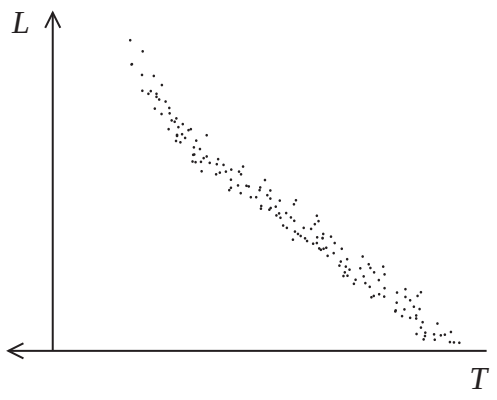
9 A Hertzsprung-Russell (HR) diagram shows how the luminosity L depends on the surface temperature T for a group of stars.

The HR diagram below is for a young star cluster.



(a) (i) Explain how we can tell that the young star cluster is in the early stages of its evolution.

(2)

(ii) Explain why the most massive stars in the cluster have the greatest luminosities.

(4)

(b) The HR diagram on the previous page shows an approximately linear relationship for stars in this cluster.

(i) It is suggested that the relationship between luminosity L and surface temperature T is of the form

$$L = kT^n$$

where k and n are constants.

Explain why a graph of log L against log T would give a straight line.

(2)

(ii) The table shows data for stars in this cluster.

L/L_{Sun}	T/K		
39.5	10 600		
545	16 400		
20 600	26 800		
535 000	44 900		
1 770 000	53 300		

Plot a graph of log L against log T on the grid opposite. Use the columns provided to show any processed data.

(5)

(iii) Determine a value for n.

(2)

(Total for Question 9 = 15 marks)