2019 Ph H1 Q19

Section: Particles and Waves

Topic: Spectra

Question Summary

Hydrogen absorption in the Sun’s outer layers: with energy levels E0, E1, E2, E3, E4 available, how many distinct absorption lines can be produced by electron transitions between these levels?

Worked Solution

An absorption line corresponds to an electron absorbing a photon and moving from a lower to a higher level.

With 5 levels (E0…E4), the number of distinct upward transitions is the number of unordered pairs (lower→higher).

Count of such transitions = C(5,2) = 5×4/2 = 10.

Therefore there are 10 possible absorption lines.

Final Answer

D — 10 lines

Revision Tips

• For n energy levels, the number of possible absorption lines is n(n−1)/2 (all lower→higher pairs).

• Emission lines follow the same counting but correspond to higher→lower transitions.

• Each line frequency satisfies ΔE = hf = hc/λ.