

Exercise walk-through

Blackbody Radiation ■ 15.4

eXercise

You must be able to

- describe the continuous spectrum emitted by a hot **blackbody** 黑体
- state that the peak wavelength shifts shorter as temperature rises (**Wien's law** 维恩定律)
- explain how blackbody radiation motivated the idea of **energy quantization** 能量量子化

Method — A blackbody

A hot object emits a **continuous** spectrum of all wavelengths, with a peak that depends on temperature.

Method — Wien's law

The **peak wavelength gets shorter** as the temperature rises — so a hotter object glows from red toward blue-white.

Method — Why it mattered

Classical physics could not explain the blackbody curve; Planck fixed it by proposing that energy comes in **quanta** — the start of quantum theory.

Practice 2.1 ■ 1 mark

State what happens to the peak wavelength of a blackbody as it gets hotter.

Solution 2.1

Method: Wien's law

Worked steps

it gets shorter **B1**.

Practice 2.2 ■ 1 mark

State the type of spectrum emitted by a hot solid.

Solution 2.2

Worked steps

a continuous spectrum **B1**.

Practice 2.3 ■ 1 mark

State why blackbody radiation was historically important.

Solution 2.3

Worked steps

it could not be explained by classical physics and led to the idea of energy quanta **B1**.

Exam-style 3.1 ■ 1 mark

As a blackbody gets hotter, its peak wavelength

- A** increases
- B** decreases
- C** stays the same
- D** disappears

Solution 3.1

Method: Wien's law

A increases

B decreases 

C stays the same

D disappears

Worked steps

B.

Exam-style 3.2 ■ 1 mark

A hotter star appears more

A red

B blue

C green

D infrared

Solution 3.2

A red

B blue



C green

D infrared

Worked steps

B.

Exam-style 3.3 ■ 1 mark

Star A glows red and star B glows blue-white.

- (a) State which star is hotter.
- (b) Explain your answer using the idea of peak wavelength.

Solution 3.3

Method: Wien's law

Worked steps

(a) star B (blue-white) **B1**. (b) a shorter peak wavelength (bluer) means a higher temperature, by Wien's law **B1** **B1**.