Hertzsprung-Russell: (H-R) Diagram

In 1905, two astronomers, named Ejnar Hertzsprung and Henry Norris Russell, photographed the spectra of light produced by many stars. Hertzsprung (a Dane) studied the magnitude and colour of stars in the Hyades cluster (part of the Taurus constellation) because they were all approximately the same distance from Earth.

1 Why might it be an advantage for all the stars studied to be the same distance from Earth?

Russell (an American) studied several stars close to the Earth whose distances were known from their parallax and red shift. The photographs were used to work out how the stars were organised in the skies. Hertzsprung discovered a link between a star's true brightness (luminosity) and colour and, later. between brightness and temperature. Colours ranged from bright blue/white to red. The brightest, bluest stars were revealed to have the shortest star life (10^6 to 10^7 years), and lightweight stars lived longer than heavy stars. Our Sun is believed to have a life of around 1010 years.

2 Write 10^6 years in expanded form. _____

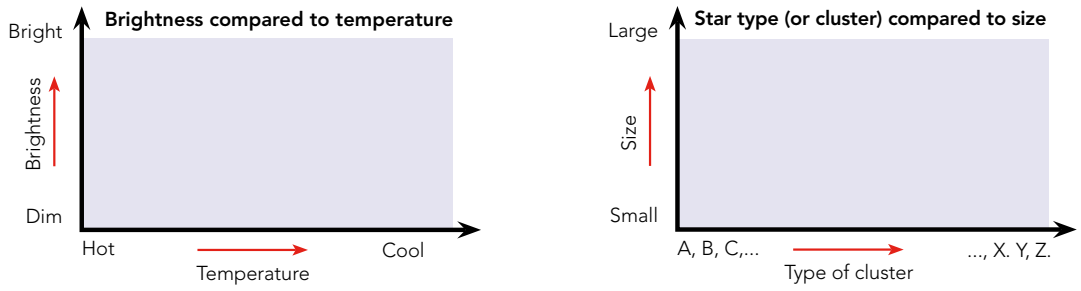
3 Write 10^7 years in expanded form. _____

4 Write 10^{10} years in expanded form. _____

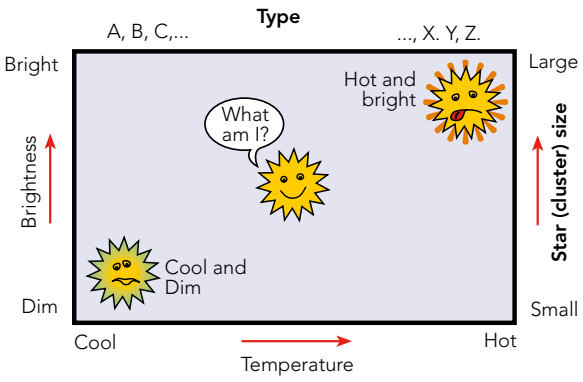
5 Why might bright stars have a shorter life than duller stars? _____

_____

Between 1911-1913 Hertzsprung and Russell independently developed diagrams which illustrated the link between a star's luminosity and its surface temperature. Each man was unaware that the other was doing the same work and reaching the same conclusions. When the data was plotted for each star, patterns occurred and, from this, a star's composition could be predicted. Eventually, the men worked together and their diagrams were so similar that they created a new one, in 1913, calling it the H-R Diagram. When the logarithm of absolute magnitude is plotted against surface temperature (which, relates to spectral type) most stars fall into a broad band called (by Hertzsprung) the 'main sequence' because it is thought to represent the evolutionary path of the vast majority of stars. Some star types don't fit into the 'main sequence' - these tend to be bright, large stars (giants and supergiants) and the extremely dense 'white dwarfs'. The H-R diagram is still used today.

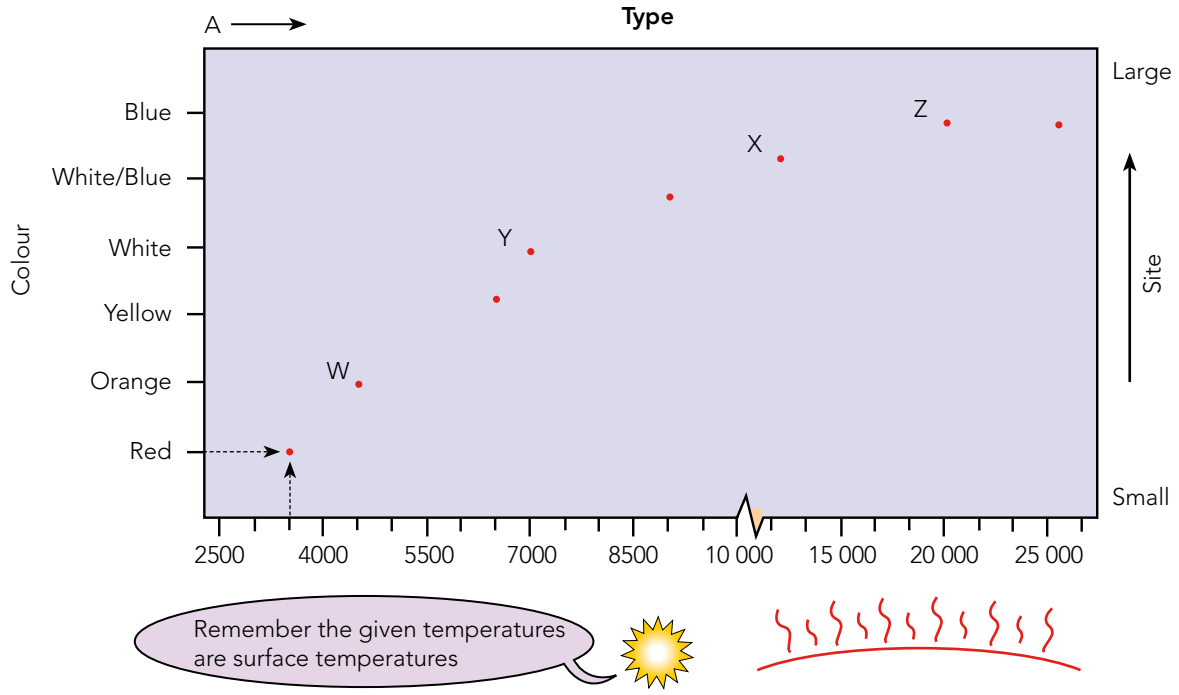


The graphs above combine to give:



The horizontal x-axis illustrates surface temperature, given as spectural type (sometimes called the colour index). The vertical y-axis shows luminosity (brightness). By piecing together the information we have about each star, and neighbouring stars, scientists create a picture of our universe that allows us to answer more questions about it.

Below is a graph based on the H-R Diagram. Use the graph to answer the questions below.



6 Stars of which colour are the hottest? _____

7 Stars of which colour are the coldest? _____

8 What colour do you expect a star with a temperature of 30 000°c to be? _____

9 Would you expect to find a blue star with a temperature of 2500°C? _____

10 Would you expect to find a yellow star with a temperature of 5S00°C? _____

11 What colour and temperature do you expect each of W, X, Y and Z on the graph above to be? Write your answers in the table below.

Star	Temperature	Colour
W		
X		
Y		
Z		

12 Use your knowledge of our Sun to draw a little sun on the graph in what you would expect to be the correct position.

13 Indicate in blue where you would expect to find main sequence stars on the graph.

14 Indicate in red where you would expect to find red giants on the graph.