1. Which gas contributes the most to surface pressure?

2. You have an ideal gas within a sealed, perfectly rigid container. Upon heating, what happens (i.e., increases, decreases, or remains same) to the:
   (a) pressure of the gas?
   (b) density of the gas?

3. Average sea-level pressure is 1000 mb. What percentage of the atmosphere’s mass lies between the 700 and 200 mb levels?

4. Average sea-level pressure is 1000 mb. The average height of the 200 mb level is 12 km above sea level. Would it be fair to say that the average height of the 600 mb level would be 6 km, halfway in between? Why or why not? Justify your answer.

5. Bizzaro World is identical to Earth but for some reason, molecular oxygen and ozone do not absorb ultraviolet radiation. Does the Bizarro atmosphere have a stratosphere? Why or why not?
6. The ideal gas law (IGL) is \( p = \rho RT \), where pressure \( p \) should be in Pascals, density \( \rho \) in kg/m\(^3\), and temperature \( T \) in Kelvin. In this case, the gas constant \( R = 287 \text{ J/kg/K} \). Use this equation to answer the following. Do not forget to convert units when appropriate. **Show work;** an answer alone does not suffice.

(a) At sea-level, \( p = 1000 \text{ mb} \) and \( T = 20^\circ \text{C} \). What is the density of this air? Your answer should be very roughly 1 kg/m\(^3\).

(b) At the tropopause, \( p = 200 \text{ mb} \) and \( T = -70^\circ \text{C} \). What is the density of this air? Your answer should be very roughly one-quarter the sea-level density.

(c) Though cold air overlays warm, this atmosphere is **NOT** overturning since density decreases with height. Suppose the air density at the tropopause were the **SAME** as at sea-level. What would the tropopause air temperature have to be for air to be this dense? You should get an extremely cold temperature. **Express \( T \) in BOTH °C and K.**
7. Consider a hot parking lot on a sunny and windy day. For each mechanism of heat transport – conduction, convection, and radiation – state whether it is active and briefly justify your answer.

8. I have two identical objects, “A” and “B”. The sole difference is that object A is hotter. I claim that object B emits less total radiation per unit area than object A. Am I correct? Justify your answer.

9. Spica, a star in the constellation Virgo, has a wavelength of maximum emission of 0.14 microns. What is Spica’s temperature? Please use Wien’s law in its simplified form, $\lambda_{\text{max}} = \frac{3000}{T}$, where $T$ is in Kelvin and $\lambda_{\text{max}}$ is in microns.
10. Referring to the previous question, how much more radiation per unit area does Spica emit compared to our Sun? Take our Sun’s temperature as 6000 K.

11. As seen from space, our Sun is a yellowish star. What is Spica’s color more likely to be, bluish or reddish? Concisely justify your answer.