

Physics

essential understanding: Vectors are mathematical objects that can represent forces, velocity and acceleration: these objects can be summed together. There are 3 types of velocities: constant, average & instantaneous; acceleration is a result of changing the velocity of a moving object.

"To be ignorant of motion is to be ignorant of Nature." - Aristotle

"Measure what is measurable, and make measurable what is not." - Galileo

overview: This unit will introduce the subject of forces and motion. It will describe the different types of motion and forces, define them mathematically, and seek to find a universal relationship between forces and the motion of objects in Nature

guiding question: What is motion? What are the different types of motion and forces in Nature? How might one define these different types and make them measurable.

lessons:

1. General lesson on motion: reference frame, speed, velocity, acceleration, graphs
2. Vectors, vector components, and vector additions
3. The different forces in Nature
4. The 4 kinematic equations, part I
5. The 4 kinematic equations, part II

group work:

I. In groups, research one of Aristotle's theories of motion. Make a multi-media presentation of your findings. Describe the law in greater detail: to what objects does it pertain? What type of motion does it address? What is a more ample description of everything the law contains? What are the strengths & weaknesses of the law? Could you set-up an experiment to disprove it? What corrections would you make to it

*objects fall at a constant rate that depends on their size.

*objects in the heavens move in circular motion without any external force compelling them to do so.

*pushing or pulling an object produces unnatural motion; if cause (push/pull) is removed, object returns to natural state and stops moving.

* objects in the heavens move in circular motion without any external force compelling them to do so.

* there is no limit to the speed that an object moves through a vacuum. $F = r \times v$, where F is a force, r is the resistance of the medium, & v is the velocity describes how force affects motion: no force, no motion.

* all bodies move towards their natural state of rest.

2. Addendum to research project: Improve on Aristotle's work; with partner, come up with 3 - 6 laws of motion that encompasses all motion in the Universe (or as much as you can explain). Present your laws to class - lend them your name.

You will consider:

* Why do objects start moving, and why do objects slow down and stop?

* What relationship exists between an object's motion & the force applied to it?

* What would happen to an object's motion in a world without forces.

* Why do you move backwards when you push forward against a wall?

* If the Earth is spinning, why don't people fly off, and why do objects dropped from tall towers land at the base of the (spinning) tower?

* Why do falling objects drop at the same rate (in a vacuum)?

*Why does the Moon travel around the Earth in a (roughly) circular orbit? Why doesn't it fall like an apple?

3. Class activities on motion and forces (groups of 3 - 4)

- **Activity 1: measuring and graphing objects at constant speed & changing speed.**
- **Activity 2: vector addition and forces**

individual work:

1. a) Name that motion interactive from "the physics classroom": 1-D kinematics interactive [www.physics.classroom](http://www.physicsclassroom.com).
b) Problem set #1 on velocity and acceleration: use your class notes to solve.
2. Problem set #2 involving vectors, & vector additions in 1-D and 2-D: use your class notes and www.physicsclassroom.com (vectors-motion & forces in 1-D & 2-D)
3. Problem set #3 involving vector addition of various forces: use the class notes
4. Problem set #4 involving kinematic equations (part I): use your class notes (kinematic equations part I, & www.physicsclassroom.com (tutorial 1-D kinematics) to solve.
5. Problem set #5 involving kinematic equations (part II): use your class notes (kinematic equations part II, www.physicsclassroom.com (tutorial 1-D kinematics) & the activites to solve.

Extension: graphing kinematic equations

Assessment: unit 1 Quiz

Readings: ‘Conceptual physics’: Ch 2

Links: kinematics: www.thephysicsclassroom.com

Aristotle: www.kaiserscience.wordpress.com/2016/10/21/aristotles.laws.of.motion/

more Aristotle: https://en.wikipedia.org/wiki/Aristotelian_physics