1. Things to look out for

1. You can either type it up or write it by hand. Whichever is more convenient for you. The important thing is that your work is clear to understand and legible. If you are writing it by hand, it is always a good idea to write a draft first and then copy it over to a final solution.
2. **Derive** all your answers. I will not accept simple numeric answers to questions. I want to see the thought logic from point A, through point B to point C!
3. Always give a verbal, summarizing answer to the problem you are solving, not just a number!
4. Write down each quantity, number and constant that is given in the problem at the very top, and convert everything into cgs units in the very beginning. This way you will not make the mistake of plugging in wrong numbers.
5. It is better to plug in numbers at the very very end, after doing all the derivations. Write out all the units and make sure that you get a unit that answers the question.
6. Please use complete, grammatically correct sentences. Atrocious, grammatically tragic solutions will get points deducted!
7. Do you own work. You can collaborate, but make sure to write your parters' names on the top of your lab work and not to just copy off of each other. If I do get you copying work, **NEITHER** of the collaborators will get any points, as I will not be able to tell who copied off of who. Keep this in mind!

2. Example solution to Problem 1a:

Here I will give an example solution to Problem 1a. Try to follow the style of it in your solutions!

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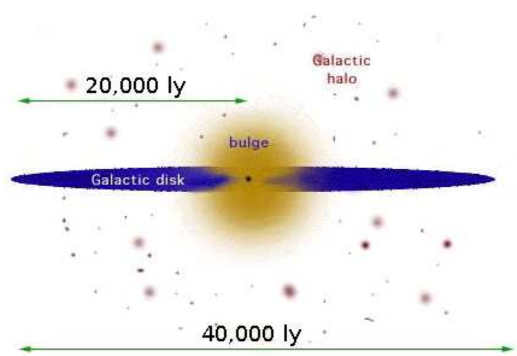
a) What is the mass of your galaxy? State the answer in grams (g) and solar masses ($M_\odot$)

Variables and constants

$$\begin{aligned} 1\ \text{ly} &= 1 \times 10^{18}\ \text{cm} \\ 1\ M_\odot &= 2 \times 10^{33}\ \text{g} \\ \text{G} &= 6.67 \times 10^{-8}\ \frac{\text{dyne cm}^2}{\text{g}^2} = 6.67 \times 10^{-8}\ \frac{\text{cm}^3}{\text{g s}^2} \\ R_{\text{gal}} &= D/2 = 20,000\ \text{ly} = 1 \times 10^{22}\ \text{cm} \\ v_{\text{orb}} &= 150\ \text{km/s} = 1.5 \times 10^7\ \text{cm/s} \end{aligned}$$



To calculate the mass of the alien race's spiral galaxy, I am going to use Newton's II. law, that says that a body of mass m subject to a force $\vec{F}$ undergoes an acceleration $\vec{a}$ that has the same direction as the force and a magnitude that is directly proportional to the force and inversely proportional to the mass.

$$m\vec{a} = \vec{F} \tag{1}$$

The force in this system is equal to the gravitational force, and the acceleration is equal to the centripetal acceleration. Plugging in their formulas I get

$$m\frac{v_{\rm orb}^2}{R_{\rm gal}} = {\rm G}\frac{mM_{\rm gal}}{R_{\rm gal}^2} \tag{2}$$

After canceling and reorganizing this equation, I get a formula for the mass of the alien race's galaxy:

$$M_{\rm gal} = \frac{v_{\rm orb}^2 R_{\rm gal}}{\rm G} \tag{3}$$

Plugging in the number gives the mass of the galaxy to be

$$M_{\rm gal} = \frac{\left(1.5\times10^7~{\rm cm/s}\right)^2 1\times10^{22}~{\rm cm}}{6.67\times10^{-8}~{\rm cm^3/g/s^2}} = \ldots~{\rm g} = \ldots~M_\odot \tag{4}$$

According to my calculations, the alien race's galaxy's mass is $\ldots M_\odot$. Comparing to the mass of our Milky Way ($\sim 5.8\times10^{11}~M_\odot$), our galaxy is about 34 times more massive as theirs.