# THE FINAL LAB

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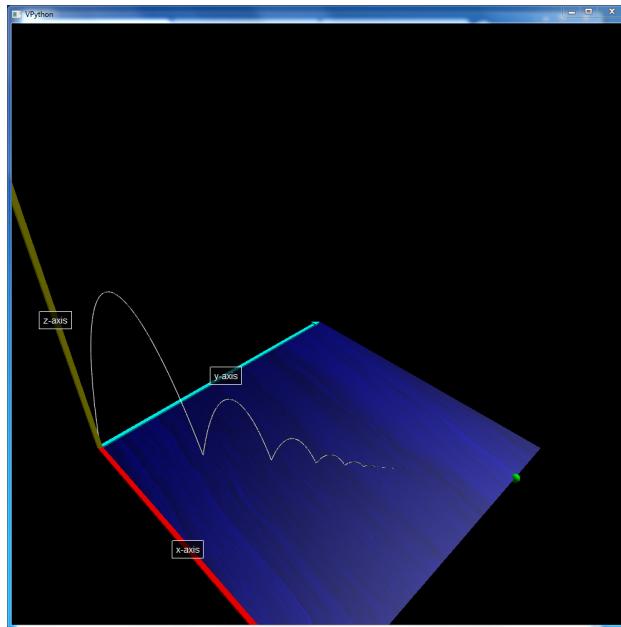
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## Bouncing Ball



Figure 1: Visual Output of the bouncing ball

For Bounce 1, the time was 6.05 seconds and the velocity was

$$\vec{v} = 3.19838\,\hat{i} + 2.68376\,\hat{j} - 29.6368\,\hat{k}\,m/s \tag{1}$$

For Bounce 2, the time was 9.97 seconds and the velocity was

$$\vec{v} = 3.19838\,\hat{i} + 2.68376\,\hat{j} - 19.1697\,\hat{k}\,m/s \tag{2}$$

For Bounce 3, the time was 12.5 seconds and the velocity was

$$\vec{v} = 3.19838\,\hat{i} + 2.68376\,\hat{j} - 12.3252\,\hat{k}\,m/s \tag{3}$$

For Bounce 4, the time was 14.12 seconds and the velocity was

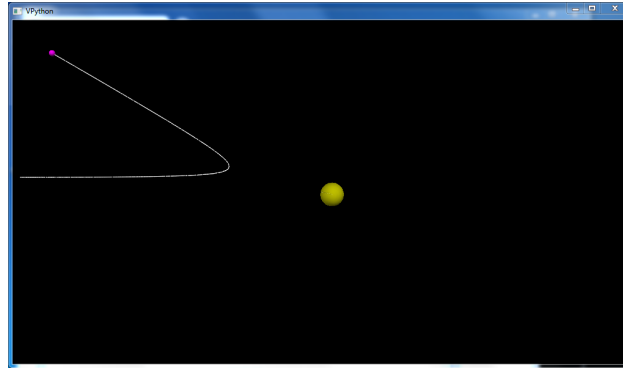$$\vec{v} = 3.19838\,\hat{i} + 2.68376\,\hat{j} - 7.86932\,\hat{k}\,m/s \tag{4}$$

For Bounce 5, the time was 15.16 seconds and the velocity was

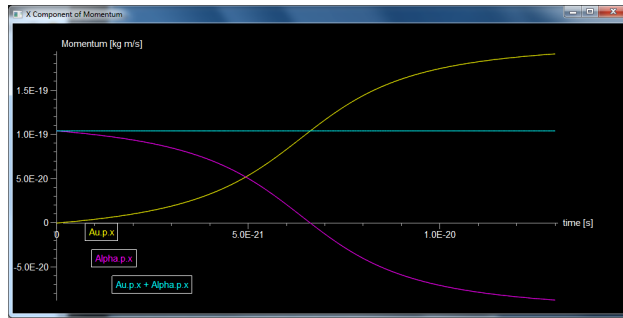$$\vec{v} = 3.19838\,\hat{i} + 2.68376\,\hat{j} - 5.05786\,\hat{k}\,m/s \tag{5}$$

For Bounce 6, the time was 15.82 seconds and the velocity was

$$\vec{v} = 3.19838\,\hat{i} + 2.68376\,\hat{j} - 3.17027\,\hat{k}\,m/s \tag{6}$$
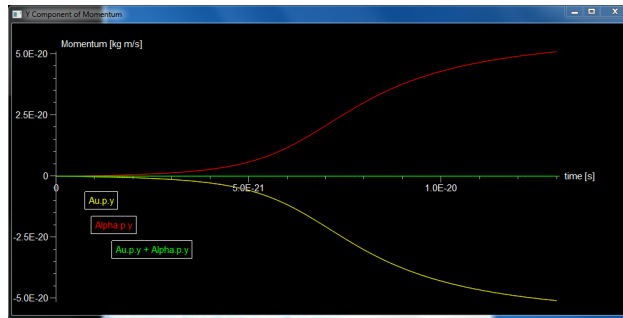
# Question 34 / 35



(a) Visual Output of Question 34



(b) Graphical output of the x component of momentum



(c) Graphical output of the y component of momentum

Figure 2: Outputs of Question 34 and 35

The unchanged python code would produce a alpha particle moving towards a stationary gold nucleus. The value of the impact parameter for the model was determined to be $5 \cdot 10^{-15}$ meters. The angle of

scattering for the model was calculated to be 2.87 radians or $164.58^o$. The impact parameter for $90^o$, $168^o$, $38^o$, and $13^o$ were determined to be $2.43 \cdot 10^{-14}$ meters, $2.34 \cdot 10^{-15}$ meters, $7.07 \cdot 10^{-14}$ meters, and $2.14 \cdot 10^{-13}$ meters, respectively.

For Question 35, the momentum is conserved in the system. This can be seen by the sum lines in Figure 2 b and c, since there is no change in the sums of the momentum the value is conserved. If momentum does not appear to be conserved than there may be a miscalculation error associated with the Electric force that was propagated to the momentum.