

GCSE Physics

Worksheet: Perfect black bodies and radiation

TIME 15 min	TOTAL 12 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Perfect black bodies and radiation

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

01

01.1

Which of these best describes a perfect black body?
Tick (✓) **one** box.

An object that reflects all radiation

An object that absorbs all incident radiation and reflects or transmits none

Any object that is black in colour

An object that only emits visible light

☐

☐

☐

☐

[1 mark]

01.2

State whether a perfect black body is a good or a poor emitter of radiation, for its temperature.

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.....

.....

.....

[1 mark]

0 2

Scientists use the idea of a perfect black body to describe how objects absorb and emit radiation.

0 2 . 1

What is a perfect black body?

[1 mark]

0 2 . 2

A perfect black body does not reflect any of the radiation that falls on it. Name **one** other thing that a perfect black body does **not** do to incident radiation.

[1 mark]

0 2 . 3

Explain why a perfect black body would be the best possible emitter of radiation.

[1 mark]

0 2 . 4

The intensity and the wavelength distribution of the radiation emitted by a body depend on one property of the body.

Which property?

Tick (✓) **one** box.

Its mass

☐

Its temperature

☐

Its volume

☐

Its weight

☐

[1 mark]

0 3

Table 1 gives the approximate surface temperature and the wavelength at which each of three stars emits its most intense radiation (its peak wavelength).

Table 1

Star	Peak wavelength in nm	Surface temperature in K
P	500	5800
Q	290	10 000
R	1000	2900

0 3 . 1

Use Table 1 to describe the relationship between a star's surface temperature and its peak wavelength.

.....

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.....

.....

[2 marks]

0 3 . 2

Star R has the longest peak wavelength, in the infrared part of the spectrum. State which star looks reddest, and which looks bluest-white, to an observer.

.....

.....

.....

.....

[2 marks]

0 4

A student says: 'Any object that looks black is a perfect black body.'

0 4 . 1

Explain why the student is wrong.

.....

.....

.....

.....

[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Physics · Worksheet: Perfect black bodies and radiation · 12 marks

Question 1 (2 marks)

01.1 [1 mark]

Correct: An object that absorbs all incident radiation and reflects or transmits none

01.2 [1 mark]

Answer: A good emitter (the best possible emitter for its temperature).

- a good emitter (the best possible emitter at its temperature) (1)
-

Question 2 (4 marks)

02.1 [1 mark]

Answer: An object that absorbs all the radiation that falls on it.

- an object that absorbs all of the radiation incident on it (1)
-

02.2 [1 mark]

Answer: Transmit it

- transmit (it) (1)
-

02.3 [1 mark]

Answer: Good absorbers are good emitters, and it is the best possible absorber.

- a good absorber is also a good emitter, and a perfect black body is the best possible absorber (1)
-

02.4 [1 mark]

Correct: Its temperature

Question 3 (4 marks)

03.1 [2 marks]

Answer: The higher the surface temperature, the shorter the peak wavelength; they are inversely proportional (peak wavelength $\times$ temperature is constant).

- as the surface temperature increases, the peak wavelength decreases (1)
- the peak wavelength is inversely proportional to the surface temperature: peak wavelength $\times$ temperature is the same for every star (e.g. $500 \times 5800 = 290 \times 10\,000 = 1000 \times 2900 = 2.9 \times 10^6$) (1)

Notes: Allow 'doubling the temperature halves the peak wavelength' (star R and star P) for the second mark.

03.2 [2 marks]

Answer: R looks reddest (coolest); Q looks bluest-white (hottest).

- star R looks reddest (it is the coolest, with the longest peak wavelength) (1)
- star Q looks bluest-white (it is the hottest, with the shortest peak wavelength) (1)

Question 4 (2 marks)

04.1 [2 marks]

Answer: A perfect black body absorbs all incident radiation of every wavelength; a black-looking object only absorbs most visible light and still reflects some radiation (and may reflect or transmit infrared), so it is not a perfect black body.

- a perfect black body absorbs all the radiation that falls on it, of every wavelength, and reflects or transmits none (1)
 - an object that looks black absorbs most visible light, but it still reflects some radiation (e.g. a shiny black surface reflects some light) and may reflect or transmit other wavelengths, such as infrared, so it is not a perfect black body (1)
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