Exoplanets Group Studies 2025/26: Non-Assessed Worksheet

1. A (fictional) newly-discovered exoplanet has a transit depth of 0.72%, as measured by the Transiting Exoplanet Survey Satellite. Its host star is GJ 1214, for which you can look up the stellar properties on the NASA Exoplanet Archive (https://exoplanetarchive.ipac.caltech.edu/).

   (i) What is the radius of this planet, based on its transit depth? Express your answer in units of Earth radii.

   (ii) The planet's atmosphere is opaque at 3 microns, and transparent at wavelengths on either side. It has a mass of 5 times greater than Earth, a temperature of 500 K, and a mean molecular weight of 2 atomic mass units. Assuming that you can see 5 scale heights of the atmosphere, what is the difference in transit depth at 3 microns vs neighbouring wavelengths?

2. In this question, you'll need to calculate the equilibrium temperatures of two different exoplanets using the planetary/stellar properties used/measured by two papers. You can find these planetary and stellar properties on the NASA Exoplanet Archive by searching for the planet name.

   (i) Mahajan et al. (2024) report an equilibrium temperature of 567 K for the planet GJ 1214 b. In this paper, which Bond albedo did they assume when calculating the equilibrium temperature?

   (ii) Scott et al. (2025) report an equilibrium temperature of 204 K for the planet TOI-6478 b. In this paper, which Bond albedo did they assume when calculating the equilibrium temperature?