2024 Ph H1 Q17

Section: Particles and Waves

Topic: Refraction of Light

Question Summary

A ray of monochromatic light passes from air into diamond. The frequency of the light in air is 5.09×10^{14} Hz. Find the speed of this light in diamond.

Worked Solution

Step 1: Frequency does not change across a boundary.

Step 2: Wavelength in diamond: $\lambda = v / f$, but we need v.

Step 3: Refractive index of diamond (n ≈ 2.42). $v = c / n$.

$v = (3.00 \times 10^8) / 2.42 \approx 1.24 \times 10^8$ m s^{-1}.

This corresponds to option C.

Final Answer

C — 1.24×10^8 m s^{-1}

Revision Tips

• Frequency is invariant across a boundary.

• Use $v = c/n$ once refractive index is known.

• Diamond has a very high n (≈2.4), so speed of light is much lower than in air.