

Question 2

part a, 6%
part b, 6%

(a) Sketch an H-R diagram, labelling the axes as fully as you can, including numerical values if possible. Mark on the diagram the main sequence and the instability strip. Show where RR Lyrae and Cepheid variables lie on the diagram. Show where you might expect stars called luminous blue variables to lie on the diagram.

(b) (i) It has been suggested that Polaris (the Pole Star) is a Cepheid variable near the end of this phase of its lifetime. It now has a very shallow amplitude of variability, so its changes in brightness are not very noticeable. The period of variability is 3.9 days. Using the graph in Figure 3, or otherwise, find the peak V band luminosity of Polaris in units of the solar V band luminosity, assuming it is correctly classified as a Cepheid variable.

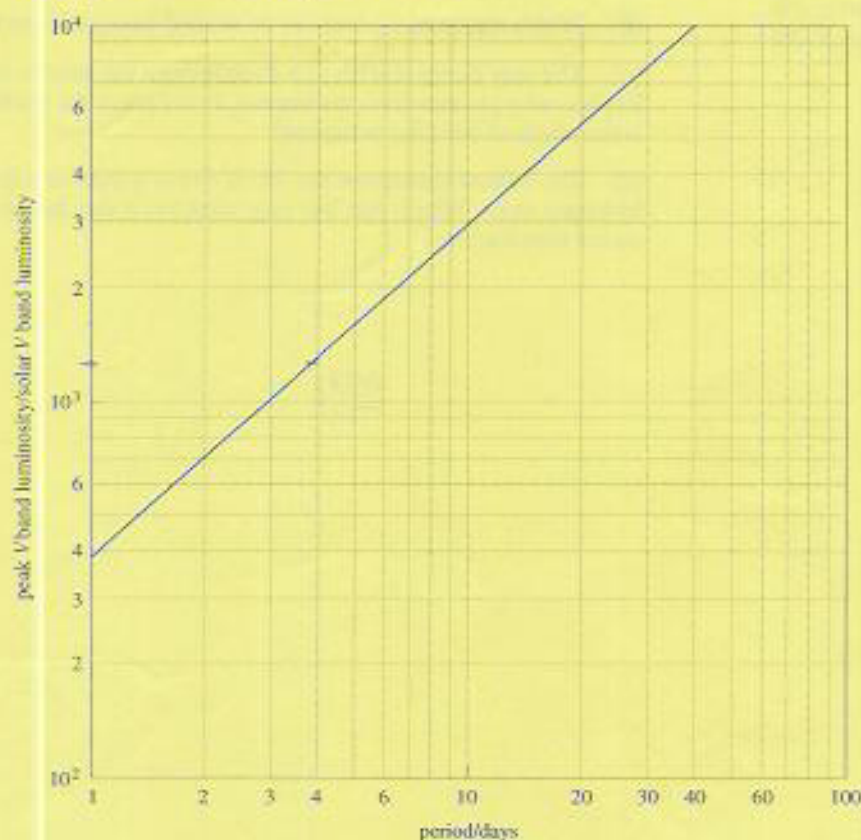


Figure 3 The period-luminosity relationship for Cepheid variables.

(ii) The flux density of Polaris as observed in the V band is approximately 3×10^{-12} of the Sun's V band flux density. Using the luminosity obtained above, calculate the distance of Polaris, expressing your answer in light years. Comment on whether your value is reasonable. (The distance of the Sun from the Earth is approximately 150×10^6 km.)