

2006-11-29 Problem Set

Due Nov 29, 2006

Problem 1: Tipler 6-41

Problem 2: Tipler 6-42

Problem 3: Tipler 6-46

Problem 4:

In class this morning (Mon, 11/27) we discussed the case of the barrier potential (Tipler p. 278) only for the case where the energy of the particle is less than the height of the barrier, $E < V_0$. This problem does some exploration of the problem for the other case where the particle energy is higher than the barrier height.

a) Write the equations for the wave function for this $E > V_0$ case for the 3 regions shown in Fig. 6-27, part (a). That is, write equations for this case that are analogous to Eq. (6-74). Apply the boundary condition that the particle is incident from the left and there is only a right-going wave on the right. Be sure to give the definitions of any new symbols that you introduce.

b) If you were to carry through the calculation of the transmission coefficient for this case, you would find Eq. (6-75) except that the hyperbolic sine ($\sinh$) function is replaced by the ordinary sine function ($\sin$). Also, the constant α , which was defined for $E < V_0$, is replaced by a different quantity appropriate for the case $E > V_0$, which you will figure out when you solve part (a). Show that the transmission coefficient can take on the value $T = 1$, when the wavelength of the wave function in the well has certain very special ratios to the width of the well. What are these ratios?