

Radio waves to gamma rays: uses and risks

Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Lab answers

These model answers use the sample table. Your own spacings will differ because every oven has its own pattern, but the speed of light you calculate should come out within a few percent of 3.0×10^8 m/s.

Level: Physics grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** HS-PS4-4, HS-PS4-5

Question 1 Mean spacing

Mean = $(6.00 + 6.20 + 6.15 + 6.10) \div 4 = \mathbf{6.11 \text{ cm}}$.

Question 2 Wavelength

The microwaves form a standing wave in the oven. Hot spots (maxima) are half a wavelength apart, so $\lambda = 2d = 2 \times 6.11 = \mathbf{12.2 \text{ cm}} = 0.122 \text{ m}$.

Question 3 Speed of light

$c = f \times \lambda = 2.45 \times 10^9 \times 0.122 = \mathbf{2.99 \times 10^8 \text{ m/s}}$.

Question 4 Percentage difference

Difference = $|2.99 \times 10^8 - 3.00 \times 10^8| \div 3.00 \times 10^8 \times 100 = \mathbf{0.4 \%}$, which is a close match.

Question 5 Turntable

The wave pattern only stays in place if the food stays still. A turning plate moves the chocolate through all the hot spots, so it melts evenly and **no spots show**.

Question 6 Uncertainty

Spacings range from 6.00 to 6.20 cm, a spread of **0.20 cm**. Judging the centre of a melted blob is the largest error, about $\pm 0.3 \text{ cm}$ on each measured distance.

Question 7 Improvement

Use a thin layer of chocolate that melts in smaller spots, count more gaps in each trial, and repeat on several oven runs to **average more values**.