



QUESTION WORKBOOK

Black-body radiation and spectral classes

Astrophysics · Year 13

AQA 3.9.2.3, 3.9.2.4

11 questions · 32 marks

NAVY SCREEN EDITION

SECTION A · Warm-up

- A1** Write down Stefan's law and Wien's displacement law, defining each symbol and giving the unit of Wien's constant. [2]

- A2** Write the spectral classes in order from hottest to coolest, and state the class of the Sun. [2]

- A3** State the two assumptions made when a star's temperature, power and radius are deduced from its measured spectrum. [2]

SECTION B · Standard

- B1** Calculate the peak wavelength of the radiation from a star with a surface temperature of 10 000 K, and state the region of the spectrum in which it lies. [3]

- B2** A star's spectrum peaks at 9.7×10^{-7} m. Calculate its surface temperature and suggest its spectral class. [3]

- B3** A star has twice the Sun's radius (take the Sun's radius as 6.96×10^8 m) and a surface temperature of 9000 K. Calculate its power output. [4]

- B4** Explain why the hydrogen Balmer absorption lines are strongest in class A stars, weaker in cooler stars, and weak again in the hottest stars. [3]

- B5** A star's surface temperature triples while its radius stays the same. State the factor by which its power output increases. [3]

SECTION C · Stretch

- C1** A red giant radiates 3.9×10^{28} W, one hundred times the Sun's output, from a surface at 3480 K. Calculate its radius, and express it in solar radii (Sun's radius 6.96×10^8 m). [5]

- C2** Two stars have the same radius. Star X is class M and star Y is class A. Compare, with reasons, their colours and their power outputs. [3]

- C3** A student says a star's colour tells you its temperature. State what measurement makes this precise, and the law that converts it. [2]