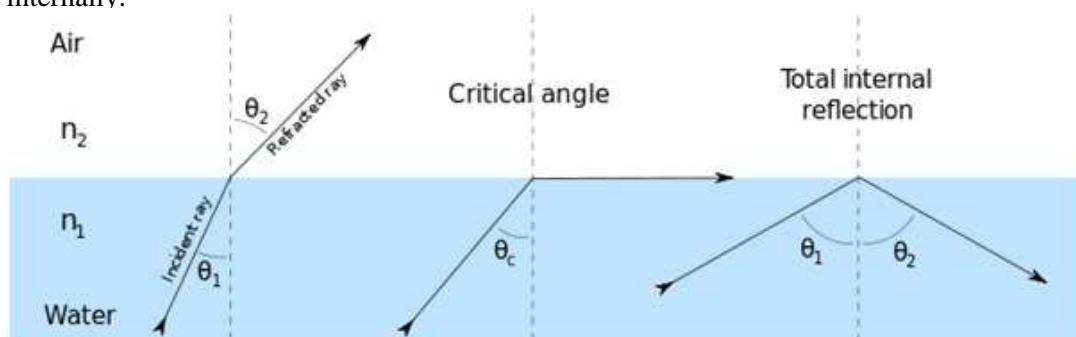


(SOLUTION) MOCK TEST 24

1 Correct Answer : B

Answer Justification :

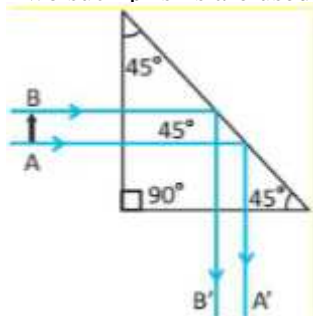
Concept: When a wave (light) reaches a boundary between different materials with different refractive indices, the wave will in general be partially refracted at the boundary surface, and partially reflected. However, if the angle of incidence is greater (i.e. the direction of propagation is closer to being parallel to the boundary) than the critical angle – the angle of incidence at which light is refracted such that it travels along the boundary – then the wave will not cross the boundary, but will instead be totally reflected back internally.



Justification: Statement 1: Optical fibres, which are widely used in telecommunications, keep the signal reflected within the fibre using total internal reflection.

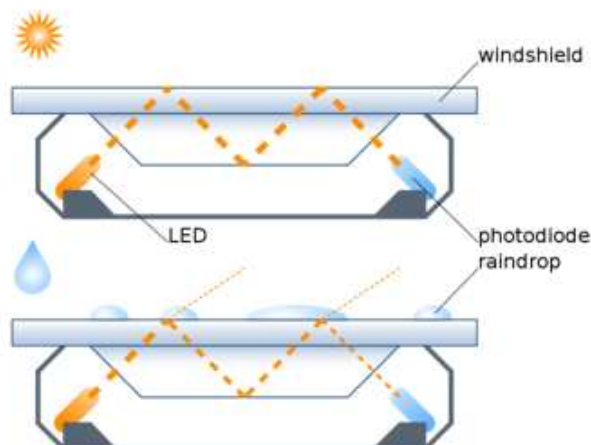
Optical fibres are used most often as a means to transmit light between the two ends of the fibre and find wide usage in fibre-optic communications.

Statement 2: Many optical instruments use right -angled prisms to reflect a beam of light through 90° or 180° (By total internal reflection) such as cameras, binoculars, periscope and telescope. One of the angles of right angled prism is 90°. When a ray of light strikes a face of prism perpendicular, it enters the prism without deviation and strikes the hypotenuse at an angle of 45°. Since the angle of incidence 45° is greater than critical angle of the glass which is 42°, the light is totally reflected by the prism through an angle of 90°. Two such prisms are used in periscope. The light is totally reflected by the prism by an angle of 180°. Two such prisms are used in binoculars.



Statement 3: Optical fingerprinting devices use frustrated total internal reflection in order to record an image of a person's fingerprint without the use of ink.

Statement 4: Automotive rain sensors, which control automatic windscreen/windshield wipers, rely on total internal reflection to keep infrared light bound to the windshield pane as long as the surface is dry: an infrared light is beamed at a 45-degree angle into the windshield from the interior — if the glass is wet, less light makes it back to the sensor, and the wipers turn on.



<http://hyperphysics.phy-astr.gsu.edu/hbase/phyopt/totint.html>

Q Source: Additional Research (AR): CAPF 2018