1. The giant star has exactly the same temperature as the main sequence star directly below it. That means, by the Stefan-Boltzmann law, that they have the same luminosity per unit area. The only way the giant can be more luminous is to be bigger than the main sequence star.

2. In order to absorb a Balmer-series photon the electro has to be in the first excited state. The absorption of a Lyman alpha photon will boost en electron out of the ground state and into the first excited state. M stars are so cool that they emit few Lyman alpha photons.

3. By Newton's first law of motion, an object's velocity will remain constant if no force acts upon it. That the book slows sown is due to Newton's 2nd Law which states that an object's velocity changes when a force acts upon it. Friction must therefore be a force since the book's velocity changed.

4. A mirror reflects light while a lens refracts (bends) it. As light enters a lens, the different color (wavelengths) of light bend in different amounts - blue light bends more than red. This chromatic aberration or dispersion results in the colors reaching different foci once they leave the lens. A mirror, instead of refracting, reflects light *equally* and therefore can send light to the same focus regardless of color.

5. There is only 1 force on either the man or the pencil, which is the gravitation due to the planet, which has the form F=G*m*Mpl/r^2 and proportional to the mass of either man or pencil. So the acceleration of them is identical. And since they have the same initial velocity, they should have the same velocity at any time.

6. To apply Kepler's 3rd law, a^3=(GM/4Pi^2)P^2, if we know the orbital radius and period of any planet in the solar system, we can figure out the mass of the Sun. Note that this is like the binary star exmaple, but here we can neglect the mass of the planet.