2021 Ph H1 Q20

Section: Particles and Waves

Topic: Refraction of Light

Question Summary

Three rays of red light (P, Q, R) travel inside glass (n = 1.50) towards the glass–air boundary. Incident angles are: P = 20°, Q = 40°, R = 60°. Which rays pass into the air?

Worked Solution

Critical angle c is found from sin c = 1/n.

Here, sin c = 1 / 1.50 = 0.667 → c ≈ 42°.

Ray P: i = 20° < 42° → refracts into air.

Ray Q: i = 40° < 42° → refracts into air.

Ray R: i = 60° > 42° → undergoes total internal reflection.

So P and Q transmit, R reflects.

Final Answer

D — P and Q only

Revision Tips

• Total internal reflection occurs if incidence > critical angle.

• Critical angle c = arcsin(1/n).

• Check each incidence angle against c to decide transmission vs reflection.