### Understanding Structures and Mechanisms

#### Simple Machine: Wheel and axles

#### Specific Expectations

**Grade 2 – Movement:**
1.1 assess the impact on society and the environment of simple machines that allow movement; 2.2 investigate and describe different kinds of movement; 2.3 investigate the structure and function of simple machines; 2.4 use technological problem-solving skills (see page 16), and knowledge and skills acquired from previous investigations, to design, build, and test a mechanism that includes one or more simple machines; 3.1 describe different ways in which objects move (*e.g.*, turning, spinning, swinging, bouncing, vibrating, rolling); 3.2 identify ways in which the position of an object can be changed (*e.g.*, by pushing, by pulling, by dropping); 3.3 identify the six basic types of simple machines – lever; inclined plane; pulley; wheel and axle, including gear; screw; and wedge – and give examples of ways in which each is used in daily life to make tasks easier; 3.4 describe how each type of simple machine allows humans to move objects with less force than otherwise would be needed; 3.5 identify simple machines used in devices that move people

**Grade 3 – Strong and Stable Structures:**
2.3 investigate, through experimentation, the effects of pushing, pulling, and other forces on the shape and stability of simple structures; 3.1 define a structure as a supporting framework, with a definite size, shape, and purpose, that holds a load

**Potential Specific Expectations with minor extensions to the lesson:**

**Grade 5 – Forces Acting on Structures and Mechanisms:**
2.2 measure and compare, quantitatively and/or qualitatively, the force required to move a load (*e.g.*, to lift a book, to open a drawer) using different mechanical systems (*e.g.*, different pulley systems, a lever, a gear system), and describe the relationship between the force required and the distance over which the force moves; 2.5 use appropriate science and technology vocabulary, including tension, compression, torque, system, and load, in oral and written communication; 3.3 explain the advantages and disadvantages of different types of mechanical systems

**Grade 8 – Systems in Action:**
2.2 investigate the work done in a variety of everyday activities and record the findings quantitatively; 2.3 use scientific inquiry/experimentation skills (see page 12) to investigate mechanical advantage in a variety of mechanisms and simple machines; 2.6 use appropriate science and technology vocabulary, including mechanical advantage, input, output, friction, gravity, forces, and efficiency, in oral and written communication; 3.2 Identify the purpose, inputs, and outputs of various systems; 3.3 Identify the various processes and components of a system that allow it to perform its function efficiently and safely; 3.5 understand and use the formula work = force \( \times \) distance \( (W = F \times d) \) to establish the relationship between work, force, and distance moved parallel to the force in simple systems; 3.6 calculate the mechanical advantage \( (MA = \text{force needed without a simple machine divided by force needed with a simple machine}) \) of various mechanical systems

#### Big Ideas (for lesson):

Students will understand why people create and use simple machines to make tasks easier to perform (*mechanical advantage*)

Students will learn how wheel and axles function are how they are used to move heavy objects

Students will see how wheel and axles are used effectively in everyday life

#### Accommodations:
- Increase time
- Visual Aids
- Manipulatives
- Chunking
- Step-by-Step
- Scaffolding
- Copy of Notes
- Student Grouping

#### Differentiated Instruction:
- **Content:** Use demonstrations throughout verbal instruction to help visual learners.
- **Process:** Students will work in pairs or groups to support each other if limitations or impediments exist.
- **Product:** Students may demonstrate their learning verbally, visually, or by written means.
- **Other:** ___________________________

#### Multiple Intelligence:
Bloom’s Taxonomy:
☒ Knowledge
☒ Comprehension
☒ Application
☒ Analysis
☒ Synthesis
☒ Evaluation

☒ Verbal/Linguistic
☒ Logical/Mathematical
☒ Visual/Spatial
☒ Bodily/Kinesthetic
☐ Naturalist
☐ Musical/Rhythmic
☒ Interpersonal
☒ Intrapersonal

Teachers Notes:
- This lesson is accompanied by a supplementary PowerPoint, “Wheel and Axles (powerpoint)”, and a worksheet, “Wheel and Axles (worksheet)”
- The use of simple machine kits can be found throughout the lesson – it is recommended that these manipulatives be used to increase the experience and understanding of the students
  - your school might have access to a set of wheel and axles you can use for this lesson
  - if this is not available, you can purchase simple machines sets here:
    - http://www.pitsco.com/Grades_3-5/Kits/Simple_Machines_Set
  - if this is still not an option, you can build your own simple machines
  - see below for examples:
- Extensions to the lesson should be done if it is to be used at the grade 5 or 8 levels
  - The material covered by these lessons is strongly emphasized at the Grade 2 level – the more complex concepts that arise at later grade levels can be situated within the lesson
    - i.e. calculating force and mechanical advantage can be added into the lesson
- Resources for teaching and learning about simple machines can be found here:
  - Bill Nye The Science Guy: Simple Machines
    https://www.youtube.com/watch?v=rRjCQGa_HCE
- The font used for the handout is called Dyslexie. It is designed to help dyslexics read, but it is a very easy to comprehend font which will aid all readers.
# Delivering the Lesson

<table>
<thead>
<tr>
<th>Portion &amp; Timing</th>
<th>Grouping:</th>
<th>Introduction:</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minds On: 5 minutes</td>
<td>W ☒ S ☐ I ☐</td>
<td>Teacher introduces <strong>wheel and axles</strong> to students - (ppt slides 1-3) Perform demonstration for class by moving various weights; <strong>Gizmos</strong> simulation can be used as well - Discuss the <strong>Mocomi</strong> video</td>
<td>- Wheel and axle set to provide example to students - projector technology</td>
</tr>
<tr>
<td>Action: 30 minutes</td>
<td>W ☒ S ☒ I ☒</td>
<td>Proceed through “<strong>Wheel and axles (powerpoint)</strong>” - “<strong>Wheel and axles (worksheet)</strong>” can be followed along and filled in by students - Answer questions about the simple machine as the lesson proceeds - Students should highlight/underline important vocabulary words Activity: - Separate students into groups or pairs - Allow students to build and operate different wheel and axle systems (different sizes) - Have them record their observations by drawing and labelling diagrams of all the different wheel and axles they can create - See which group can create the most efficient and effective wheel and axles (can move the most weight easily)</td>
<td>- Wheel and axle sets to allow students to explore the use and function of wheel and axles</td>
</tr>
<tr>
<td>Consolidate: 5 minutes</td>
<td>W ☒ S ☒ I ☐</td>
<td>Conclude lesson by taking up worksheet – ensure each student has filled in all the appropriate information - Answer any remaining questions on wheel and axles</td>
<td></td>
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</tbody>
</table>

References:
Mocomi; [http://mocomi.com/](http://mocomi.com/)

All images from Google image search, Educational websites, and stock photos
All videos found on YouTube for educational purposes