3)

| Galaxy Name | Halo Mass ($10^{12}$ Msun) | Disk Mass ($10^{12}$ Msun) | Bulge Mass ($10^{12}$ Msun) | Total Mass ($10^{12}$ Msun) | $f_{bar}$ |
|---|---|---|---|---|---|
| **Milky Way** | 1.975 | 0.075 | 0.010 | 2.06 | 0.041 |
| **M31** | 1.921 | 0.12 | 0.019 | 2.06 | 0.067 |
| **M33** | 0.187 | 0.009 | 0.0 | 0.196 | 0.046 |
| **Local Group** | | | | 4.316 | 0.054 |

4)

4.1)

In this simulation, the total mass of the Milky Way and M31 are equal. The halo mass (dark matter) dominates the total mass of both galaxies.

4.2)

The stellar mass of M31 is larger than that of the Milky Way, therefore, I would expect M31 to be more luminous than the Milky Way.

4.3)

The total dark matter mass of the Milky Way is slightly larger than that of M31, with a ratio of ~1.028. This isn't surprising, since M31 has more stellar mass and the two galaxies have the same total mass in this simulation.

4.4)

Stellar mass to total mass ratios:

MW = 0.041

M31 = 0.067

M33 = 0.054

The universal ratio of baryons to dark matter of ~16% is quite a lot larger than the baryon fraction for each galaxy in this simulation.

One possible explanation for this difference could be that there is a lot of baryonic mass that is not in galaxies, such as gas in the inter-galactic medium.