1. Draw an HR diagram. Label each axis (include the spectral sequence) and draw all important stages of stellar evolution.

![HR Diagram]

2. You see a bright red star and a fainter blue star. What can you say about their relative temperatures, luminosities and distances? Describe every possibility you can think of.

The red star is cooler than the blue star regardless of their age, mass or distance or anything else because stars all produce light as blackbodies and the hotter the blackbody the more short wavelength radiation, therefore the bluer.

If both stars were on the MS, then the blue one would definitely be more luminous than the red one. However it is possible that the red star is a red supergiant (an evolved massive star) and is inherently as luminous as the blue one. However, it is not possible for the red one to be more luminous than the blue one since massive stars do not increase in brightness when they evolve off the MS. In sum, they are either equally luminous or the blue one is brighter.

Because the red one has either equal or less inherent brightness than the blue one, that it appears brighter tells us that it must be closer than the blue one. Should they be the same brightness, for the blue one to appear dimmer it would have to be farther away. This argument still stands (and is actually stronger) if the red star is inherently less luminous than the blue one.

3. What physical evidence is there that shows we know how the Sun generates energy?

The only physical evidence that we know how (fusion) the sun is generating energy is the detection of neutrinos from the Sun. These neutrinos are created in fusion but quickly escape the star (unlike the photons that have to random walk out) and can be detected very large underground tanks of materials like Argon.