Generic Lesson Plan Template

You should submit this form in addition to any computer generated files/documents/models to your group folder on Angel. Please create a .zip file and upload the group of files as a single archive.

Name: **Bruce Peachey**
Grade level(s)/Subject taught: **12/Physics**
Objectives: **Students will understand that the vertical component of motion of an object in free-fall is not dependent on properties of the object, or on the horizontal component of the object's motion.**

Please provide a rich **one-page, single-spaced**, description or a *vision* of your best thinking on a way or ways you might teach the planned lesson. (approximately ½ page for the teacher role, ½ page for the student role). Also, construct a tentative rubric that you might use with your students (see example)

Items to include in your lesson plan: (Choose your discipline/concepts from your own area).

1. *Write* the Mathematical Concept or "key idea" that modeling will be used to teach: (e.g. Students use mathematical modeling/ multiple representation to provide a means of presenting, interpreting, communicating, and connecting mathematical information and relationships)

and/or…

1b. *Write* the Science Concept or "key idea" that modeling will be used to teach: (e.g. Organisms maintain a dynamic equilibrium that sustains life).

Students will understand that the vertical component of motion of an object in free-fall is not dependent on properties of the object, or on the horizontal component of the object's motion.

Materials:

Interactive Physics loaded on a class set of computers.

"…a rich **one-page, single-spaced**, description or a *vision* of your best thinking…"

Prompts:

1. How will you assess the prior knowledge of the student?
2. How will you begin the lesson?
3. What are the teacher and students doing every 5-10 minutes? (Teacher Actions and Student Actions
4. How will you assess the learning for the lesson?

Using _____Interactive Physics_____ I plan on having my students…
(software / modeling package(s)

In Interactive Physics, create two identical spheres and let them fall together from the same height. Make predictions regarding how their velocity and height will compare as they fall together from the same height. Then run the simulation and observe and discuss their motion. Then set up IP to measure height for each one, and repeat the experiment, this time looking at the measured data instead of the actual height. This can be accomplished more easily using the step tool in Interactive Physics.

After this, students will change several parameters and predict how this will affect the measurements. Then they will run the simulation with the new values and check their predictions, after which they will record their observations on why things came out the way they did.

See the attached worksheet to determine exactly how to make these changes. This is flexible, so that the individual teacher can adjust the worksheet for the individual class or student.

Ultimately, students will be expected to make determinations of this kind mathematically, and they will need to understand that they need to ignore the horizontal component of motion in order to correctly analyze the vertical component.

Name: _____ Date: _____

Physics (R) Free-Fall Motion Simulation

1. Follow your instructor's example and use the Circle tool to set up two identical spheres in Interactive Physics. Make sure they both begin at the same height (y value). As the activity goes along, make sure you save every once in a while.

2. Predict how their speed and height will compare as they fall together.

3. Run the simulation and observe the motion of the balls. Was your prediction correct? How could you tell? [If you have trouble seeing them fall, go to View, View Size, and increase the Window width.]

4. Select one of the spheres and pick measure, P-V-A, Y. Now do the same for the other sphere.

5. Run the simulation again and compare the numbers. This can be more easily accomplished using the step tool near the lower left hand corner of the screen.

6. Did the measured values confirm your observations?

7. Double-click one of the spheres and change its mass in the Properties window. At the top of the window, select the other sphere and confirm that it has a different mass. You can also check their initial y-values when you do this to make sure they begin at the same height. Choose one of the spheres and change its color by selecting it and going to Window, Appearance.

8. Do you think one of the spheres will now fall faster than the other? If so, which one, and why? If not, why not?

9. Run the simulation again and check your prediction. Record your observations and comments below.

10. Use the Properties window to make the masses identical again, and give each sphere the same upward initial velocity (make V_y positive). Make sure that V_x is still zero for each sphere. Now how do you think they will behave when you run the simulation?

11. Run the simulation and check your prediction. Record your observations and comments (including any questions) here.

12. Now set V_y to +10 m/s for one sphere and zero for the other. Run the simulation step-wise and observe the measured values. You should see some patterns in the data. Write down any patterns you see, and think about why they might occur. Even simple patterns can be meaningful. Record any thoughts below, including questions you may have at this point.

13. Reset V_y to zero for each sphere, and give one of them a non-zero value for V_x. This will set that sphere up to move horizontally as it begins to fall, as would a rolling ball just as it leaves the edge of a horizontal table top. The other sphere will fall from the same height from rest, as would a second ball that is simply dropped from next to the edge of the same horizontal table top. The simulation you have set up will show what those two motions would look like if they occurred simultaneously. Run the simulation and observe the motion of the two spheres. Then re-run it using the step tool, or stop it once in a while (pick Stop, Run, Stop, Run, Stop, etc.), and compare the measured values. What patterns do you observe? Do you find this surprising? Record your comments below, including questions.

14. What do you think will happen if both spheres are given a horizontal initial velocity? What physical scenario would that simulate? Does it matter whether they have the same speed? Does it matter whether they have the same direction? Try it and see. Remember that V_y must be zero here. Record your values, predictions, and observations below. Use enough trials to draw valid conclusions.

15. What do you think will happen if both spheres are given a vertical initial velocity? What physical scenario would that simulate? Does it matter whether they have the same speed? Does it matter whether they have the same direction? Try it and see. Remember that V_x must be zero here. Record your values, predictions, and observations below. Use enough trials to draw valid conclusions.

16. Finally, you are free to give each sphere any values you wish for its horizontal and vertical components of initial velocity, while keeping their initial heights the same. State as simply as you can how you could set these values to produce the same height measurements for both spheres, and how you could set them to produce different height measurements for the two spheres.