Homework Assignment 2 **ASTR4201, Fall 2020**

Corresponds to Chapter 2 of "To Build a Star" (TBS) by E.F. Brown

1. *See below* Team: 1 Lead: Anthony
   The ocean's density only changes by 5% from surface to ocean floor. How much does gravity change? Assume the ocean floor is 2 miles below the surface.

2. TBS exercise 2.1 Team: 2 Lead: Michael

3. *See below* Team: 3 Lead: Ryan
   Calculate the weight of a column of air above a 1 m^2 area at sea level. Calculate the same above a 1 in^2 area. Finally, calculate the weight of earth's atmosphere.

4. TBS exercise 2.2 Team: 4 Lead: Jacob
   Hint: Recast density in terms of pressure. Note that you then have a first order homogeneous linear equation. Consult the solutions for common differential equations, e.g. in your math methods textbook.

5. *See below* Team: 1 Lead: Britt
   Calculate the average molecular mass of dry air, approximating the atmosphere as 78% nitrogen, 21% oxygen, 0.95% argon, and 0.05% carbon dioxide. Keep in mind that nitrogen and oxygen are diatomic gases in earth's atmosphere.

6. *See below* Team: 2 Lead: Sam
   Solve TBS exercise 2.3, as well as the following question.
   The sun is ~70% hydrogen, ~28% ~2% metals, which we denote by X=0.70, Y=0.28, Z=0.02. If we treat the metals as ^{14}N, what is he mean molecular weight of the solar composition?

7. TBS exercise 2.4 Team: 3 Lead: Josh

8. TBS exercise 2.5 Team: 4 Lead: Gula

9. TBS exercise 2.6 Team: 5 Lead: Justin

10. TBS exercise 2.7 Team: 1 Lead: Gavin

11. TBS exercise 2.8 Team: 2 Lead: Quinn

12. TBS exercise 2.9 Team: 3 Lead: Harshil

13. TBS exercise 2.10 Team: 5 Lead: Robert
    Hints: For part 4, "lowest order in $\delta R/R$" means to expand such that γ isn't in an exponent anymore. For part 5, $(1+\delta R/R)^2 \sim (1+2*\delta R/R)$ and $(1+\delta R/R)^{-2} \sim (1-2*\delta R/R)$. For part 6, consider the equation of motion for common systems (e.g. a spring).