HW #7
KEY

+33 TOTAL

1. Largest asteroid = Ceres, 500 km radius +3
Total mass of all asteroids $\ll$ mass of terrestrial planet

	composition	origin
2. primitive meteorite	rocky minerals + metal flakes	remnants from birth of solar system
processed meteorite	iron/nickel + other metals OR rocky minerals	fragments of larger asteroids that underwent differentiation

+4

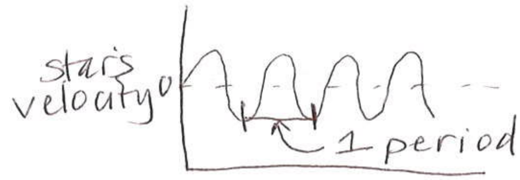
3. $p = 4.23 \text{ days} \times \frac{1 \text{ yr}}{365 \text{ day}} = 1.16 \times 10^{-2} \text{ yr}$ +2

$p^2 = a^3$, $a = \sqrt[3]{(1.16 \times 10^{-2} \text{ yr})^2} = \boxed{0.05 \text{ AU}}$

4. Eris is a large Kuiper Belt object. It is 5% larger than Pluto and 27% more massive. The small size, and ice-rich composition (known by reflectivity + spectra) suggests these objects are large comets. +3

5. The Doppler technique measures the velocity of a star over time by recording the doppler shift (towards or away) of its spectra. Aaway = redshifted, towards = blueshifted.

- The period of 1 cycle of a star's change in velocity is equivalent to the orbital period of the planet.



+6

- Once we know period we can solve for distance using - $p^2 = \frac{4\pi^2}{GM} a^3$

- We can find orbital eccentricity based on the asymmetry of the doppler curve.

6. $T_{no\ greenhouse} = 280\text{K} \times \sqrt[4]{\frac{(1 - \text{reflec.})}{d^2}}$

+5

- 50,000 AU → $T = 280\text{K} \times \sqrt[4]{\frac{1 - 0.03}{(50{,}000)^2}} = \boxed{1.24\text{ K}}$

- 3 AU → $T = 280\text{K} \times \sqrt[4]{\frac{1 - 0.03}{(3\text{ AU})^2}} = \boxed{160.4\text{ K}}$

- 1 AU → $T = 280\text{K} \times \sqrt[4]{\frac{1 - 0.03}{1^2}} = \boxed{277.9\text{ K}}$

At 3 AU (or closer) water will sublimate.

7. Extrasolar planets orbits are mostly elliptical (not circular like our planets) and orbit close to their parent stars. +4

These are surprising because modern theory predicts jovian planets should form in outer regions of star systems.

8. (a) $T_{no\,g.h.g.} = 280\text{ K} \times \sqrt[4]{\frac{1-\text{reflec}}{d^2}}$

$T = 280\text{ K} \times \sqrt[4]{\frac{1-0.15}{(0.052\text{ AU})^2}} = \boxed{1179\text{ K}}$

$\boxed{\text{Earth} = 290\text{ K} \quad \sim 4\times\text{ warmer}}$ +6

(b) $T = 280\text{ K} \times \sqrt[4]{\frac{1-0.8}{(0.052)^2\text{AU}}} = \boxed{821.1\text{ K}}$

(c) No, planet is likely too warm for life (too close to star)