

TURNING POINTS

3-1 Special Relativity

1. (a) (i) Absolute rest is a state of being at rest that does not depend on the motion of any observer and is the same throughout the universe.
(ii) Absolute time is time that does not depend on the motion of any observer that is the same throughout the universe.

(b) The purpose of the Michelson-Morley experiment was to establish whether the ether hypothesis was correct by measuring any change in the position of the interference fringes when the apparatus was turned through 90° . The change was predicted to be 0.4 of a fringe width.
(The ether was an invisible substance that the waves were vibrations in. The Earth moved through the ether. Light travelled at a fixed speed in the ether. The speed of the light would be different if the Earth was moving in the direction of the light compared with when the light was moving perpendicular to the direction of the Earth).
2. (a) The two plane mirrors are there to reflect the perpendicular beams back together again so that the interference pattern could be observed.

(b) The compensator glass block ensures that both beams travel through the same thickness of glass.
3. (a) A dark fringe is formed when the two beams arrive in antiphase (i.e. 180° out of phase) because of the difference in their path lengths.

(b) When the apparatus was rotated through 90° and the beam directions relative to the Earth's motion were swapped it was expected that the interference fringes would shift measurably (by about 0.4 of a fringe width).
4. (a) The result of the experiment was that it did not matter how the apparatus was oriented, the fringe pattern did not move.

(b) (i) It was a 'null' result because no shift occurred.
(ii) The significance was that the 'ether' theory could no longer be maintained.