Katherine Aho
NSF GK-12 Vibes and Waves in Action
Honors and CP Physics
Lesson 4: Newton's Second Law R Simulation

Summary of the Lesson

In this lesson, an R simulation was created to demonstrate Newton's Second Law to show the relationship between force, mass, and acceleration. Various bar graph were plotted so that students could clearly see what happens if the mass were cut in half or if the force was cut in half and how that changed the acceleration. Students learned the difference between directly related and inversely related.

Honors and CP Physics Lesson Plan

Text: Conceptual Physics, Paul G. Hewitt
Chapter: Ch 6, Newton's Second Law of Motion
Objectives: Understand how force, mass, and acceleration are related?
Essential Question: How does changing the force or mass affect the acceleration?
Frameworks: Motion and forces- 1.4; SIS1, SIS2, SIS3, SIS4

L-Side Activities: Teacher	R-Side Notes: Students
At the Bell: Identify examples of things that are directly related. Identify examples of things that are inversely related. **Agenda:** 1. Discuss the difference between direct and indirect relationships 2. Explain details of the R code 3. Ask the students to determine what type of relationship is force-acceleration 4. Ask the students to determine what type of relationship is force-mass **Working It Out:** 1. How are force and acceleration related? 2. How are force and mass related? **Class Activity:** Vary the input parameters (i.e. Double the force, double the mass) and observe change in acceleration **Homework:** None	I. Force is directly related to acceleration II. Mass is inversely related to acceleration

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# KATHERINE AHO
# NSF GK-12 FELLOWSHIP VIBES AND WAVES IN ACTION

# NEWTON'S SECOND LAW: F=ma
# DEMOSTRATE RELATIONSHIP BETWEEN FORCE, MASS, AND ACCELERATION
#################################################################


# FIXED FORCE, HALF MASS
m1 <- c(10,5)  # grams
F1 <- 15  # Newtons
a1 <- F1/m1   # m/s

# Grouped Bar Plot
par(mfrow=c(1,2))
height <- rbind(a1[1],a1[2])
barplot(height, main="Mass and Acceleration",
      xlab="Mass Values (g)", ylab="Acceleration (m/s)", col=c("darkblue","red"), beside=TRUE)

#################################################################

# FIXED MASS, HALF FORCE
m2 <- 10   # grams
F2 <- c(10,5)    # Newtons
a2 <- F2/m2   # m/s

# Grouped Bar Plot
height <- rbind(a2[1],a2[2])
barplot(height, main="Force and Acceleration",
      xlab="Forces (N)", ylab="Acceleration (m/s)", col=c("darkblue","red"), beside=TRUE)
```