

1-3. We have investigated four fundamental physical relationships that describe how planets in our solar system, including Earth, warm due to radiation from Sun.

1. $R = \sigma T^4$
2. $R_P = R_{SUN} \left(\frac{r_{SUN}}{r_{SPD}} \right)^2$
3. $R_{SF} = R_P(1 - a)$
4. $T_P = \left(\frac{R_{SF}}{4\sigma} \right)^{\frac{1}{4}}$

Write one or two complete English sentence(s) explaining the concept represented by each equation. Identify each term in the equation, any units, and explain why it is important to understanding a planet's climate.

I will do an example using equation 5. $E = mc^2$.

"Equation 5 expresses that energy is equal to the product of mass, m, and the speed of light, c, squared. Mass has units of kilograms (kg), and the speed of light has units of meters per second, resulting in energy having units of kg*m²/s². This unit, the Joule (J), is the fundamental unit of energy. Equation 5 is important to a planet's climate because energy represents the ability to do work, such as generating heat.

1-4. Write 1-2 such sentence(s) for Equations 1-4 (1 point each). You do not need to retype the equations on your homework, just refer to them as equation #1,2,3 or 4.

5. We have seen that Equation 4 provides a close approximation to the observed average temperatures of some planets, but not for others. Write one or two sentences explaining why the value predicted from equation 4 works well for some planets but not others. Remember, there are two factors.

6. We have learned that some planets have a "greenhouse effect". Write a few sentences explaining what the greenhouse effect is, what causes it, and its impacts. Information you might want to include: What makes some gases "greenhouse gases" and not others? What do greenhouse gases do that other gases don't? Does this involve different interactions with solar (shortwave) versus terrestrial infrared (longwave) radiation? Speculate what the role of human activities such as fossil fuel combustion and deforestation might be playing in Earth's greenhouse effect today.

You should be at around 500 words by the time you answer these 5 questions. You don't have to hit 500 exactly. If your answers are good, and you only have 400 words, you will not be penalized for failing to hit 500 words. If you only have 300 words, however, then you might consider expanding your answers a bit. If you have 900 words that don't address any of the questions, you will not receive any credit.