Force and Motion in AKC Agility

This lesson works best as a continuation of students' exploration of forces and motion.

Learning Objectives:

Students will plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

Students will predict the effect of a given force or change in mass on the motion of an object.

Grades 3-5 Next Generation Science Standards:

PS2.A: Forces and Motion

Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum zero can cause changes in the object's speed or direction of motion.

Materials:

- Computer with internet access
- Vocabulary cards for review game (included)
- Wide craft sticks (enough for each student to have one)
- Clay (can be air hardening or not), enough for each student to have about ¼ cup
- Student Question Sheet (included)

Vocabulary:

- Force: energy applied to move an object
- Motion: an act of an object changing its location
- Inertia: an object in motion stays in motion. An object at rest stays at rest.Inertia is related to mass.
- Fulcrum: the support or point of rest on which a lever turns
- Balanced forces: equal and opposite forces
- Unbalanced forces: forces that cause a change in motion of an object

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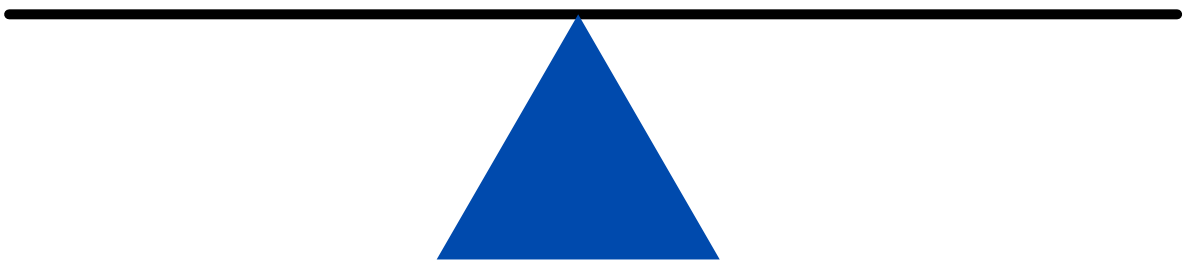
Lesson:

Introduction

- Review the vocabulary terms above.
  - A fun way to review vocabulary is to play a version of the game Headbandz. Students play with a partner or in small groups. Before starting the game, print and cut vocabulary cards, making sure there are enough for each small group or partner pair. When it is their turn, students select a card without seeing what their word is. They hold the card up on their forehead so their teammate(s) can see it. Teammate(s) give clues to the student about the word, without using the word itself, or parts of the vocabulary word, or words that rhyme with the target word. Clues must be related to the target word's definition.
  - After a couple rounds of the game, as students to tell you what they remember about what they've already learned about force and motion.

- Show students a picture of a perfectly balanced seesaw. Ask students to name the parts of the picture and tell what forces are working on the balanced seesaw. (*The seesaw is a lever with a fulcrum, and gravity is pulling equally on both sides of the lever because the fulcrum is in the middle. Inertia means that the seesaw will not move unless another force works on it, like a person sitting on one of the sides.*)
  - Example image:



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Lesson:

Explicit Instruction and Guided Practice

- Ask students if they've ever seen a dog go through an Agility Course.
- If any students have, ask them to describe the obstacles the dogs go through.
  - Let students know that dogs who complete an AKC Agility Course learn to climb onto a seesaw and then make it tilt, touch the ground on the other side, and climb off the other end. This can be scary for most dogs, so it takes a lot of practice and rewarding from their trainer to be able to complete this obstacle.
  - Any size dog can compete in AKC Agility, as well as any breed, including All American dogs.
  - Ask students to predict what will happen when three different sized dogs complete the seesaw portion of an Agility Course.
  - Discuss student predictions.
  - Students watch the videos of three different sized dogs completing an Agility Course:
    - Video of a Papillon completing Agility course. *Note how the seesaw moves.
    - Video of an Australian Shepherd completing Agility course
    - Video of a Mastiff completing Agility course. Note when the seesaw tilts.

Independent Work Time

- After watching the three videos, students complete the student question sheet.

Hands on investigations

- Students create a seesaw using craft sticks and wedges made of clay. Students try to balance the seesaw, and then add weights (or counting bears or pennies) to try to unbalance and rebalance the seesaw. Replicate the three different sized dogs by using different weights (i.e. different numbers of pennies, or different sized counting bears/manipulatives).

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Lesson:

Hands on investigations

- Students can also explore what happens when you move the fulcrum. Challenge students to try to balance two different sized manipulatives (or 3 pennies on one side, 1 penny on the other) by moving the fulcrum.
- A fun, interactive model for a seesaw with two different sized people using it. Using this model, students can move the large person, the small person, and the fulcrum, to find out how they interact.
    - Make sure students select "Off" for the bullet point "Turn the Physics on or off." Turning the physics on provides a description of the torque applied by the larger and smaller person. This is more appropriate for older students.

Review and Closing

- Discuss student responses to the question sheet, and questions/observations that arise from the hands on investigations.
- Some students may be ready to try to theorize rules about how far a person or object needs to be from the fulcrum in order to balance a different sized object on the other side of the seesaw

FORCE AND MOTION VOCABULARY CARDS

FORCE	MOTION

INERTIA	FULCRUM

FORCE AND MOTION VOCABULARY CARDS

BALANCED FORCES	UNBALANCED FORCES

Name: _____

FORCE AND MOTION IN AKC AGILITY

1. If the seesaw is perfectly balanced, are any forces working? If so, what are they?	2. How can a Papillon, an Australian Shepherd, and a Mastiff all make the same seesaw tilt?
3. What differences did you notice in the way the three different sized dogs made the seesaw tilt?	4. How far from the fulcrum do the Mastiff, the Australian Shepherd, and the Papillon need to be to tilt the seesaw? (You don't need to give exact measurable distances, just a description of their relative distance.)

5. Why does the Papillon need to be farther from the fulcrum than the other two dogs in order to tilt the seesaw?

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