1. Short answers
    a. (3 pts.) Knowing the orbital period of Jupiter, astronomers used Kepler's 3rd Law to find the size of Jupiter's orbit in AU. Cassini & Richter measured the AU.
    b. (3 pts.) Hertzsprung-Russell diagram. Discovery of white dwarfs. Discovery of giants. Discovery of the source of stars' energy. $E=mc^2$. Spectral classification.
    c. (1 pt.) Sirius B is a white dwarf. (2 pts.) Adams' key measurement was to find that the temperatures of Sirius A and B are about the same.
2. Hertzsprung-Russell diagram of the star cluster M15.
    a. (2 pts.) The absolute magnitude of the hottest main-sequence stars is 3.7.
    b. (3 pts.) Hotter main-sequence stars have become giants or finished burning fuel.
    c. (2 pts.) Stars with a color B-V=0.6 have differing sizes. (3 pts.) For a range of 5 magnitudes, the range in luminosity is 100 (two factors of 10). Since $L=T^4R^2$ (L is luminosity, T is temperature, and R is radius), the range is size is a factor of 10.
    d. (3 pts.) Pick a star with absolute magnitude 0. Its apparent magnitude is 15.2. Its flux is 15.2/2.5=6.08 factors of 10 fainter than it would be at a distance of 10 pc, which is 1.2×10^6. Since flux depends on $1/D^2$ (D is distance), its distance is $\sqrt{(1.2\times10^6)}=1.1\times10^3$ farther than 10 pc or 1.1×10^4pc.
3. Observations of the parallactic shift of a star.
    a. (3 pts.) The parallactic shift changes from -0.15 to +0.15 arcsec. The distance is 1/0.15 = 6.7 pc.
    b. (1 pt.) The right ascension of the star is 0 hr. (2 pts.) The biggest parallactic shift occurs on 12/21 and 6/21. Therefore the right ascension could be 0 or 12 hr. If the right ascension is 12 hr, the shift on 6/21 is to the west. Therefore the right ascension is 0 hr.
    c. (3 pts.) The parallactic shifts are too small to measure directly. Measuring the shift between the star and a reference star is much more accurate.