

Perfect black bodies and radiation

4.6.3.2 · Waves · revision notes

How the intensity and wavelength distribution of the radiation a body emits depend on its temperature. GCSE Physics only, not in Combined Science.

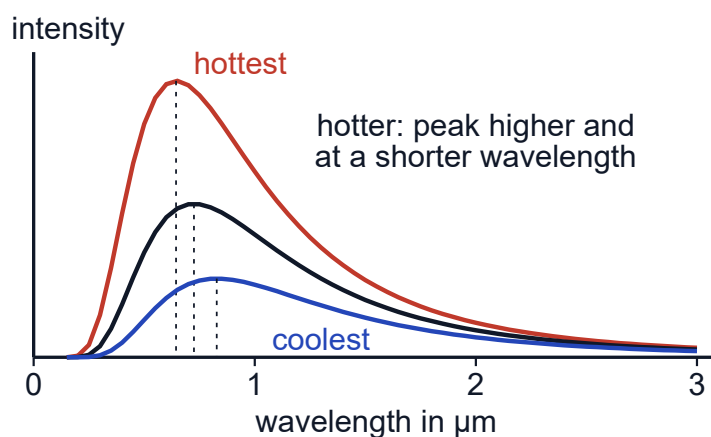
Key facts

- All bodies emit radiation
- Hotter → more radiation at every wavelength; the peak moves to a shorter wavelength
- Intensity and wavelength distribution depend on temperature
- Sun (very hot): lots of visible light. Earth (cooler): mainly infrared

Notes

Emission depends on temperature

- All bodies emit radiation. The **intensity** (how much is emitted) and the **wavelength distribution** (how it is spread across the wavelengths) depend on the temperature of the body.
- As a body gets hotter it emits more radiation at every wavelength, and the intensity at shorter wavelengths increases the most.
- So the peak of an intensity–wavelength graph is higher, and at a **shorter wavelength**, for a hotter body.



As the temperature rises, the peak gets higher and moves to shorter wavelengths.

- Example: a metal rod being heated at first emits infrared that you can feel but not see; as it gets hotter it glows dull red, then orange-yellow and finally white.
- The Sun is very hot, so it emits a lot of visible light. The Earth is much cooler, so it emits mainly longer-wavelength infrared.

How to answer each type of question

Describe how the radiation emitted changes with temperature

2 marks

Grade 5

1. Say the total radiation (intensity) increases at all wavelengths.
2. Say the peak moves to shorter wavelengths (a greater proportion at short wavelengths).

Example. A metal rod is heated in a flame. It starts to glow red and later glows yellow-white. Describe how the radiation emitted by the rod changes as its temperature increases.

Model answer. The rod emits more radiation (a greater intensity) at all wavelengths (1). A greater proportion is emitted at shorter wavelengths, so the peak wavelength decreases and its colour changes from red towards white (1).

Don't lose marks

- ✗ Saying a hotter body emits 'only shorter wavelengths'. It emits more at all wavelengths; the peak moves to shorter wavelengths.
- ✗ Reading the graph the wrong way round: check which axis is wavelength and which is intensity.

More tips

Memory tricks

- Hotter = higher and further left: on an intensity–wavelength graph (wavelength increasing to the right) the hotter curve is higher and peaks at a shorter wavelength.
- Red hot to white hot: as an object heats up, more of the shorter wavelengths are added, so the peak wavelength gets shorter.

Exam technique

- When a graph is given, quote peak wavelengths or intensities from it to support your answer.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3

State that all bodies emit radiation

Every object emits radiation; how much, and at which wavelengths, depends on its temperature.

Grade 5

Describe how emission changes with temperature

A hotter body emits more radiation at every wavelength, and relatively more at shorter wavelengths.

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