Problem Solving

For each problem, draw a concept map for how to solve for the desired quantities.
Example: After finding the mass of a MS star by observing its "wobble" and finding its peak wavelength from its spectrum, predict the total luminosity of the star. Mass & peak wavelength >>> Luminosity

Mass → $R \propto M^{.75}$ → Radius

Radius & Surface Temp → $L = 4\pi R^2 \sigma T^4$ → Luminosity

Peak wavelength → Wien's Law → Surface Temp

a) Suppose you want to do a study on the light coming from K stars in a particular cluster where the stars are all at basically the same distance. By simply looking at the sky, we can see what solid angle the cluster subtends and can thereby figure out what angular resolution we would like to see this cluster in. Knowing that all the objects you want to study are at the same temperature and that there is a given resolution you would like to see them in, find the appropriate diameter of a telescope for this study. Temperature of a star & desired resolution >>> diameter of the viewing telescope

b) It is theorized that a system of two main sequence of vastly different mass (the ratio of their masses is significantly greater than 1) cannot possibly exist. To test this theory, you must figure out the ratio of surface temperature of the two stars, so that you can know what their spectrum looks like and thereby have a signature for seeing whether they exist anywhere. The masses of two stars >>> ratio of their temperature

c) You find a very interesting B star (with a known luminosity) and want to predict how much it is going to move in the sky 6 months from now. If we look at it in 6 months and its somewhere other than we predict, we can figure how fast its actually moving across the sky. Apparent Brightness & luminosity of a star >>> parallax

d) Some up and coming nuclear physicist predicts how much mass is converted to energy per second due to fusion for some star of radius R. Use this information to find the wavelength that a star's spectrum should peak at, so that you may confirm this prediction. Mass loss per second due to fusion & radius >>> Peak wavelength

e) You look into a cluster where all the stars have the same velocity (that you determined earlier by examining Doppler shifts in light). Within this cluster, you observe some mystery star's spectrum and find a peak wavelength. Now, theorize how much energy the star is emitting per second per unit area on its surface so that you may check its brightness with known theory. Observed peak wavelength & velocity >>> brightness at the surface of the star