In [8]:
```python
#Import nescesarry functions and constants
from scipy import constants
from math import sqrt

#Get inputs from users
m=float(input("What is the mass of your particle? "))
energy=float(input("What is the kinetic energy in eV? "))
step=float(input("What is the potential step in eV? "))

#Calculate wave vectors using inputs
k1=math.sqrt(2*m*energy)/constants.hbar
k2=math.sqrt(2*m*(energy-step))/constants.hbar

#If/else statement to determine is kE is geater than potential step
if energy > step:

    #Calculates probability of T(transmission) and R(reflection) of the partic
    T=(4*k1*k2)/(k1+k2)**2
    R=((k1-k2)/(k1+k2))**2

    #Prints calculated values
    print(f'The probability of transmission of the particle is {T:.2f}.')
    print(f'The probability of reflection is {R:.2f}.')

else:
    print("Your kinetic energy is smaller than the potential step.")
```

```
What is the mass of your particle? 9.11e-31
What is the kinetic energy in eV? 10
What is the potential step in eV? 9
The probability of transmission of the particle is 0.73.
The probability of reflection is 0.27.
```

In [8]:
```
#Exercise 2.6
#Import functions and constants
from scipy import constants
from math import sqrt, pi
import numpy as np

#Constants and inputs of given values
M=1.9891e30
G=constants.G
planet=input("What is your planetary object? ")
l1=float(input("What is your distance l1 (the perihelion) of the object? "))
v1= float(input("What is your objects velocity v1 at the perihelion? "))

#Contants of quadratic to be solved for v2
ax=1
bx=-(2*G*M)/(v1*l1)
cx=-((v1**2)-((2*G*M)/l1))

#Calculates roots
roots= np.array([(-bx+sqrt(bx**2 -4*ax*cx))/(2*ax),(-bx-sqrt(bx**2 -4*ax*cx))/
#Isolates smaller root
v2=min(roots)
#Used to check that the correct velocity was calculated
#print(v2)

#Calculates l2
l2=(l1*v1)/v2
#Calculates semi-major axis
a=(1/2 * (l1+l2))
#Calculates semi-minor axis
b=sqrt(l1*l2)

#Calculates orbital period in seconds
Orbital_T=(2*pi*a*b)/(l1*v1)
#Calculates orbital eccentricity (unitless)
Orbital_e=(l2-l1)/(l2+l1)

#Prints out desired values
print(f'The distance l2 (the aphelion) is {l2:.2f} meters.')
print(f'The velocity v2 at the aphelion is {v2:.2f} m/s.')
print(f'The orbital period T is {Orbital_T:.2f} seconds.')
print(f'The orbital eccentricity e is {Orbital_e:.6f}.')
```

```
What is your planetary object? The Earth
What is your distance l1 (the perihelion) of the object? 8.7830e10
What is your objects velocity v1 at the perihelion? 5.4529e4
The distance l2 (the aphelion) is 5258128751516.07 meters.
The velocity v2 at the aphelion is 910.83 m/s.
The orbital period T is 2383099138.05 seconds.
The orbital eccentricity e is 0.967142.
```

What is your planetary object? The Earth What is your distance l1 (the perihelion) of the object? 1.4710e11 What is your objects velocity v1 at the perihelion? 3.0287e4 The distance l2 (the aphelion) is 152004039521.90 meters. The velocity v2 at the aphelion is 29309.86 m/s. The orbital period T is 31538215.90 seconds. The orbital eccentricity e is 0.016396

What is your planetary object? Halley's Comet What is your distance l1 (the perihelion) of the object? 8.7830e10 What is your objects velocity v1 at the perihelion? 5.4529e4 The distance l2 (the aphelion) is 5258128751516.07 meters. The velocity v2 at the aphelion is 910.83 m/s. The orbital period T is 2383099138.05 seconds. The orbital eccentricity e is 0.967142.