

CL16_Q1. What is a quantum mechanical tunnelling? Explain its significance.

Ans:

Quantum tunnelling or barrier tunnelling refers to the process of transmission through a potential barrier even when the energy of the particle is lesser than the barrier potential. This plays an essential role in several physical phenomena, such as the alpha decay and the nuclear fusion that occurs in main sequence stars like the Sun. It has important applications to modern devices such as the tunnel diode, quantum computing, and the scanning tunnelling microscope.

CL16_Q2. A particle is incident on a potential barrier of width a , with total energy less than the barrier height, and it is reflected. Does the reflection involve only the potential discontinuity facing its direction of incidence? If the other discontinuity were moved by increasing a , is the reflection coefficient changed? What if the other discontinuity were removed, so that the barrier was changed into a step?

Ans:

The reflection does not only involve the potential discontinuity facing the direction of incidence. The width of the barrier has an effect on the reflection and transmission coefficients, as the barrier width is increased the amount of reflection in general decreases (though there are some particular widths and energies for which the amount of reflection is particularly high or low due to constructive or destructive interference between the waves reflected off of each discontinuity.) If the second discontinuity were removed, changing the barrier into a step, then there would be 100% reflection, compared to smaller reflections for barriers of finite thickness.