

SUBJECT: ***DRAWBRIDGES, SOUND, MOTION, & ENERGY***

GRADE LEVEL: ***Kindergarten – 3rd Grade***

OBJECTIVES/GOALS:

Explore sound the various ways it is made and how it relates into motion and energy in *Drawbridges Open and Close*.

LESSON & BACKGROUND (20-25 minutes):

Movement requires the expenditure of energy and sound throughout *Drawbridges Open and Close* through the movement of the bridge and its components, the vehicles, and animals all make a variety of sounds and noises to communicate movement and energy.

Opening a drawbridge is an event involving all kinds of signals, sounds, and noises surrounding a seemingly simple event, which reveals the use of energy and motion.

- The approach of a barge by a working tugboat (*chug-chug-chug* -- sound of a marine engine) begins the sequence.
- The tugboat horn (*toot TOOT* -- sound of the air, steam, or electric horn) and call (*CRACKLE*) on the radio request the drawbridge open.
- Todd the bridge tender begins the steps of opening the bridge with the warning (*clang-clang, flash-flash* – electric powered) bells and lights.
- This is later followed by the unlocking of the bridge (*scrape* of metal and hum of electric motors).
- Opening or closing the bridge activates the motors that hum to turn the gears that groan as electricity powers the motors to operate the drawbridge.
- Many boats pass through the open bridge, including the swooshing (wind powered) sailboat, smoking steam boat (fuel burning steam power and use of a boiler to turn water into steam), talking tour boat, and funky fishing boat (gas, diesel, or electric powered).
- Expressing impatience Terry Turtle uses the (*Honk, HONK* of the electric powered) horn of his sports car.
- Closing the bridge the sequence is reversed to restore the street traffic using the electricity to power the motors and gears.
- Each different vehicle crossing the bridge or watercraft moving along the waterway would make its own unique sounds reflecting the power and energy expended.

While reading aloud *Drawbridges Open and Close* see if students can identify the power or energy source making the noise or identify sounds they imagine would be made throughout the book that are not explicitly called out. Such as:

- The paddling and splash of kayaks (manual labor).
- The click of switches (electro-mechanical).

[PTM Werks Series](http://www.PTMWerks.com) introduces students to how things work with *Drawbridges Open and Close*, *Airplanes Take Off and Land*, and *City Railways Go Above and Below*. These books help to introduce basic science, technology, engineering, art, and math and are ideal for lunching further exploration of STEAM topics. For more see: www.PTMWerks.com

- The chirp of birds (abdominal muscles contract the lungs as breath through vocal cords create sounds).
- The screech of brakes and skidding of tires against pavement (friction).
- Tick of a clock (mechanical, battery, or electric power).
- Waves lapping at the shore (effect of wind on the water or wake from the boats).
- Scratch of claws (cat power).
- Whir of bicycles (animal power).

QUESTIONS TO PROMPT DISCUSSION & FURTHER EXPLORATION:

- How did you get to school today, what sounds were made, and what was the energy source?
- When moving faster or slower did the sound change?
- Which is usually louder, something moving faster or slower?
- Does your distance away from something make a difference?
- What happens when you are working hard? What kind of noises do you make?
- Heart pumping and breathing hard, what kind energy is used and where does it come from?
- What is the best way to not make any noise?
- Does sitting still use much energy? Why not?

HANDS-ON ACTIVITY (25-30 minutes):

Activity: Ask students sit and listen for sounds. Make a list of all the sounds and then identify the energy source and type of motion the sound indicates. This makes for a good homework assignment too.

LINKS & ADDITIONAL MATERIALS:

Doppler effect:

- Visual explanation of the Doppler effect
<https://www.youtube.com/watch?v=h4OnBYrbCjY>
- Family in a car demonstrating the Doppler effect
https://www.youtube.com/watch?v=Djz_rtnXSfY
- Demonstration of Doppler effect and communicating with spaceships
http://www.esa.int/spaceinvideos/Videos/2014/07/Doppler_effect_-_classroom_demonstration_video_VP05

Energy

- Six types of energy <https://www.youtube.com/watch?v=Xnn9NMNEMZA>

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