Falling Objects

FIND YOUR NAME on the list of today's studio groups, find your partner(s), seat yourselves comfortably, and please read through the rest of this document.

Today's Agenda

Today we'll complete our investigation of falling pennies, then work through the exercise from the Chapter 20 notebook on the Earth falling into the Sun.

Three Models of Falling Pennies

Use this space for notes on the comparison of the three models.

How much do Model 2 and Model 3 differ? How does that error compare to other sources of uncertainty? List some other sources of uncertainty and their percent error.

In summary, what would you say about the usefulness of Model 1, Model 2, and Model 3?

Introducing the Law of Universal Gravitation

In this section, we will be working through the exercise at the end of the Chapter 20 notebook. Use the space on this page to answer questions posed in the slides and capture any additional notes.

What are the state variables in this model?

What are the system variables (parameters)?

What happens when r goes to zero? How do we handle that in our simulation?

How long does it take for the Earth to fall into the Sun?

Optional: Compute the gravitational potential energy of the Earth at the beginning and end of the simulation.

Optional: Compute the kinetic energy of the Earth at the beginning and end of the simulation. Does the simulation conserve energy?

Reflection Questions

Why did we invoke the Law of Universal Gravitation in modeling the Earth falling into the Sun, but not in modeling a penny falling from the Empire State Building? What was similar and what was different about the Python implementations of these models? Qualitatively, how did the behavior of the falling objects compare?

Next Steps

Before class on Tuesday, please do the following things:

- ☐ Write your name here: _____
- ☐ Write your partner's name here: _____
- ☐ By tonight: Scan this worksheet and submit it on Canvas.
- ☐ Read Chapter 22 and complete the reading quiz. Run the Chapter 22 notebook before class.
- ☐ Meet in the studios again on Tuesday.