show that the mergers of two spirals can produce an elliptical galaxy.
The merger origin of ellitpicals also helps explain why ellipticals are found more frequently in dense regions where mergers are more likely.
However, as discussed in the text on pg 302 there are reasons to think that mergers may not have been dominant in forming elliptical galaxies.

3) Describe the Faber-Jackson relation and how it is connected to the fundamental plane?

Elliptical galaxy lumosity is proportional to the velocity dispersion to the 4th power; $L \sim \sigma^4$
The F-J relation is a projection of the fundamental plane which relates surface brightness, size, velocity dispersion and other parameters such as radius, luminosity, mass, velocity dispersion, metallicity, surface brightness, colors etc.

6) Why do we believe that elliptical galaxies are old- give 2 observations that support this idea.
The stars are very old- this comes from their colors and their spectra: detailed analysis of the combined stellar spectra can give an indication of the ages of the stars- this can be used to calibrate the colors which can be used for many more systems . There is very little evidence for recent star formation.
Observations show that elliptical galaxies exist at least up to z~1 and that their colors and luminosites follow a pattern with is consistent with a simple stellar population which formed at high redshift (early in the universe, $zf_{orm} \sim 2$) .

b)What does this mean for the color of the galaxy and the nature of the stellar population?
Thus ellipticals are 'red' and the bulk of the stars are low mass with most of the like coming from evolved red giant stars.
c) How should the color and luminosity of an elliptical galaxy change over cosmic time and what do the observations tell us? (how does this connect with the answer you gave to parts (a and b)?)

We showed in class notes that the colors and luminosities of ellipticals follow a pattern as a functions of redshift (time) which is very similar to that predicted for a simple stellar population which ages, with no new star formation.