Names: _____ _____

_____ _____

Grade	

Introduction to Active Learning: The Scale of the Solar System

Pre-Lab Quiz

Record your team's answers as well as your reasonings and explanations.

1.
2.
3.
4.
5.

Part 1: Exploring Astronomical Topics

1. Read and learn about active learning and active learning roles on the main page of the lab webpage for this lab. On the first page of this lab where you wrote your lab group members' names, write the active learning role each person will play today next to their name. Going forward, always note the week's role assignments each time you list your lab partners' names at the top of your lab.

2. With your group members, write down three interesting questions that you think Astronomy is capable of answering. You may share your questions with the class. How did your lab group Manager keep your group on track as you decided on your three questions?

3. Choose a question from the list on Part 1 of the lab webpage for this lab. Using the internet, research it and prepare to lead the class in a discussion of your question by writing a brief summary of the answer to the question in the space below. How did your lab group Scribe ensure you agreed on your conclusions? What potential weaknesses were present in your proposed answer that your Skeptic probed your group members about?

Part 2: Exploring the Solar System

1. Including the **Moon** and **Pluto**, in the table below list the planets in order by their distance from the Sun. Then look up each planet's average distance from the Sun (in Astronomical Units, AU) as well as its radius (relative to Earth's).

Once complete, associate each ball in the demo with the appropriate planet.

Note: www.wolframalpha.com may prove useful for looking up information. For example, try typing in "Venus radius". Alternatively, check out the *properties of planets* demo on the lab website.

Planet	Distance from Sun (AU)	Radius (Earth Radii)	Ball #
Earth	1.0	1.0	
Moon			

2. If the scaling for the model is 1:1 billion, how far away from the Sun would Earth need to be in meters? What would the diameter of the Sun be? Show your work.

Note: The distance to the Sun is ~150 billion meters while its diameter is ~1.5 billion meters.

3. Using *Google Maps*, find something whose distance from the classroom matches the scaled distance from the Sun that you just calculated. Try to find something that is viewable from the window.

Note: Right click and select "measure distance" to use the distance tool. You can switch between metric and english units by clicking on the scale at the bottom right of the page.

4. If Jupiter is represented by a watermelon, what fruit would represent Earth? Guess how many of these Earth-fruits would fit inside the Jupiter-watermelon. For the Skeptic of your lab group, can you think of any experience that would lead you to believe that your group members might be overestimating the size of the Earth-fruits? Underestimating them? Share any concerns you may have.

Note: Use your intuition – don't search the internet for answers. We'll calculate the actual value in the next problem and see how well your guess was.

5. Using the equation for the volume of a sphere, $V = 4\pi r^3/3$, as well as the radius of Jupiter in Earth radii, estimate how many Earths would fit inside Jupiter. Show your work.

Note: Remember from math that $(x^a / y^a) = (x / y)^a$; round the radius to a nice number to make the calculation easier. Do **NOT** look up the radius of Earth – it should cancel out in the end.

6. Using a new scale, 1:100 billion, calculate the distance of the planets + Pluto from the Sun in this model and fill in the table below.

Hint: If there are ~150 billion meters in 1 AU, how can we convert the distances in AU (from Question 1) to the scaled distance?

Planet	Scaled Distance from Sun (meters)
Earth + Moon	

For the Manager of your lab group, how is your group doing on time? Is there enough time left in the lab period for your group to slow down and consider questions more carefully? Or do you need to try to speed up to finish on time? Share this information with your lab group members.

7. As a class, we will go out into the hallway and place the planets at their scaled distances that we calculated in Question 6. For the Scribe of your lab group, take notes on each group member's initial ideas on what the hallway model will look like, and after looking at the scale model of the solar system, write down some of your thoughts and observations.

8. The nearest star to our Sun is Alpha Centauri, which is ~41 quadrillion meters away (4.1×10^{16} meters). In our scaled system from Problem 6, how far away would Alpha Centauri be in km? Using *Google Maps*, find a city that is roughly this distance from Iowa City.

Note: 1 km = 1000 meters
Note: 100 billion = 1×10^{11}