In Class Activity Plan

Week Two: Practice Constant Motion & Introduce Motion Maps, Develop Constant Acceleration Model

30 min **Constant Motion Activity (**[**Word**](constant_motion_activity.docx)**,** [**Pdf**](constant_motion_activity.pdf)**)**

PURPOSE: Introduce Motion Maps; practice with representations

*Goals for the students to focus on:*

* *Coordination of representations (Consistency between the p-t graph, the v-t graph, and the frame of reference)*
* *Application of constant velocity model rules (see the instructor guide from Week 1)*
* *Introduce Motion Maps (if not done previously)*
  + *See Motion Maps.doc for more information (you can hand this out to students after the discussion if you like)*
  + *Points (dots) represent position at a time*
  + *Arrows represent velocity (speed and direction)*

***Seed:***

* *On #2 point out that you don’t know the initial position from a v-t graph. Get two groups to put different initial positions.*

10 min **Whiteboard – Constant Motion Activity**

*Note: Assign individual groups to whiteboard their models for specific problems. Have two groups present that have different answers for #1 and two more groups #2.*

20min **Board Meeting**

PURPOSE: Share problem solutions, provide feedback on solutions.

* *Emphasize internal consistency within problem solution* *- This means both the instructor and students should look for the model for each group is consistent. Note that all groups doing a particular problem do not need to have identical solutions, they may vary by choice of reference frame, so it depends on how each group has chosen to model the situation.*

120 min **Investigating Constant Acceleration Lab (**[**Word**](investigation_constant_acceleration_lab.docx)**,** [**Pdf**](investigation_constant_acceleration_lab.pdf)**)**

PURPOSE: Extend graphs and motion maps to now include constant accelerated motion.

Video Examples: ([Group1](../../video/week2_2a_1.html), [Group2](../../video/week2_2a_2.html))

*Logistic Notes:*

* *Need to add acceleration graph to Logger Pro*
* *Hurry students through page 1 & 2, don’t let them spend too much time here*
* *If the lab is too long for a single day, you may want to do a whiteboard discussion after page 8*
* *If graphs are too noisy, the instructor can do some examples with fan carts to get the point across*

***Seed****:*

* Is it ok to throw out the noise in the data?
* Is acceleration actually constant?
* How are position graphs in trials 1-4 different (concavity)?
* Previously, the slope of the position vs. time graph gave the velocity, is this still true?
  + - * *Consider: How do we now modify this statement “The slope of the position vs. time graph equals the velocity”? (Answer: We have to insert “at any point”)*
* Are any of the trials 1-4 similar with respect to velocity graphs?
* Can velocity be negative?
* Can acceleration be negative?
* Can you have a negative acceleration, but be speeding up?
* Table of (1) Direction of Motion (2) Direction of acceleration and (3) Speeding up/Slowing down

15 min **Whiteboard – Investigating Constant Acceleration Lab**

PURPOSE: Summarize results from constant acceleration investigation.

Video Examples: ([Whiteboarding](../../video/week2_2b_1.html))

* What did you learn?
  + *Note: “Learning” does not require evidence. Possible examples of learning statements:*
    - *Definitions*
    - *Using the equipment*
    - *Experimental technique (e.g. minimizing the error)*
* What rules can you make (and what evidence do you have to support those rules)?
  + *Note: If you look ahead to the discussion section, as the instructor you’ll want to make sure all of those rules appear on various whiteboards*
* What questions do you still have?

45 min **Board Meeting**

PURPOSE: Establish consensus on defined terms, and rules for interpreting graphs and motion maps with constant acceleration.

Video Examples: ([Discussion1](../../video/week2_2d_1.html), [Discussion2](../../video/week2_2d_2.html))

*Note: Today is a day that you will be in the center of the circle many times (thus, you may not want to wear a short skirt this day)*

Terms to define:

* Acceleration must include:
  + Motion maps have changing lengths of arrows
  + Velocity-time graphs are straight lines, not necessarily horizontal
* Get rid of deceleration
  + *Here you might ask what deceleration means, and you get multiple answers such as slowing down and negative acceleration, and then you point out this is not a helpful term*

Rules – constant acceleration model

* When constant acceleration, constant v rules don’t apply
  + Which rules still apply?
    - Slope of position tells us velocity (*Note: derivative = slope of the tangent line)*
    - Area under the curve of velocity tells us the change in position
* Acceleration is the slope of velocity-time graph
  + Direction
  + a = ∆v/∆t
* Area under the curve of acceleration graph tells us change in velocity
  + ∆v = a∆t
* In the Motion Maps the change in length of velocity vector is proportional to the acceleration
* Chart of relation between direction of velocity, direction of acceleration, and speeding up/slowing down

60 min **Accelerated Motion In-Class Activity (**[**Word**](accelerated_motion_in-class_activity.docx)**,** [**Pdf**](accelerated_motion_in-class_activity.pdf)**)**

PURPOSE: See relationships between representations and apply rules of constant acceleration model

*Note: Finish for homework*. *This is getting turned in for a grade.*

*Goals:*

* Coordination of representations (Consistency between the p-t graph, the v-t graph, the a-t graph, motion map, and frame of reference)
* Application of constant acceleration model rules