Lesson Plan Template

Grade: 11+12	**Subject: Physics: Atwood's Machine**
Materials: Computer, Vernier Photogate w/ pulley attachment, Vernier interface, mass set, logger pro, string	**Technology Needed: Computer, photogate, logger pro**
Instructional Strategies: ☐ Direct instruction ☐ Guided practice ☐ Socratic Seminar ☐ Learning Centers ☐ Lecture ☐ Technology integration ☐ Other (list) ☐ Peer teaching/collaboration/ cooperative learning ☐ Visuals/Graphic organizers ☐ PBL ☐ Discussion/Debate ☐ Modeling	**Guided Practices and Concrete Application:** ☐ Large group activity ☐ Independent activity ☐ Pairing/collaboration ☐ Simulations/Scenarios ☐ Other (list) Explain: ☐ Hands-on ☐ Technology integration ☐ Imitation/Repeat/Mimic
Standard(s) **HS-PS2-1: Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.** **Objective(s)** **Students can use a photogate to study the acceleration of an Atwood's machine.** **Students can identify relationships between mass and acceleration by analyzing collected data.** **Bloom's Taxonomy Cognitive Level: Analysis**	**Differentiation** **Below Proficiency: Students will be working with their regular lab groups so students that are below proficiency will get support from their lab partners. Students will be expected to get at least their data during this lesson, and a review of the concepts will follow.** **Above Proficiency: Students that are above proficiency will be encouraged to use the class time to complete the entire lab handout and continue working on the Atwood's Machine worksheet they received previously. These students will also be asked questions on how the lab results correspond with the concepts and calculation on the worksheet.** **Approaching/Emerging Proficiency: These students will be encouraged to complete as much of the lab handout as possible and will be asked questions regarding the Atwood's machine concepts they have been exploring in previous assignments.** **Modalities/Learning Preferences: Visual, physical, interpersonal, logical**
Classroom Management- (grouping(s), movement/transitions, etc.) Students will begin class with a brief introduction in their desks and then transition into their lab groups.	**Behavior Expectations- (systems, strategies, procedures specific to the lesson, rules and expectations, etc.) Students will be expected to collaborate with their lab partners to complete the lab acticity and handout.**

Minutes	Procedures
10	**Set-up/Prep: Collect materials and set in them in a location lab groups can access easily.**
5	**Engage: (opening activity/ anticipatory Set – access prior learning / stimulate interest /generate questions, etc.) Brief discussion regarding the homework problems with Atwood's machines. Students will be asked about how Newton's second applies to the acceleration of the system. Students will discuss what they would expect to see when either the net force or total mass increase within the system.**
5	**Explain: (concepts, procedures, vocabulary, etc.) Directions and modifications to the lab will be explained to the students.**
30	**Explore: (independent, concreate practice/application with relevant learning task -connections from content to real-life experiences, reflective questions- probing or clarifying questions) The students will set up simple Atwood's machines and will record the acceleration of the weights using photogates and logger pro on their computers. The students will change weight distributions as directed to explore how net force and total mass affect the acceleration of a system. Students will collect data and collaborate on reflection questions.**

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-	**Review (wrap up and transition to next activity): Lab groups will have time to ask questions and complete the lab handout. If the lab is completed, students will continue to work on Atwood's Machine Worksheet that contains calculations of different Atwood's machine scenarios. Students will discus the correlations of their calculations and results they say from the lab.**

Formative Assessment: (linked to objectives) Progress monitoring throughout lesson- clarifying questions, check-in strategies, etc. I will be able to check in on each of the lab groups throughout the lab. I assess student understanding through probing questions and joining in on their conversations. **Consideration for Back-up Plan: If the photogates and/ or computers didn't work, the lab's concepts would still be learned by giving the students theoretical data sets that they could discuss and do calculations to see how net force and total mass affect the acceleration of the system.**	**Summative Assessment (linked back to objectives)** **End of lesson: Students will complete one lab handout for each lab group including reflection questions and extensions to the lab. These will then be turned in and assessed.** **If applicable- overall unit, chapter, concept, etc.:**

Reflection (What went well? What did the students learn? How do you know? What changes would you make?) Most students went into the lab knowing that an increase of net force would result in an increase of system acceleration, but there were a lot of questions on why increasing total mass decreases acceleration (at constant net force). I discussed these with the individual lab groups and then they worked on the mathematical calculations corresponding with this scenario. For next time, I would take time to go through an example of Atwood's calculations step by step the day before. This would help students be more confident with their own calculations during the lab when they get results they may not have expected.