



# Planet Designer: Kelvin Climb

---

Name:

## Part 1

Open the computer interactive “Planet Designer: Kelvin Climb.” Explore your featureless planet with the given controls on the “Distance” section of the interactive. Keep a record of the attributes of your planet on the table provided.

Planet Mass	Planet Density	Planet Radius	Distance from the Sun	Blackbody Temperature

Answer the following questions in your lab book or science journal.

1.1. Which attributes (mass, density, distance) affect the blackbody temperature of your planet? *Note: If the answer is not obvious from your results, you may try varying one attribute while keeping the other two fixed to see the effect on temperature.*

1.2. Which attributes (mass, density, distance) do not contribute to the blackbody temperature of your planet?

1.3. In two-to-three sentences, describe how blackbody temperature is affected by changes in certain attributes:



# Planet Designer: Kelvin Climb

1.4. Why do *you think* some attributes factor into the blackbody temperature while others do not? Discuss your reasoning with a peer, and write your answer.

Part 2

Real planets have regions of light and dark, which contribute to the temperature by reflecting or absorbing sunlight. The average reflectivity of the light and dark regions is called albedo.

Set a planetary mass, density, and distance in the computer interactive, and then click the “Next” button to enter the “Albedo” section. Explore the effects of albedo on the blackbody temperature of the planet by painting your planet using the controls provided. What happens when your planet is all black, all white, or different solid colors? Record your findings in the table below.

DISTANCE FROM THE SUN:

Albedo	Description of color	Blackbody Temperature
1		
0		

2.1. Explain in your own words how albedo affects the blackbody temperature of the planet.



# Planet Designer: Kelvin Climb

---

### Part 3

Paint your planet in any way you choose before clicking “Next” to enter the “Atmosphere” section of the interactive. In this section you will add an atmosphere to your planet by changing the atmospheric thickness and greenhouse strength. The greenhouse strength is a multiplier used to estimate the amount of infrared absorption in the atmosphere to give the surface temperature of a planet.

Note: Neither the atmospheric thickness nor the greenhouse strength can tell us what is in the planet’s atmosphere, but we can make educated guesses about what *could possibly* be there. The interactive gives *only one* possible solution to the contents of the atmosphere based upon the atmospheric thickness and greenhouse strength, but there could be many more solutions.

Record your findings in the table below:

Atmospheric Pressure (bars)	Description of Atmosphere Thickness (Thin, Moderate, etc.)	Greenhouse Strength (Weak, Moderate, etc.)	Surface Temperature (Kelvin)	Description of Possible Atmospheric Constituents



## *Planet Designer: Kelvin Climb*

---

---

--	--	--	--	--

3.1. As you changed the atmospheric conditions, the albedo was held constant to simplify the solution. In reality, how do you think albedo would be affected by changes to the atmosphere? (Hint: In the simulated image on the left, what changes do you observe as you change the atmospheric pressure and greenhouse strength? Recall that albedo is a measure of the reflectivity of the planet.)

3.2. Is it possible for liquid water to exist at the surface of your planet? Explain your answer. (Hint: If not, explain why *you think* liquid water is not possible on the planet. If so, explain the conditions necessary for liquid water. The “Debriefing” section of the interactive, available by clicking the “next” button, may assist you.)

Project  
**SPECTRA!**

*Planet Designer: Kelvin Climb*

---