Q1b
Figure 1.1 – 1.5: The Evolution of an electron over time

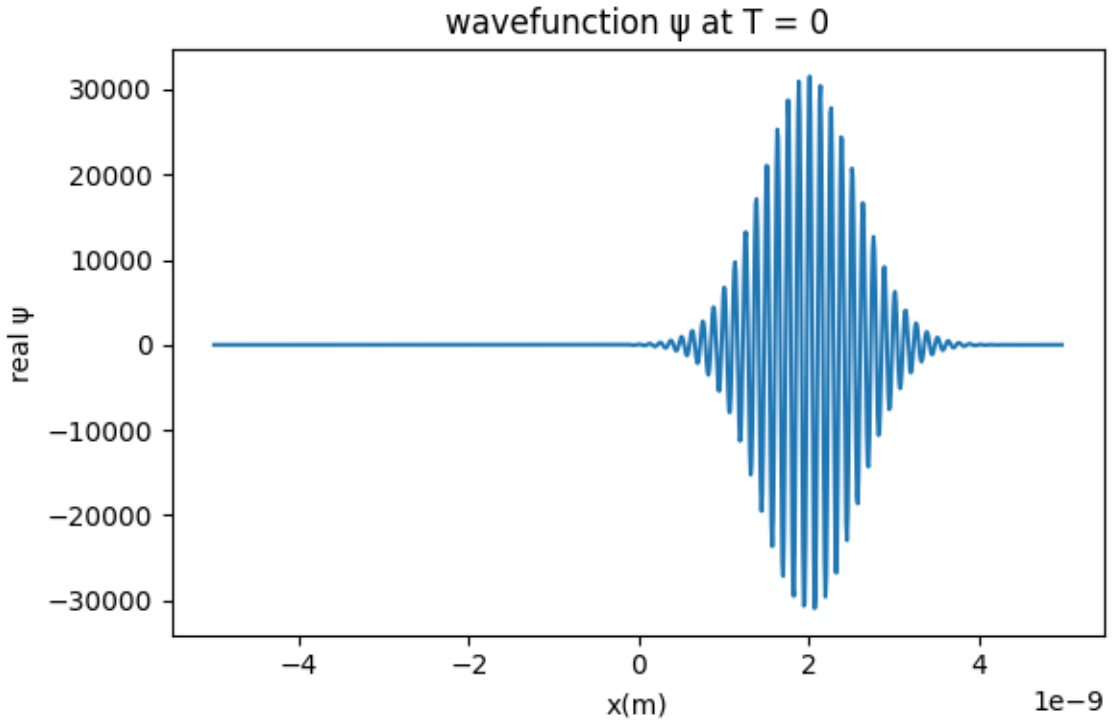


Figure 1.2

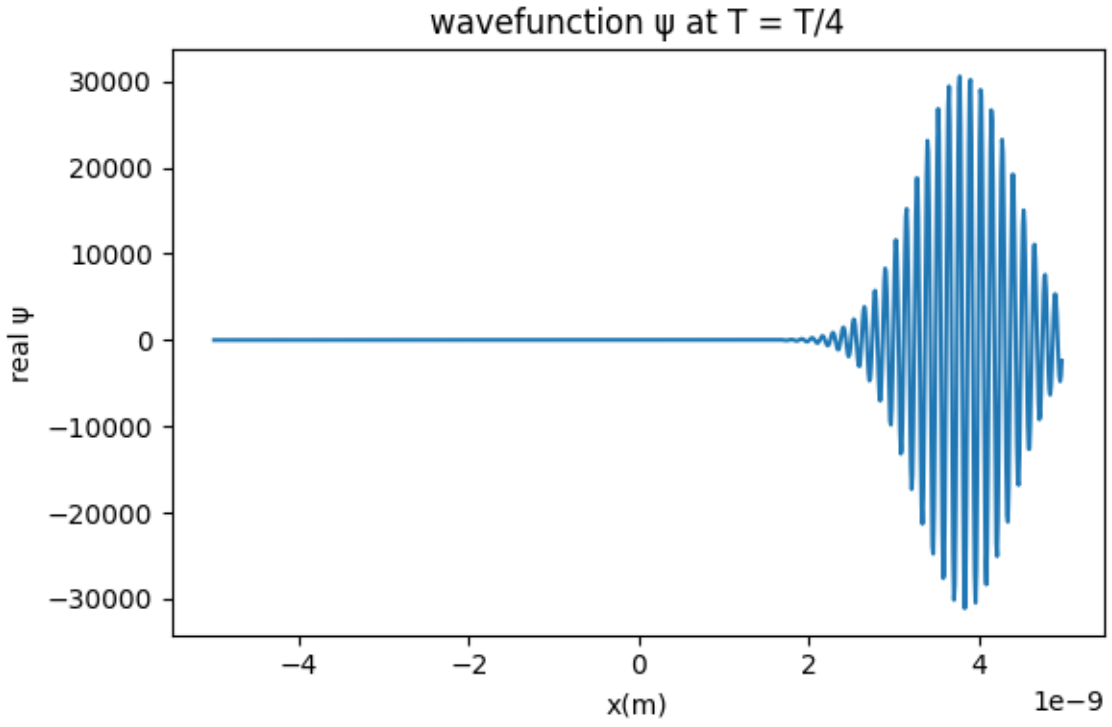


Figure 1.3

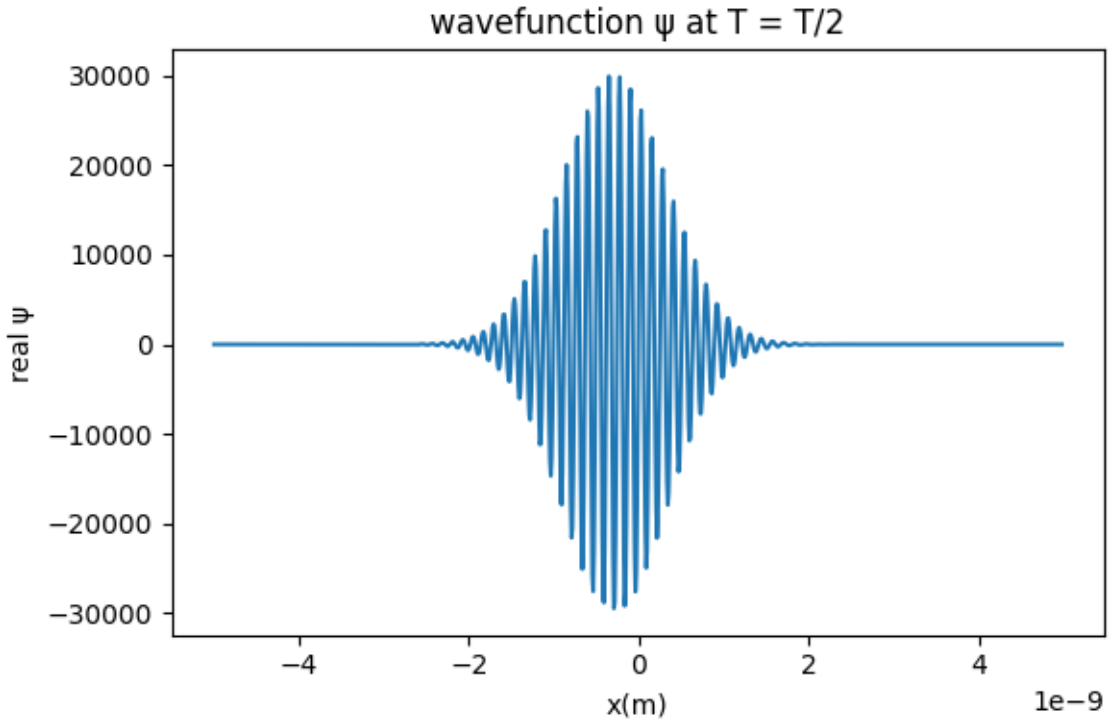


Figure 1.4

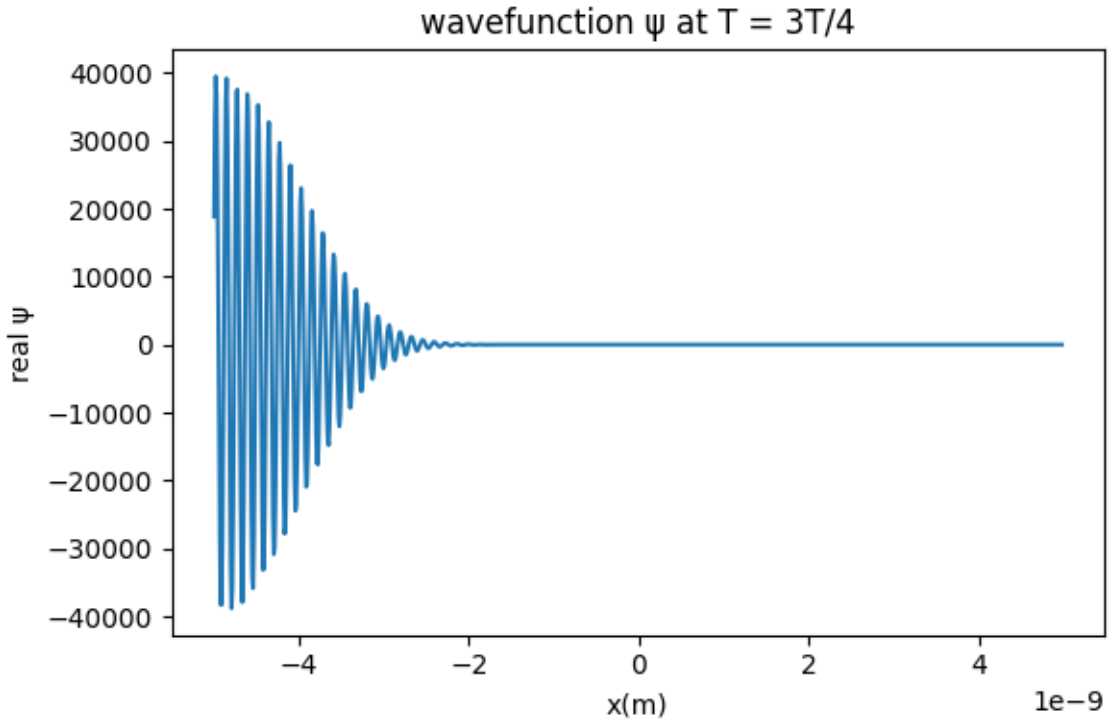
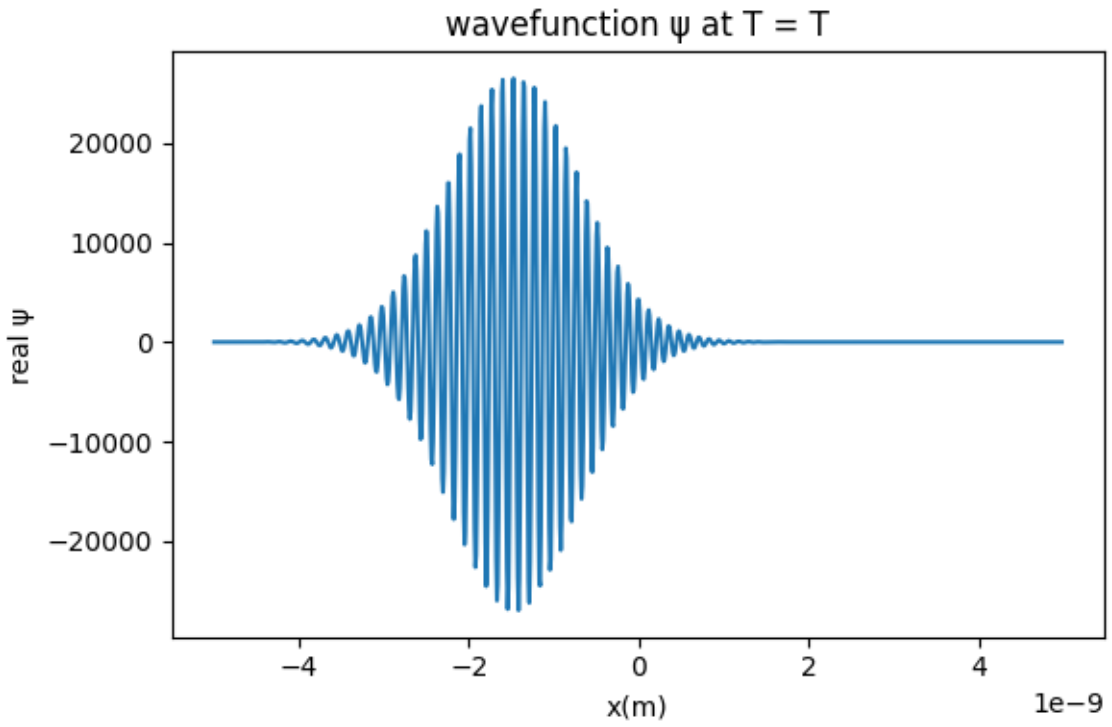
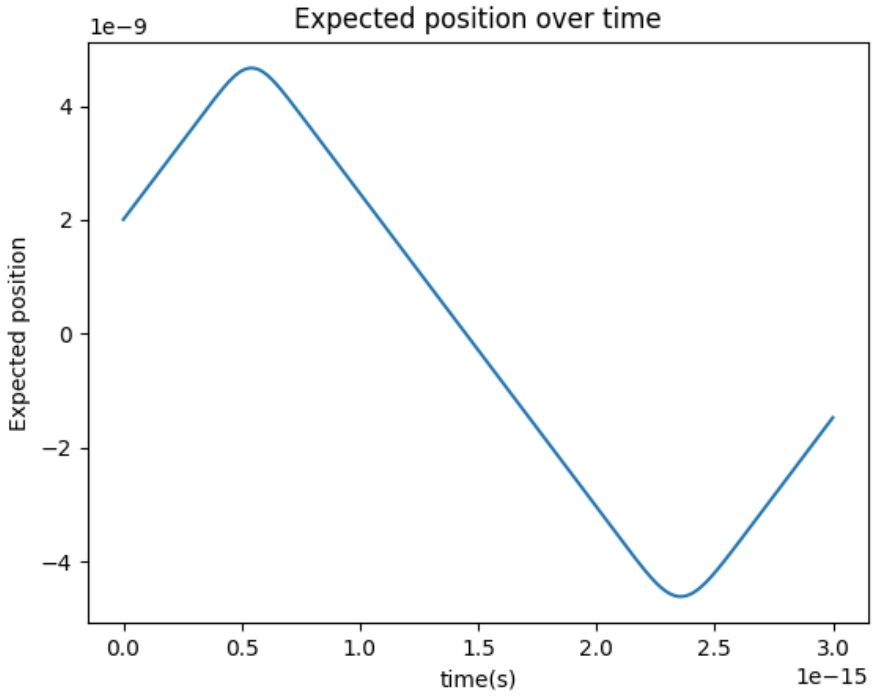


Figure 1.5



At t = 0, the shape of the wave function resembles an ordinary wave packet. As time evolves, the wave packet started to spread out and move at a constant speed. The particle collided with the edge of the potential well at t = T/4 and t = 3T/4, which reflected the wave packet and reversed its moving direction.

(SEE NEXT PAGE)
Figure 1.6: Expected position of electron



As expected from the previous section, the particle moves in with a constant speed at all times. Its direction reversed twice at t = T/4 and t = 3T/4 respectively, as shown on the wave function plots.

Q1c

Figure 1.7: Normalization of the wave function

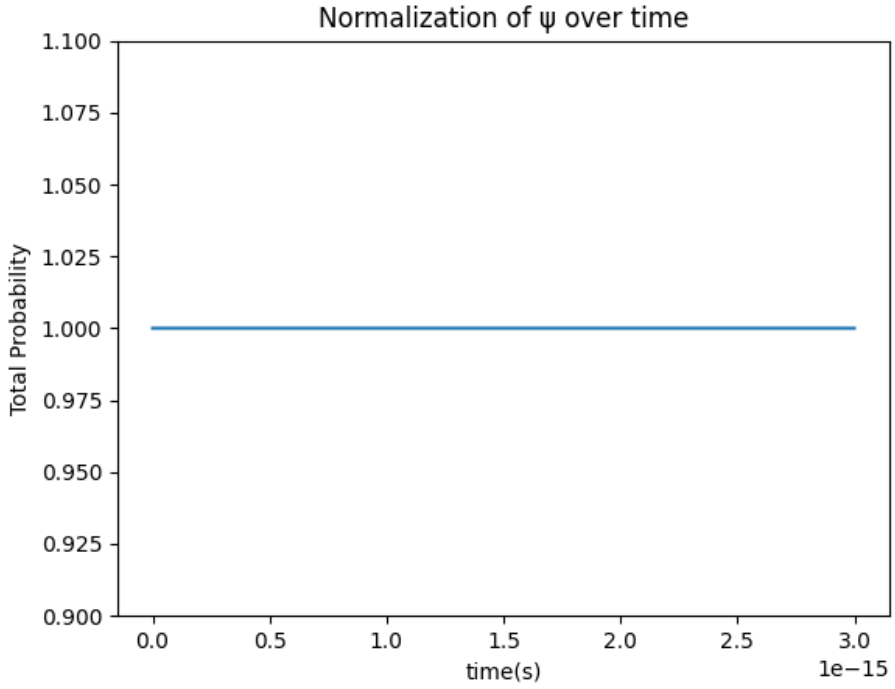
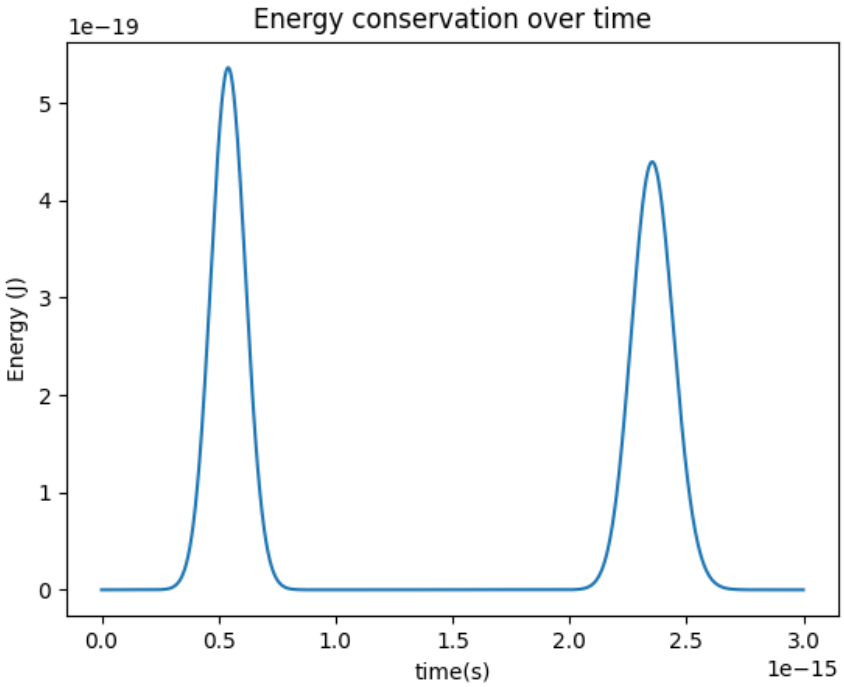


Figure 1.8: Energy of the system over time



The function remains normalized over time, which is expected behaviour for the wave function. However, there are 2 distinct spikes in the energy plot over time. Those two instances correspond to the times when the particle is colliding with the boundary of the potential well. This suggests that the simulation failed to conserve energy during collision. The total energy remains constant under other conditions. After examining the code in detail and different grid sizes for a, we noticed that the physical grid size a is related to both movement speed and magnitude of the energy spike, but we did not identify the underlying cause.