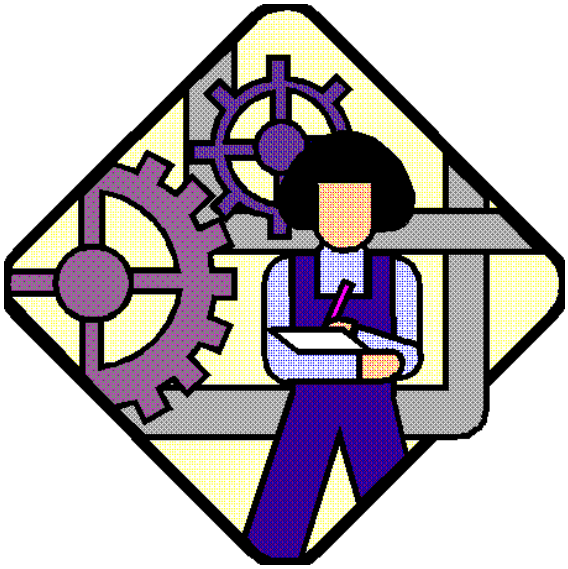
May The Force Move You

Forces Acting on Structures & Mechanisms; Motion



Including:

Explore - Simple Machines - 5 /6
Introduction to Culminating Performance Tasks - 5/6
Explore - Pulleys - 5/6
Explore - Levers - 5
Explore/Focus - Levers - 6
Explore - Strength and Stability - 5/6
Explore - Forces and Motion - 5/6
Focus - Design Process - 5/6
Focus - Forces - 5
Focus - Motion - 6
Apply - A Quick Quiz about Forces - 5
Apply - A Quick Quiz about Motion - 6
Focus - Structural Strength and Stability - 5
Focus - Changing Motion - 6
Apply - Flagpole Construction - 5/6
Apply (Culminating Performance Task) - On Your
Celebrate - Putting It All Together - 5/6

A Unit for Grade 5/6

Written by:

Ontario Teachers

Length of Unit: approximately: 16 hours

August 2000

A Unit for Grade 5/6
Written by:

Ontario Teachers
Ontario Ministry of Education, 2000

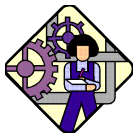
Grades 4-6 Math Implementation Resource Project
Original unit available for download at http://planner.media-x.com

Based on a unit by:

Ontario Teachers
Ontario Ministry of Education, 2000

Grades 4-6 Math Implementation Resource Project
Original unit available for download at http://planner.media-x.com

This unit was written using the Curriculum Unit Planner, developed for use in the province of Ontario by the Ministry of Education and Training. The planner provides electronic access to all provincial Curriculum Expectations, an electronic Teacher's Guide comprised of fourteen databases (including teaching/learning and assessment strategies, Special Education guide, glossary, annotated bibliography) and a database of provincially licensed software for use in schools. The Curriculum Unit Planner offers educators a choice of three writing environments (Outliner, Lite, Open) Units written using the planner can be shared and then edited electronically. This unit was printed from Version 2.0 (Sept 99), using the "Open" writing environment.



May The Force Move You
Forces Acting on Structures & Mechanisms; Motion A Unit for Grade 5/6

Task Context

Rationale

"As students continue to design and build mechanical devices and structures, they develop a more sophisticated understanding of forces. Students in Grade 5 will identify the forces acting on and within structures, and will give simple quantitative descriptions of these forces." (***The Ontario Curriculum, Grades 1-8: Science and Technology***, page 80) Students will demonstrate an understanding of the forces that act upon a structure by designing and building a bridge that will support a load.

Students in Grade 6 will learn to classify different types of motion and analyse and predict the motion of objects by understanding the forces that act upon them. Students will design and make mechanisms that "move in different ways, and will demonstrate and explain how mechanisms change one type of motion into another". (***The Ontario Curriculum, Grades 1-8: Science and Technology,*** page 82)

Task Summary

Key Learnings

Grade 5	**Grade 6**
There are many types of forces that can act upon an object: air pressure, mass, compression, tension.	Motion can be classified into four types: linear, rotational, reciprocating and oscillating.
Different forces have different effects on different structures and mechanisms.	The motion of an object, stationary or moving, can be changed by applying a force.
Mechanisms can change the amount of effort required to move an object or load.	Mechanisms change one type of motion into another and transfer one type of energy into another.
Forces acting on structures and mechanisms can be both identified and measured.	Forces acting on structures and mechanisms can be countered.
There are skills and strategies required for scientific inquiry and technological design.	There are skills and strategies required for scientific inquiry and technological design.

Culminating Task Assessment

An Uplifting Experience - Grade 5

The McPaz Amusement Park is sending out tenders for an engineering firm who can make their park more accessible to those who require a wheelchair. The park is built on two levels so as not to interfere with the natural elevation of the area. The contract will be awarded to the firm whose design can lift the greatest load with the least amount of force. Your task will be to submit a labeled diagram of your plan that will lift a measured load from one level to another. You will need to create a working scale model along with a list of materials required for its construction. You will be required to test this design and make and record modifications where necessary.

An Amusing Adventure - Grade 6

You are an engineer who has been contracted by the Ballenson Amusement Park to design a new feature attraction. Your task will be to submit a labeled diagram of this feature attraction that includes at least one change in motion, speed or direction. You will need to create a working scale model along with a list of

materials required for its construction. During the construction you will be required to test this design and make and record modifications where necessary.

Links to Prior Knowledge

Grade 5

Students should:
- understand the characteristics of pulleys
- be familiar with the design process
- be familiar with the six types of simple machines
- demonstrate an understanding of factors that affect the stability of structures

Grade 6

Students should:
- understand four of the different kinds of forces (compression, tension, gravity, air pressure)
- understand how forces affect structures and mechanisms
- identify parts of a load-bearing structure that are vulnerable to forces

Notes to Teacher

General Information

This unit has been written using the principles of 'backward design' (Identify Desired Results, Determine Acceptable Evidence, Plan Learning Experiences and Instruction) as formally described in ***Understanding by Design*** by Jay McTighe and Grant Wiggins. This unit also incorporates practical ideas from the most current learning theories and the latest 'Brain Mind Learning' research on how children learn best. For example, the Culminating Performance Task, with which the students demonstrate their learning from the unit in an authentic, integrated way, is introduced at the beginning of the unit. Another important feature is the identification of Key Learnings (the enduring understandings that students will be working to acquire during this unit). Finally, the sequence of learning experiences or subtasks is organized into an interconnected framework known as the "Learning Cycle"; in this version the subtasks are organized into a logical flow, with the phases of the cycle labeled as Explore (introduce concepts and skills, identify prior knowledge and experiences, engage the students), Focus (focus the teaching and learning on specific knowledge, skills, and attitudes), Apply (demonstrate their learning by applying their knowledge, skills, and attitudes), and Celebrate (share their learning in creative ways, have fun with their learning).

Learning Centres

Learning Centres are a way to cope with fewer materials. Only enough materials for one group are needed, and groups of students rotate to each centre.

Learning Centres do require table space. Clearly indicate where each centre is to be performed and group a minimum of four desks together to provide a working space if tables are not available.

Learning Centres do work best if students are independent. Students are required to keep track of results of centres and, as they are not doing the same investigation as the other groups, they must remain focused on their own task.

Learning Centres do require preparation time by the teacher. However, once they are set up you only need to replenish used materials. (e.g., balloons) It may take awhile to feel comfortable with students doing different things at the same time.

Learning Centres sometimes work better when you have a tracking sheet for each student. That way, when finished a centre, students check off which one was completed, and the teacher can easily see who has fallen behind. The teacher may also want to create a Learning Centre Wheel that indicates the order in which students will perform each centre.

Learning Centres can be fun, but only do what you are comfortable with--you do have a combined grade after all.

Assessment and Evaluation

Although Assessment is used in this Curriculum Unit Planner to represent both Assessment and Evaluation, it is critically important to distinguish between the two. Assessment is the "formal or informal gathering of information about the progress or achievement of a student or group of students, using a variety of tools and techniques. There is no judgement inherent in assessment. It is the act of describing student performance for the purpose of enhancing learning." Evaluation is "the process of judging the quality of student achievement against provincial standards." (***GUIDELINES FOR ASSESSMENT AND EVALUATION OF STUDENT ACHIEVEMENT - Principles and Standards for Effective Practice***, Halton District School Board). In this unit, when an expectation is marked as 'Assessed', we are using that to mean 'Evaluated'. Consequently, various strategies will be identified in the Assessment section of the Subtask with which to assess the expectations identified, but it will only be the check marked expectations that will be evaluated.
There are three forms of assessment and evaluation included: diagnostic (used to determine current knowledge and skills of individual or groups of students prior to beginning instruction; addressed in the " Links to Prior Knowledge" and the Explore Subtasks), formative (assessment and/or evaluation that is ongoing throughout the unit, provides students with helpful and motivating feedback, and enables teachers to track student progress), and summative (evaluation involving making judgements about student progress and achievement at the end of the unit in relation to provincial learning expectations and achievement levels).

Although both overall and specific expectations are addressed in this unit, only overall expectations are evaluated. Each of the specific expectations are subsumed under the overall expectations.

Assessment Checklists

Throughout the unit reference will be made to a checklist under **"Assessment Recording Devices".** It is recommended that the teacher use an established class list with the following suggested headings:

Subtask 1: Simple Machines
Subtask 3: Journal Entry--Pulleys
Subtask 4: Journal Entry--Levers
Subtask 5: Journal Entry--Stable Shapes
Subtask 6: Neighborhood Walk

Subtask Numbering

The subtasks in this unit have been designed so that both grades are working on the same task, or one grade is working independently while the teacher works with the other grade.
The subtasks are numbered sequentially but also to represent the grade level (as indicated by the second number); if there is only one number in the subtask, then the subtask is intended for both grades.

The Importance of Safety

"Teachers are responsible for ensuring the safety of students during classroom activities and also for encouraging and motivating students to assume responsibility for safety". "To carry out their responsibilities with regard to safety, it is important that teachers and students have the knowledge necessary to use the materials, tools, and procedures involved in science and technology ***(The Ontario Curriculum, Grades 1-8: Science and Technology, page 8).***
The safe use of tools and materials needs to be strongly emphasized with students. They must be supervised using saws, safety snips, drills, or glue guns. Teachers need to model safe use of these items

before student use. To ensure their own safety and that of others, safety precautions must always be taken (e.g., students need to check that fixed pulleys in pulley systems are secure before testing them). Routines and rules, such as "No Enter" zones around workbenches, using tools safely, and using safety goggles when cutting, drilling, or nailing, need to be strictly enforced.

Adaptations/Accommodations

In order to meet the needs of all students, teachers may need to make changes to the learning experiences and assessment and evaluation strategies. These changes should respond to considerations related to gender, learning style, and accommodations and/or modifications required for students with special needs, including ESL/ELD. Individual accommodations and modifications must reflect program modifications and accommodations as outlined in the Individual Education Plan (IEP).

May The Force Move You

Forces Acting on Structures & Mechanisms; Motion A Unit for Grade 5/6

1 Explore - Simple Machines - 5 /6

Students will explore a variety of everyday simple machines. Students will sort and record simple machines.

2 Introduction to Culminating Performance Tasks - 5/6

An Uplifting Experience - Grade 5

The McPaz Amusement Park is sending out tenders for an engineering firm who can make their park more accessible to those who require a wheelchair. The park is built on two levels so as not to interfere with the natural elevation of the area. The contract will be awarded to the firm whose design can lift the greatest load with the least amount of force. Your task will be to submit a labeled diagram of your plan that will lift a measured load from one level to another. You will need to create a working scale model along with a list of materials required for its construction. You will be required to test this design and make and record modifications where necessary.

An Amusing Adventure - Grade 6

You are an engineer who has been contracted by the Ballenson Amusement Park to design a new feature attraction. Your task will be to submit a labeled diagram of this feature attraction that includes at least one change in motion, speed or direction. You will need to create a working scale model along with a list of materials required for its construction. During the construction you will be required to test this design and make and record modifications where necessary.

3 Explore - Pulleys - 5/6

Key Learning: Mechanisms can change the amount of effort required to move an object or load.

Working together in cross-grade groups, students will use given equipment to demonstrate their knowledge of the characteristics and uses of pulleys. Students will record individually their observations in diagrams and words, pertaining to the effort required to lift a container in various situations. Students will be taught/reminded how to use a spring scale.

4.5 Explore - Levers - 5

Key Learnings: Mechanisms can change the amount of effort required to move an object or load.

Students will explore the effects of moving the fulcrum of a first class lever by measuring the force required to lift a load using a spring scale.

4.6 Explore/Focus - Levers - 6

Key Learning: The motion of an object, stationary or moving, can be changed by applying a force.

Grade 6 students will explore the force required to lift a load using the three classes of levers. They will then determine the purpose of each type of lever and describe everyday examples of each type of lever.

May The Force Move You

Forces Acting on Structures & Mechanisms; Motion A Unit for Grade 5/6

5 Explore - Strength and Stability - 5/6

Key Learnings: Grade 5- Different forces have different effects on different structures and mechanisms

Grade 6- The motion of an object, stationary or moving, can be changed by applying a force.

Working in cross-grade groups, students review and explore the strength and stability of different structural designs by applying a variety of forces.

6 Explore - Forces and Motion - 5/6

Key Learnings: Grade 5- There are many types of forces that can act upon an object: air pressure, mass, compression, tension.

Grade 6- Motion can be classified into four types: linear, rotational, reciprocating and oscillating.

Students will be observing, exploring and recording the types of forces (Grade 5) or motion (Grade 6) through teacher demonstration, discussion and a community walk.

7 Focus - Design Process - 5/6

Key Learnings: Grades 5 and 6- There are skills and strategies required for scientific inquiry and technological design.

With teacher guidance in a whole class discussion, students will review the Design Process and make connections to the Culminating Performance Task.

8.5 Focus - Forces - 5

Key Learnings:
There are many types of forces that can act upon an object: air pressure, mass, compression, tension.
Different forces have different effects on different structures and mechanisms.
Mechanisms can change the amount of effort required to move an object or load.
Forces acting on structures and mechanisms can be both identified and measured.

Through a series of hands on activities, students will discover how the forces of tension, compression, gravity and air pressure affect structures and mechanisms. (See Teacher Resource blackline master for information on Learning Centres - this is also in the Unit Notes in Unit Overview)

8.6 Focus - Motion - 6

Key Learnings:
Motion can be classified into four types: linear, rotational, reciprocating and oscillating.
The motion of an object, stationary or moving, can be changed by applying a force.
Mechanisms change one type of motion into another and transfer one type of energy into another.
Forces acting on structures and mechanisms can be countered.

Through a series of hands on activities students will discover the four types of motion and learn how each may be controlled or changed.

May The Force Move You

Forces Acting on Structures & Mechanisms; Motion **A Unit for Grade 5/6**

9.5 Apply - A Quick Quiz about Forces - 5

Key Learnings:
There are many types of forces that can act upon an object: air pressure, mass, compression, tension.
Different forces have different effects on different structures and mechanisms.
Mechanisms can change the amount of effort required to move an object or load.
Forces acting on structures and mechanisms can be both identified and measured.

Grade 5 students complete a T-Chart that includes the types of forces studied and an example of everyday situations where these forces are in action.

9.6 Apply - A Quick Quiz about Motion - 6

Key Learnings:
Motion can be classified into four types: linear, rotational, reciprocating and oscillating.
The motion of an object, stationary or moving, can be changed by applying a force.
Mechanisms change one type of motion into another and transfer one type of energy into another.
Forces acting on structures and mechanisms can be countered.

Grade 6 students complete a cross-classification chart that includes the types of motion, a description of each type of motion, and real life examples of objects that demonstrate each type of motion.

10.5 Focus - Structural Strength and Stability - 5

Key Learnings:
There are many types of forces that can act upon an object: air pressure, mass, compression, tension.
Different forces have different effects on different structures and mechanisms.
Mechanisms can change the amount of effort required to move an object or load.
Forces acting on structures and mechanisms can be both identified and measured.

Students will perform a variety of investigations dealing with strength and stability in structures. They will be working in grade specific groups.

10.6 Focus - Changing Motion - 6

Key Learnings:
Motion can be classified into four types: linear, rotational, reciprocating and oscillating.
The motion of an object, stationary or moving, can be changed by applying a force.
Mechanisms change one type of motion into another and transfer one type of energy into another.
Forces acting on structures and mechanisms can be countered.

Students will investigate how the direction, speed or type of motion can be changed. These may be set up as centres, or each group may do the same activity at the same time.

May The Force Move You

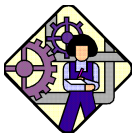
Forces Acting on Structures & Mechanisms; Motion **A Unit for Grade 5/6**

11 Apply - Flagpole Construction - 5/6

Key Learnings

Grade 5	Grade 6
There are many types of forces that can act upon an object: air pressure, mass, compression, tension.	Motion can be classified into four types: linear, rotational, reciprocating and oscillating.
Different forces have different effects on different structures and mechanisms.	The motion of an object, stationary or moving, can be changed by applying a force.
Mechanisms can change the amount of effort required to move an object or load.	Mechanisms change one type of motion into another and transfer one type of energy into another.
Forces acting on structures and mechanisms can be both identified and measured.	Forces acting on structures and mechanisms can be countered.
There are skills and strategies required for scientific inquiry and technological design.	There are skills and strategies required for scientific inquiry and technological design.

Working in cross-grade groups students will construct a flagpole that rests on a load bearing structure. Grade 5 students will be responsible for constructing the load bearing structure and insuring that it is stable and strong enough to support the working flagpole. Grade 6 students will be responsible for insuring that the completed model will change rotational motion into linear motion and raise the flag.



12 Apply (Culminating Performance Task) - On Your Mark, Get Set, GO! - 5/6

Key Learnings

Grade 5	**Grade 6**
There are many types of forces that can act upon an object: air pressure, mass, compression, tension.	Motion can be classified into four types: linear, rotational, reciprocating and oscillating.
Different forces have different effects on different structures and mechanisms.	The motion of an object, stationary or moving, can be changed by applying a force.
Mechanisms can change the amount of effort required to move an object or load.	Mechanisms change one type of motion into another and transfer one type of energy into another.
Forces acting on structures and mechanisms can be both identified and measured.	Forces acting on structures and mechanisms can be countered.
There are skills and strategies required for scientific inquiry and technological design.	There are skills and strategies required for scientific inquiry and technological design.

Students work on their Culminating Performance Tasks:

An Uplifting Experience--Grade 5

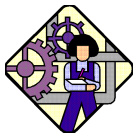
The McPaz Amusement Park is sending out tenders/requests for an engineering firm who can make their park more accessible to those who require a wheelchair. The park is built on two levels so as not to interfere with the natural elevation of the area. The contract will be awarded to the firm whose design can lift the greatest load with the least amount of force. Your task will be to submit a labeled diagram of your plan that will lift a measured load from one level to another. You will need to create a working scale model along with a list of materials required for its construction. You will be required to test this design and make and record modifications where necessary.

An Amusing Adventure--Grade 6

You are an engineer who has been contracted by the Ballenson Amusement Park to design a new feature attraction. Your task will be to submit a labeled diagram of this feature attraction that includes

13 Celebrate - Putting It All Together - 5/6

Students put together a model amusement park using their Culminating Performance Task models.



May The Force Move You

Forces Acting on Structures & Mechanisms; Motion **A Unit for Grade 5/6** **60 mins**

Description

Students will explore a variety of everyday simple machines. Students will sort and record simple machines.

Expectations

5s88 – use appropriate vocabulary, including correct science and technology terminology, in describing their investigations and observations (e.g., use terms such as component, subsystem, and device when describing systems);

5s90 – communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, written notes and descriptions, drawings, charts, and oral presentations (e.g., give a presentation on the process of designing and making a specific structure);

6s90 – use appropriate vocabulary, including correct science and technology terminology, in describing their investigations and observations (e.g., use terms such as fulcrum, pivot, rack and pinion, belt);

6s92 – communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, written notes and descriptions, charts, drawings, and oral presentations (e.g., describe how a product was created from the first idea to the final model; produce a set of instructions to control the sequence of movements of a mechanical device).

5m114 – display data on graphs (e.g., line graphs, bar graphs, pictographs, and circle graphs) by hand and by using computer applications;

6m115 – experiment with a variety of displays of the same data using computer applications, and select the type of graph that best represents the data;

Groupings

Students Working In Small Groups
Students Working Individually
Students Working As A Whole Class

Teaching / Learning Strategies

Classifying
Discussion
Learning Log/ Journal

Assessment

Use classroom checklist to indicate whether students understand what a simple machine is or not.

See also Learning Log Rubric.
NOTE: Although this rubric is attached to Subtask 1, it is a rubric that may be used throughout the unit as there will be several Learning Log entries. Typically, an activity in the EXPLORE stage would not be formally evaluated.

Assessment Strategies

Learning Log

Assessment Recording Devices

Checklist

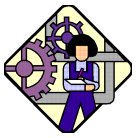
Adaptations

Teaching / Learning

Two options for this lesson have been provided:

Option # 1--Teacher gives each group a selection of simple machines to observe. Teacher tells students that there are six simple machines (Pulley, Wheel and Axle, Wedge, Screw, Lever, Inclined Plane) and lists them on the board or chart paper. (See Teacher Resource 1 for a list of possible objects)

Working in cross-grade groups, students observe the



selection of simple machines given to them. Together, students decide which objects are examples of each simple machine. They then prepare a chart in their learning log with the names of the simple machines at the top and the list of objects fitting each heading underneath.

Teacher will share Learning Log Rubric with students, pointing out requirements of the learning log entries. (Use of science terminology and units of measure, clear and organized format with appropriate use of diagrams, and connections to the world around them).

In their learning log, students then record how their group sorted the objects. They discuss the characteristics of each simple machine that influenced their decision to place an object into a particular category. Teacher will use class checklist to record that the work is complete and accurate.

With the whole class, teacher reviews and discusses the characteristics of each simple machine and shows the examples from the tray. Students should make revisions to their notes where necessary.

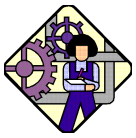
Option #2-- Teacher tells students that there are six simple machines and lists them on the board or chart paper. Teacher then distributes worksheet of pictures of simple machines (BLM 1).

Students draw a chart listing the six simple machines at the top. They then cut, sort and paste the pictures into the simple machine categories. Students then discuss the characteristics of each simple machine that influenced their decision to place an object into a particular category. Teacher collects charts and uses classroom checklist to record observations.

Teacher will share Learning Log Rubric with students, pointing out requirements of the learning log entries. (Use of science terminology and units of measure, clear and organized format with appropriate use of diagrams, and connections to the world around them).

In their learning log or science journal, students then record how their group sorted the objects. They discuss the characteristics of each simple machine that influenced their decision to place an object into a particular category. Teacher will use class checklist to record that the work is complete and accurate.

With the whole class, teacher reviews and discusses the characteristics of each simple machine and gives examples of each.



Resources

Learning Log

Teacher Resource 1 - Simple Machines TR 1_Simple Machines.cwk

Classifying Simple Machines Simple Machines BLM.cwk

Examples of simple machines 6-10 per group

Notes to Teacher

Teacher may consider making the simple machine chart in advance and photocopy to distribute to students. This will increase the amount of time that students can actually work on the sorting activity.

Teacher Reflections

May The Force Move You

Forces Acting on Structures & Mechanisms; Motion **A Unit for Grade 5/6** **40 mins**

Description

An Uplifting Experience - Grade 5

The McPaz Amusement Park is sending out tenders for an engineering firm who can make their park more accessible to those who require a wheelchair. The park is built on two levels so as not to interfere with the natural elevation of the area. The contract will be awarded to the firm whose design can lift the greatest load with the least amount of force. Your task will be to submit a labeled diagram of your plan that will lift a measured load from one level to another. You will need to create a working scale model along with a list of materials required for its construction. You will be required to test this design and make and record modifications where necessary.

An Amusing Adventure - Grade 6

You are an engineer who has been contracted by the Ballenson Amusement Park to design a new feature attraction. Your task will be to submit a labeled diagram of this feature attraction that includes at least one change in motion, speed or direction. You will need to create a working scale model along with a list of materials required for its construction. During the construction you will be required to test this design and make and record modifications where necessary.

Expectations

5s77 A	• demonstrate an understanding of the effect of forces acting on different structures and mechanisms;
5s78 A	• design and make load-bearing structures and different mechanisms, and investigate the forces acting on them;
5s79 A	• evaluate the design of systems that include structures and mechanisms, and identify modifications to improve their effectiveness.
6s78 A	• demonstrate an understanding of different kinds of motion (linear, rotational, reciprocating, oscillating);
6s79 A	• design and make mechanical devices, and investigate how mechanisms change one type of motion into another and transfer energy from one form to another;
6s80 A	• identify modifications to improve the design and method of production of systems that have mechanisms that move in different ways.
5s88 A	– use appropriate vocabulary, including correct science and technology terminology, in describing their investigations and observations (e.g., use terms such as component, subsystem, and device when describing systems);
5s91	– design and make a frame structure that can support a load (e.g., a bridge);
5s98	– identify modifications intended to improve the performance, aesthetic appeal, and impact on the environment of a product they designed;

Groupings

Students Working As A Whole Class

Teaching / Learning Strategies

Direct Teaching
Discussion

Assessment

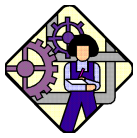
The rubric is used only for reference at this point.

Assessment Strategies

Assessment Recording Devices

Rubric

Adaptations



6s87 A – design and make mechanical devices that change the direction and speed of an input to produce a desired output and that perform a useful function (e.g., a clothesline);

6s90 A – use appropriate vocabulary, including correct science and technology terminology, in describing their investigations and observations (e.g., use terms such as fulcrum, pivot, rack and pinion, belt);

6s95 A – write a plan outlining the different materials and processes involved in producing a product (e.g., resources, equipment, marketing);

Teaching / Learning

The purpose of this lesson is to make the students aware of the Culminating Performance Task, and the process involved in completing it.

Teacher will give each student a copy of the Culminating Performance Task and briefly go over the expectations.

Share with students that this is their end of unit goal, and through the remaining lessons, they will acquire the necessary knowledge and skills needed to complete the task.

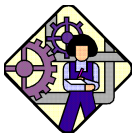
If the teacher is going to include the celebration component of this unit, indicate this to students, especially emphasizing that there will need to be a variety of solutions to these problems.

Share with, and briefly go over the rubric that will be used to evaluate the Culminating Performance Task.

An Uplifting Experience--Grade 5

The McPaz Amusement Park is sending out tenders/requests for an engineering firm who can make their park more accessible to those who require a wheelchair. The park is built on two levels so as not to interfere with the natural elevation of the area. The contract will be awarded to the firm whose design can lift the greatest load with the least amount of force. Your task will be to submit a labeled diagram of your plan that will lift a measured load from one level to another. You will need to create a working scale model along with a list of materials required for its construction. You will be required to test this design and make and record modifications where necessary.

An Amusing Adventure--Grade 6



You are an engineer who has been contracted by the Ballenson Amusement Park to design a new feature attraction. Your task will be to submit a labeled diagram of this feature attraction that includes at least one change in motion, speed or direction. You will need to create a working scale model along with a list of materials required for its construction. During the construction you will be required to test this design and make and record modifications where necessary.

Resources

An Uplifting Experience - Grade 5

An Amusing Adventure - Grade 6

Culminating Performance Task CulPerfTasks.cwk

Notes to Teacher

NOTE: This will seem overwhelming to the students (and possibly the teacher). Emphasize that this is only to give them an idea of where they are heading. They are not expected to know how to solve the problem at this point.

At this point you may want to have students brainstorm types of mechanisms used to lift loads from one level to another. (elevator, stationary or moving ramp, ski/tow lift, stairs or escalator, conveyor belt)

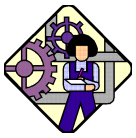
If your students have had little experience with amusement parks or local carnivals and/or fairground rides, you may want to visit the following web sites before beginning the unit:

www.whirlin.com
www.rides4u.com
www.learner.org/exhibits/parkphysics.com

Consideration: If the unit on Electricity was taught before this unit, grade six students could apply this knowledge to produce battery driven rides.

Career Connections: Teacher could draw attention to the fact that the knowledge and skills students are working on in this unit would be useful in a career in engineering or construction.

Teacher Reflections



Description

Key Learning: Mechanisms can change the amount of effort required to move an object or load.

Working together in cross-grade groups, students will use given equipment to demonstrate their knowledge of the characteristics and uses of pulleys. Students will record individually their observations in diagrams and words, pertaining to the effort required to lift a container in various situations. Students will be taught/reminded how to use a spring scale.

Expectations

5m37 • demonstrate an understanding of and ability to apply appropriate metric prefixes in measurement and estimation activities;

6m42 • demonstrate an understanding of and ability to apply appropriate metric prefixes in measurement and estimation activities;

5s83 – describe, using their observations, the advantages and disadvantages of using different types of mechanical systems (e.g., a single-pulley system has no mechanical advantage; a pulley system with two or more pulleys has a mechanical advantage);

6s81 – describe, using their observations, ways in which mechanical devices and systems produce a linear output from a rotary input (e.g., screw, crank and slider, rack and pinion, cam and cam follower);

Teaching / Learning

1) Teacher gives each group 2 pulleys, a metre stick, a piece of thick string, a shoe with laces, and a spring scale.

2) Teacher demonstrates how to use a spring scale. Show students that when an object is placed on the hook of the spring scale it causes the spring to be stretched and the moving pointer shows how much force is being applied to lift the object.

3) Students are to explore the following tasks and record their observations in chart form. See Testing Pulleys BLM 3.1

a) Use the spring scale to lift the shoe and record the number of Newtons required to lift it (EFFORT). This number is also the amount of resistance exerted by the mass of the object. Students should record this number in the "Resistance" column of the chart.

b) Tie one of the pulleys onto the metre stick as close

Groupings
Students Working In Small Groups
Students Working As A Whole Class

Teaching / Learning Strategies
Demonstration
Brainstorming
Discussion
Experimenting
Inquiry
Note-making

Assessment

Teacher checks to ensure that learning log entry is complete and accurate. Offer feedback where necessary, and meet with students that seem to have had difficulty with this task.

Assessment Strategies
Learning Log

Assessment Recording Devices
Checklist

Adaptations

to the stick as possible. Tie one end of the string to the shoe. Thread the string through the pulley and attach it to the spring scale. Lift the shoe by pulling down on the spring scale and record the number of Newtons required to lift it. This is a FIXED pulley.

c) Tie one end of the string onto the metre stick. Thread it through the pulley and tie the other end of the string to the spring scale. Hook the shoe onto the pulley, then lift the shoe and record the number of Newtons required to lift it. This is a MOVABLE pulley.

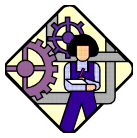
d) Tie one end of the string to the metre stick. Thread the string through the first pulley, then thread through the fixed pulley and attach string to the spring scale. Now attach the shoe to the first movable pulley.
This is a BLOCK AND TACKLE pulley system. Lift the shoe and record the number of Newtons required to lift it. (Refer to Types of Pulleys BLM 3.2 for diagrams of a Fixed, a Movable, and a Fixed and Movable [or Block and Tackle] pulley system)

e) In a large group discussion, students share their observations from their work with pulleys. Teacher could take this opportunity to clarify and/or expand on concepts.

f) Students complete the following statement in their learning log: While using the pulleys I noticed that.... (three statements)

Key observations should include: Mechanisms such as pulleys can change the direction of the force. A fixed pulley reduces the amount of force required. A movable pulley reduces the force by half. Forces can be measured.

g) Students brainstorm a list of real life examples where pulleys are used. Record on chart paper and post in classroom.



Resources

May The Force Move You

Forces Acting on Structures & Mechanisms; Motion **A Unit for Grade 5/6** **60 mins**

Testing Pulleys BLM 3.1	Testing Pulleys BLM3.cwk
Types of Pulleys BLM 3.2	Types of Pulleys.cwk
Focus on Science	Frank J. Flanagan/Alexander Teliantnik
Science and Technology: Forces on Structures--5	Steve Campbell et. al.
pulleys per group	2
metre stick per group	1
thick string 2 m long per group	1
shoe with laces per group	1
spring scale per group	1

Notes to Teacher

Teacher Reflections

Description

Key Learnings: Mechanisms can change the amount of effort required to move an object or load.

Students will explore the effects of moving the fulcrum of a first class lever by measuring the force required to lift a load using a spring scale.

Expectations

5s80 – identify and measure forces acting on a structure (e.g., mass, air pressure), and describe the effects of their application;

Teaching / Learning

Teacher begins by reviewing levers and their components. (effort, load, fulcrum) Do this by giving students a picture of a first class lever and have them label it. Then introduce the second and third class levers, draw them on the blackboard and label the effort, load and fulcrum. Have students copy the diagrams into their science journals. See Teacher Resource - Levers for illustrations of the types of levers.

1) Teacher gives each group a metre stick, a spring scale, a shoe, string, a fulcrum (ideas for fulcrums: chalk board eraser, tin can, wooden block).

2) Review how to use a spring scale.

3) Use the spring scale to measure the number of Newtons required to lift the shoe (RESISTANCE). Students record all measurements in a chart (BLM 4.51):Testing First Class Levers. See BLM 4.52 for diagram of set up.

4) Students set up a first class lever (fulcrum in the middle, load on one end and effort applied at the other end) on their desk or a table. (Ensure that the metre stick hangs over the edge of the desk on both sides.) They begin by placing the fulcrum at the 50 cm mark. Attach the shoe to the 10 cm mark. Tie a loop of string onto the 90 cm mark of the metre stick, tape it in place, and hook the spring scale through it. Measure and record the number of Newtons required to lift the load to a balanced position.
(NOTE: Mathematics application--students could graph the results)

5) Repeat above procedure this time placing the fulcrum at the 30 cm mark.

Groupings
Students Working In Small Groups

Teaching / Learning Strategies
Brainstorming
Discussion
Experimenting
Inquiry
Note-making

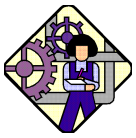
Assessment

Teacher checks to ensure that students know the parts of a first class lever.

Assessment Strategies
Learning Log

Assessment Recording Devices
Checklist

Adaptations



6) Repeat above procedure this time placing the fulcrum at the 15 cm mark.

7) In their learning log/science journal, students finish the following statements:

a) When using a first class lever I noticed that as the was moved closer to the load....

b) Some of the advantages and disadvantages of using levers are....

c) Draw a labeled diagram of a first class lever.

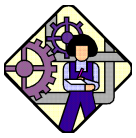
8) Students brainstorm a list of real life examples of first class levers. Record on chart paper and post in classroom.

Home Connection: "Top Ten Levers in _____'s home". Students search their homes for ten examples of first class levers in their home.

Teacher discusses results and students make revisions to their notes as necessary.

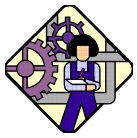
Resources

Teacher Resource 4 - Levers	TR Types of Levers.cwk
Testing First Class Levers BLM 4.51	TestingFirst ClassLevers4_5.cwk
Lever Set-up BLM 4.52	Lever set_up2.cwk
metre stick	1
spring scale	1
shoe with laces	1
1 m length of string	1
fulcrum	1
desk	1



Notes to Teacher

Teacher Reflections



Description

Key Learning: The motion of an object, stationary or moving, can be changed by applying a force.

Grade 6 students will explore the force required to lift a load using the three classes of levers. They will then determine the purpose of each type of lever and describe everyday examples of each type of lever.

Expectations

6s82 A – describe, using their observations, the purposes or uses of three classes of simple levers (e.g., wheelbarrow, tongs, seesaw);

6m42 • demonstrate an understanding of and ability to apply appropriate metric prefixes in measurement and estimation activities;

Teaching / Learning

1) Teacher gives each group a metre stick, a spring scale, a shoe, a fulcrum (ideas for fulcrums: chalk board eraser, tin can, wooden block).

2) Teacher reviews how to use a spring scale.

3) Students use the spring scale to measure the number of Newtons required to lift the smelly shoe (RESISTANCE). Students record all measurements in a Testing Levers chart (BLM 4.61). See Lever
Set-up (BLM 4.62) for experiment set-up.

4) Students set up a first class lever (fulcrum in the middle, load on one end and effort applied at the other end) on their desk or a table). They begin by placing the fulcrum at the 50 cm mark. Attach the shoe to the 10 cm mark of the metre stick. Tie a loop of string onto the 90 cm mark of the metre stick and hook the spring scale through it. Measure and record the number of Newtons required to lift the load to a balanced position. Repeat placing the fulcrum at the 30 cm mark. Record the number of Newtons required to lift the load.

5) Repeat above procedure this time placing the load at the 50 cm mark, the fulcrum at the 10 cm mark and the effort (spring scale) at the 90 cm mark. This is a second class lever. Repeat placing the load at the 30 cm mark. Measure and record the number of Newtons required to lift the load.

6) Repeat above procedure this time keeping the fulcrum at the 10 cm mark, moving the load to the 90 cm mark and the effort (spring scale) at the 50 cm mark. This is a third class lever. Repeat moving the load to the 70 cm mark. Measure and record the number of Newtons required to lift the load.

Groupings
Students Working In Small Groups

Teaching / Learning Strategies
Brainstorming
Classifying
Discussion
Mini-lesson
Note-making

Assessment

Teacher checks to ensure that students know the parts of a lever and can demonstrate the difference between the different classes of levers.

Assessment Strategies
Learning Log

Assessment Recording Devices
Checklist

Adaptations

7) In a large group, student share results and observations. Teacher should take this opportunity to expand and clarify concepts.

8) Students finish the following statements:

a) The differences between the three classes of levers are....

b) In each class, as the load moved closer to the fulcrum.....

c) Some of the advantages and disadvantages of using levers are....

d) Draw labeled diagrams of each class of lever.

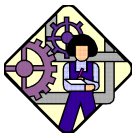
9) Students brainstorm a list of real life examples of each type of lever. Record on chart paper and post in classroom.

Homework: "Top Twelve Levers in _____'s home". Students search their homes for twelve examples of levers in their home - 4 examples of each class of lever.

Teacher discusses results and students make revisions to their notes as necessary.

Resources

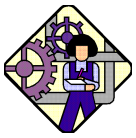
Teacher Resource - Types of Levers	TR Types of Levers.cwk
Testing Levers BLM 4.61	Testing LeversBLM4.6.cwk
Lever Set-up BLM 4.62	Grade six_lever set_up.cwk
Science and Technology:Motion-6	Steve Campbell et. al.
metre stick	1
spring scale	1
shoe with laces	1



	**1m length of string**	1
	**fulcrum**	1

Notes to Teacher

Teacher Reflections



May The Force Move You

Forces Acting on Structures & Mechanisms; Motion **A Unit for Grade 5/6** **40 mins**

Description

Key Learnings: Grade 5- Different forces have different effects on different structures and mechanisms
Grade 6- The motion of an object, stationary or moving, can be changed by applying a force.

Working in cross-grade groups, students review and explore the strength and stability of different structural designs by applying a variety of forces.

Expectations

5m65 • identify, describe, compare, and classify geometric figures;
5m66 • draw and build three-dimensional objects and models;
6m64 • identify, describe, compare, and classify geometric figures;
5s79 • evaluate the design of systems that include structures and mechanisms, and identify modifications to improve their effectiveness.
5s77 • demonstrate an understanding of the effect of forces acting on different structures and mechanisms;
6s80 • identify modifications to improve the design and method of production of systems that have mechanisms that move in different ways.

Teaching / Learning

Teacher begins by reviewing/discussing the distinction between stability and strength*. To ensure a solid understanding of stability and its connection to balance and centre of gravity, students engage in actions that put them in and out of balance (e.g., stand facing a partner about 1.5 m away, with palms up and arms straight out towards partner, lean towards partner until contact is made; each partner then tries to push the other into balance ([i.e., both partners standing up straight]).
* Stability - The capacity of an object to maintain or return to its original position; the state of being balanced in a fixed position
Strength - The capacity of an object to sustain the application of force without yielding or breaking

1) Teacher gives each group of students paper fasteners/brads, strips of card stock (3 cm by 15 cm), scissors, and a ruler.

2) Using three or more strips of card stock, students are challenged to create the strongest 2-dimensional shape. (i.e., A, H, square, triangle.) Shapes are considered strong when they do not lose their shape when pushed or pulled. See Teacher Resource - Strong Shapes for diagrams of

Groupings
Students Working In Pairs

Teaching / Learning Strategies
Discussion
Inquiry
Note-making

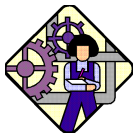
Assessment

Teacher checks to ensure that students understand what shapes are strong and the characteristics of the shape that make it strong.

Assessment Strategies
Learning Log

Assessment Recording Devices
Checklist

Adaptations



possible shapes to test.

3) Students design, construct and test each shape for strength by applying tension and compression at each joint, and record observations in a chart (Strong Shape Chart [BLM 5]). Students should be encouraged to modify each shape that was not considered strong, and record changes made in the chart.

4) Students examine pictures/images of various structures (e.g., magazines, community walk, video, software [see Resources]); they search for examples of the strongest shapes they have explored previously. Teacher discusses/shares the difference between strength and stability.

4) In their learning log/science journal:

a) Students draw the shapes they found to be strongest.

b) Complete the following statement: The strongest shapes are.....because....

c) Draw and or describe the most stable structures.

Resources

Teacher Resource - Strong Shapes	TR #5 Stable Shapes.cwk
Strong Shape Chart	BLM5Stable Shapes.cwk
The Way Things Work, 2.0	
Neighborhood Walks	
1998 Candian and World Enclyclopedia	
How Do They Build Bridges	Hearst Broadcasting Products, 1996
Bill Nye The Science Guy	KCTS Television (with Rabbit Ears Productions & Walt Disney Television)
paper fasteners/brads	15
strips of card stock 3cm by 15 cm	30
scissors	2

ruler 2

Notes to Teacher

NOTE: See also Resources for the ***Bill Nye The Science Guy*** video on Balance/Structures (addresses tension and compression in structures also).

Teacher Reflections

May The Force Move You

Forces Acting on Structures & Mechanisms; Motion **A Unit for Grade 5/6** **60 mins**

Description

Key Learnings: Grade 5- There are many types of forces that can act upon an object: air pressure, mass, compression, tension.

Grade 6- Motion can be classified into four types: linear, rotational, reciprocating and oscillating.

Students will be observing, exploring and recording the types of forces (Grade 5) or motion (Grade 6) through teacher demonstration, discussion and a community walk.

Expectations

5m113 – design surveys, collect data, and record the results on given spreadsheets or tally charts;

6m114 – design surveys, organize the data into self-selected categories and ranges, and record the data on spreadsheets or tally charts;

5s77 • demonstrate an understanding of the effect of forces acting on different structures and mechanisms;

5s80 – identify and measure forces acting on a structure (e.g., mass, air pressure), and describe the effects of their application;

6s78 • demonstrate an understanding of different kinds of motion (linear, rotational, reciprocating, oscillating);

6s82 – describe, using their observations, the purposes or uses of three classes of simple levers (e.g., wheelbarrow, tongs, seesaw);

Teaching / Learning

1) Teacher explains to class that a force is a push or pull on an object. (Examples: wind moving leaves, bicycle moving, clothes blowing in the wind, people walking, pulling a wagon, etc.) and indicates that forces are all around us. Teacher explains to Grade 6 students that objects move in different ways and can change the direction, speed and way they move. It is not necessary to name the types of motion at this point as students are still in the exploring stage. It is more important that they try to focus on how things move as opposed to searching for examples of given motions.

2) Students take an observation walk through the school and their school neighbourhood.

Grade 5 students will be looking for and recording examples of pulleys, first class levers, strong shapes, stable objects and indications of force. (BLM 6.5)

Grade 6 students will be looking for and recording examples of pulleys, the three classes of levers, stable

Groupings
Students Working As A Whole Class
Students Working Individually

Teaching / Learning Strategies
Classifying
Discussion
Field Trip

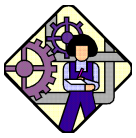
Assessment

Teacher checks to ensure that students have recorded necessary examples for each category. See Answer Blackline Masters (BLM 6a, BLM 66a).

Assessment Strategies
Learning Log

Assessment Recording Devices
Checklist

Adaptations



shapes and objects in motion. They will be asked to list the object in motion and describe how it is moving, (e.g.. straight line, in a circle) and indicate if it changed direction, speed or way it was moving. (BLM 6.6)

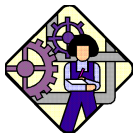
3) Upon returning to the classroom, teacher leads a discussion around their observations. Teacher should take the time now to clarify any misconceptions, and make note of students who are having difficulties. See BLM 6.51 and 6.61 for possible solutions.

Resources

Grade 5 Walk	Walking BLM6.cwk
Grade 6 Hike	Hike BLM66.cwk
Grade 5 Walk Answers	WalkingAnswersBLM6a.cwk
Grade 6 Hike Answers	HikeAnswers BLM66a.cwk

Notes to Teacher

Teacher Reflections



May The Force Move You

Forces Acting on Structures & Mechanisms; Motion **A Unit for Grade 5/6** **60 mins**

Description

Key Learnings: Grades 5 and 6- There are skills and strategies required for scientific inquiry and technological design.

With teacher guidance in a whole class discussion, students will review the Design Process and make connections to the Culminating Performance Task.

Expectations

5s79 A • evaluate the design of systems that include structures and mechanisms, and identify modifications to improve their effectiveness.

5s86 – formulate questions about and identify needs and problems related to structures and mechanisms in the outdoor environment, and explore possible answers and solutions (e.g., construct a bridge that must support a given load across a given distance; determine which surface of a cantilever bridge or beam is under tension and which is under compression);

5s90 – communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, written notes and descriptions, drawings, charts, and oral presentations (e.g., give a presentation on the process of designing and making a specific structure);

5s87 – plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure a fair test and identifying criteria for assessing solutions;

6s87 – design and make mechanical devices that change the direction and speed of an input to produce a desired output and that perform a useful function (e.g., a clothesline);

6s88 – formulate questions about and identify needs and problems related to structures and mechanisms in the environment, and explore possible answers and solutions (e.g., describe how a system, such as a plumbing system, could be modified to meet different needs);

6s89 – plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure a fair test and identifying criteria for assessing solutions;

6s90 – use appropriate vocabulary, including correct science and technology terminology, in describing their investigations and observations (e.g., use terms such as fulcrum, pivot, rack and pinion, belt);

6s79 A • design and make mechanical devices, and

Groupings

Students Working As A Whole Class
Students Working In Pairs

Teaching / Learning Strategies

Direct Teaching
Discussion
Inquiry

Assessment

Teacher asks students to record the steps of the design process in their learning logs/science journals. They must also give a brief description of what would be done during each step.

Teacher checks to ensure that students understand the design process. Review process with those students who have significant gaps.

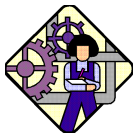
Assessment Strategies

Learning Log

Assessment Recording Devices

Checklist

Adaptations



investigate how mechanisms change one type of motion into another and transfer energy from one form to another;

5s78 A • design and make load-bearing structures and different mechanisms, and investigate the forces acting on them;

5m38 • identify relationships between and among measurement concepts (linear, temporal, monetary);

6m43 • identify relationships between and among measurement concepts (linear, square, cubic, temporal, monetary);

Teaching / Learning

1) Teacher tells students that they will be asked to work in groups to solve a problem. Students are told that they must record each step they took to solve the problem.

2) Teacher gives the students the following problem: Design a tinfoil boat that will hold the most pennies before sinking. Following the design process, students will draw a labeled diagram of the vessel. Students will include possible dimensions of the vessel.

3) Each cross grade group will need: tin foil (30 cm by 30 cm), 1 m of masking tape, pennies, a balloon, a straw, a ball of plasticene (10 cm in diameter), cardboard, graph paper and a pencil.

4) Each group should choose a timekeeper, a material handler, a recorder, a praiser/encourager.

5) Tell students that they have 20 minutes to finish the task. They may come to the central tub of water to test their boat, but only one group may test at a time. They may use any/all of the materials provided, but do not have to use them all.

6) Teacher gives students the signal to begin, and students work on designing and constructing their boats.

7) When the 20 minutes are up teacher tests each group's boat and records on chart paper how many pennies each boat will hold before sinking.

8) After testing the boats, teacher leads a discussion to determine how groups went about solving the design challenge. Teacher records responses on the board, or on chart paper. At this point, teacher is guiding students through the design process.

9) Teacher distributes the Design Process blackline master (see Resources), and discusses the relationship between

what the students did to solve the challenge, and the actual Design Process.

10) Students are told that this is the process they will follow when completing their design and build tasks.

11. Students record steps in journal and write a description of what is done at each step. Students then share ideas with class and make changes as necessary.

Resources

Design Process	DesignProcess BLM7.cwk
tinfoil--30 cm by 30 cm square	1
1 m length of masking tape	1
pennies	several
balloon	1
straw	1
plasticene ball--10 cm in diameter	1
cardboard--30 cm by 30 cm (approximately)	1
graph paper	3sheets

Notes to Teacher

Teacher Reflections

May The Force Move You

Forces Acting on Structures & Mechanisms; Motion **A Unit for Grade 5/6** **120 mins**

Description

Key Learnings:
There are many types of forces that can act upon an object: air pressure, mass, compression, tension.
Different forces have different effects on different structures and mechanisms.
Mechanisms can change the amount of effort required to move an object or load.
Forces acting on structures and mechanisms can be both identified and measured.

Through a series of hands on activities, students will discover how the forces of tension, compression, gravity and air pressure affect structures and mechanisms. (See Teacher Resource blackline master for information on Learning Centres - this is also in the Unit Notes in Unit Overview)

Expectations

5s77 A • demonstrate an understanding of the effect of forces acting on different structures and mechanisms;

5s78 A • design and make load-bearing structures and different mechanisms, and investigate the forces acting on them;

5s80 A – identify and measure forces acting on a structure (e.g., mass, air pressure), and describe the effects of their application;

5s81 A – identify the parts of a structure that are under tension and those that are under compression when subjected to a load (e.g., the wires in a suspension bridge are under tension; a ladder bearing a mass is under compression);

Teaching / Learning

Depending on availability of materials, teacher preparation time, independence of students, classroom space, or teacher comfort level, the following activities may be performed in 2 ways:

1) As learning centres through which groups of students rotate.
2) All students do the same thing at the same time.

Teachers may consider having students use the Scientific Method as a way of recording activity results (i.e., have students develop and test possible explanations (or hypotheses) for the various situations described below - see Scientific Method BLM 8 in Resources); another simpler experimentation approach could involve recording their work using such categories as: Materials, Procedure (predictions, possible explanations, testing the explanation), What Did You Learn.
NOTE: Students at this level should become familiar with the term "fair test", which, simply put, means controlling variables so that only the variable being tested changes,

Groupings
Students Working In Small Groups

Teaching / Learning Strategies
Collaborative/cooperative Learning
Experimenting
Learning Log/ Journal
Note-making

Assessment

Students record observations for each activity (may use Scientific Method / lab report format or science journal/learning log using categories suggested in Teaching / Learning). Teacher collects centre observations and notes strengths/next steps for each child.

Assessment Strategies
Learning Log

Assessment Recording Devices
Anecdotal Record

Adaptations

and all other variables are held constant (e.g., the materials for building the bridge to be tested in #2* are the same in type and amount for each test).

OR

Students may record results in their Science Journal; they could organize their learning using a Scientific Inquiry approach using such categories as Question, Plan/What We Did, Observations/Data, Results/Conclusions. In the last category students explain how the activity demonstrated the effects of the forces being investigated (i.e., tension, compression, gravity, air pressure).

1) Teacher discusses the types of forces and gives definitions (tension, compression, gravity, air pressure). Students record these definitions in their notebook. See Glossary of Terms for definitions. Teacher then explains what students will be doing at each activity centre. At this time the grade six students are working on finding definitions for the four types of motion.

Activities:

Tension (pulling) and Compression (pushing)

1) Give each student/pair/groups some plasticene/play dough/ silly putty and form it into a cube. By pushing and pulling the cube, observe what happens when tension(pulling) and compression (pushing) are applied to the shape.

OR

2) To test the forces of compression and tension on a structure, challenge the group to build a bridge 35 cm long. The winning bridge will withstand the greatest force of wind (hair dryer) and load (weights). Limiting the amount of materials* (50 straws or ten sheets of newspaper, a metre of masking tape) construct a bridge that will span a gap of 35 cm. Suspending a weight from the centre of the bridge will be the load test (pulling on the bridge beam) while using a hair dryer set at a constant high speed will test the effect of wind on the bridge (compression/pushing on the bridge). Teacher reinforces how the forces of tension and compression are affecting the bridge.

Air pressure

3) To show that air has pressure, fill a drinking glass about 2/3 full of water. Wet the rim of the glass. Put a cue card on the top of the glass. While holding the cue card tightly

against the mouth of the glass (no air bubbles should be allowed to enter between the cardboard and the glass), turn the glass upside down. Hold over a pail, garbage can or aquarium, and gently let go of the cue card. (The water stays in the glass because the pressure of the outside air against the cue card is greater than the pressure of the water against the cardboard.)

OR

4) To show that air has pressure, deflate a basketball and have a student sit on it. Attach a bicycle pump to the pin in the ball. Pump up the basketball. (The ball inflates and lifts the student. Air pressure builds inside the ball causing enough pressure to move the student.)

Gravity

5) To demonstrate the force of gravity and the effect that air resistance can have on it, drop a small weight from a high place, such as standing on a chair, ladder, or at the top of a set of stairs, and time how quickly the object falls. Cut four pieces of string equal lengths and tape one end of each piece of string to a ball you have made from a piece of paper. Tape the other end of the string to the small object. Drop the object from the same height that you dropped it before and again, time how quickly the object falls. Next, create a parachute using four equal lengths of string and a flat piece of paper. Tape one end of the string to the object and the other end to one of the four corners of the paper. Drop the object as you did before being sure to time the descent.

OR

6) To demonstrate that gravity is a strong force to be overcome, have students try jumping off a low chair/step/crate, and then try jumping up onto that same chair/step/crate. They will notice that it is more difficult to move against gravity than to move with it.

Resources

Teacher Resource - Learning Centers Learning Centres.cwk

May The Force Move You

Forces Acting on Structures & Mechanisms; Motion **A Unit for Grade 5/6** **120 mins**

Scientific Method	ScientificMethod BLM8.cwk
Force Activity Cards	Force Activity Cards.cwk
plasticene--3 cm in diameter	1
hair dryer	1
straws	50
sheets of newspaper	10
1m length of masking tape	1
metric masses--various	1
plastic drinking glass	1
pail or garbage can	1
deflated basketball and bicycle pump	1
string--1m long	1
small metric mass	1

Notes to Teacher

Teacher Reflections

May The Force Move You

Forces Acting on Structures & Mechanisms; Motion **A Unit for Grade 5/6** **120 mins**

Description

Key Learnings:
Motion can be classified into four types: linear, rotational, reciprocating and oscillating.
The motion of an object, stationary or moving, can be changed by applying a force.
Mechanisms change one type of motion into another and transfer one type of energy into another.
Forces acting on structures and mechanisms can be countered.

Through a series of hands on activities students will discover the four types of motion and learn how each may be controlled or changed.

Expectations

6s78 A • demonstrate an understanding of different kinds of motion (linear, rotational, reciprocating, oscillating);

Teaching / Learning

Depending on availability of materials, teacher preparation time, independence of students, classroom space, or teacher comfort level, the following activities may be performed in 2 ways:

1) As learning centres through which groups of students rotate.
2) All students do the same thing at the same time.

Teachers may consider having students use the Scientific Method as a way of recording some of the activity results (i.e., have students develop and test possible explanations (or hypotheses) for the various situations described below - see Scientific Method BLM 8 in Resources) ; another simpler experimentation approach could involve recording their work using such categories as: Materials, Procedure (predictions, possible explanations, testing the explanation), What Did You Learn.
NOTE: Students at this level should become familiar with the term "fair test", which, simply put, means controlling variables so that only the variable being tested changes, and all other variables are held constant (e.g., keeping the pendulum variables constant [e.g., length of string, weight of load, height of swing], except for the one being tested*).
OR

Students may record results in their Science Journal; they could organize their learning using an Observational Studies/Systematic Observation (using such categories as what did we observe, cause/effect, compare/contrast), or Scientific Inquiry approach (using such categories as Question, Plan/What We Did, Observations/Data, Results/Conclusions).

Groupings
Students Working In Small Groups

Teaching / Learning Strategies
Collaborative/cooperative Learning
Experimenting
Note-making

Assessment

Students record learning for each activity (may use scientific method/lab report format). Teacher collects and notes strengths/next steps for each child.

Assessment Strategies
Learning Log

Assessment Recording Devices
Anecdotal Record

Adaptations

1) Teacher instructs students to look up each of the four types of motion in the dictionary, and record the definitions in their science journal/notebook. Where possible, students could try to give examples of things that move in each way. See Glossary of Terms for definitions. (While students are doing this, teacher work with grade five students and explains each activity).

Activities (See Motion Diagrams BLM for information on setting these activities up):

Linear

a) Students build balloon rockets. Thread a string/fishing line (3m) through a straw. Attach each end of the string/fishing line to a chair and pull chairs so that string/fishing line is taught. Inflate a balloon, but do not tie it. Tape the balloon to the straw and release. Students describe the motions observed, and with teacher guidance, determine what kind of motion occurred (linear and possibly rotational).

Rotational

b) Students now attach the balloon to a circular cardboard disk, that has a pencil through the middle (so it can spin). Students describe the motions observed and of what it reminds them. With teacher guidance, students determine what kind of motion occurred (rotational).

Reciprocating

c) Students perform a variety of actions such as typing on a keyboard, cutting a piece of wood, pushing on a door bolt, stretching an elastic band, doing a pushup, moving a plunger. Students describe the motions observed and determine what kind of motion occurred (reciprocating).

Oscillating

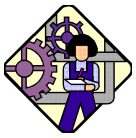
d) In small groups, students make a pendulum. To make a pendulum, set up two chairs back to back about one metre apart. Rest a dowel (or teacher's pointer) on the backs of the chairs. Tie one end of a string to the dowel and then measure 30 cm and cut the string. Tie a paper clip to the bottom of the string. Students investigate how string length and mass affect the swing of the pendulum. To test mass, add different numbers of washers to the paper clip. To test the length of string simply cut the string to 20 cm. Ensure that students are aware of the fact that they must only test one variable at a time*. They must bring the string back to the same point each time before releasing. Count

one swing when it returns to the side it started from. Time the number of swings it makes in 15 seconds. Students describe the motion observed, and the effects of the variables tested; with teacher guidance they determine what kind of motion occurred. (oscillating).
Teacher also discusses with students the fact that changing variables can cause a change in the motion observed (Length of string affects the number of swings, but increased mass does not).

At the end of these activities, teacher discusses the four types of motion investigated and reviews definitions with the students (linear, rotational, reciprocating, oscillating).

Resources

Motion Diagrams for Set-up	Motion diagrams.cwk
Balloons	many
string/fishing line--3m long	1
straw	1
masking tape	
circular cardboard disc	1
pencil	1
keyboard	1
saw and wood	1
door bolt	1
dowel/teacher's pointer	1
elastic bands	1
chairs	2
washers	5



Notes to Teacher

Teacher Reflections

Description

Key Learnings:
There are many types of forces that can act upon an object: air pressure, mass, compression, tension.
Different forces have different effects on different structures and mechanisms.
Mechanisms can change the amount of effort required to move an object or load.
Forces acting on structures and mechanisms can be both identified and measured.

Grade 5 students complete a T-Chart that includes the types of forces studied and an example of everyday situations where these forces are in action.

Expectations

5s77 A • demonstrate an understanding of the effect of forces acting on different structures and mechanisms;

Teaching / Learning

Grade 5 students write a quick quiz about Forces. See Types of Forces Quiz blackline master for copy of quiz.

Groupings
Students Working Individually

Teaching / Learning Strategies
Retelling

Assessment

Students write quiz individually. Teacher evaluates achievement by judging accuracy of answers.

Assessment Strategies
Quizzes, Tests, Examinations

Assessment Recording Devices
Rating Scale

Adaptations

Resources

Types of Forces Quiz TypesofForces BLM9.cwk

Notes to Teacher

Teacher Reflections

Description

Key Learnings:
Motion can be classified into four types: linear, rotational, reciprocating and oscillating.
The motion of an object, stationary or moving, can be changed by applying a force.
Mechanisms change one type of motion into another and transfer one type of energy into another.
Forces acting on structures and mechanisms can be countered.

Grade 6 students complete a cross-classification chart that includes the types of motion, a description of each type of motion, and real life examples of objects that demonstrate each type of motion.

Expectations

6s78 A • demonstrate an understanding of different kinds of motion (linear, rotational, reciprocating, oscillating);

Teaching / Learning

Grade 6 students write a quick quiz about Motion. See Motion Quiz blackline master for copy of quiz.

Groupings
Students Working Individually

Teaching / Learning Strategies
Retelling

Assessment

Students write quiz individually. Teacher evaluates achievement by judging accuracy of answers.

Assessment Strategies
Quizzes, Tests, Examinations

Assessment Recording Devices
Rating Scale

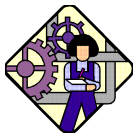
Adaptations

Resources

Motion Quiz Motion Quiz - BLM96.cwk

Notes to Teacher

Teacher Reflections



May The Force Move You

Forces Acting on Structures & Mechanisms; Motion **A Unit for Grade 5/6** **120 mins**

Description

Key Learnings:
There are many types of forces that can act upon an object: air pressure, mass, compression, tension.
Different forces have different effects on different structures and mechanisms.
Mechanisms can change the amount of effort required to move an object or load.
Forces acting on structures and mechanisms can be both identified and measured.

Students will perform a variety of investigations dealing with strength and stability in structures. They will be working in grade specific groups.

Expectations

5s77 A • demonstrate an understanding of the effect of forces acting on different structures and mechanisms;

5s78 A • design and make load-bearing structures and different mechanisms, and investigate the forces acting on them;

5s79 A • evaluate the design of systems that include structures and mechanisms, and identify modifications to improve their effectiveness.

5s80 A – identify and measure forces acting on a structure (e.g., mass, air pressure), and describe the effects of their application;

5m66 • draw and build three-dimensional objects and models;

Teaching / Learning

In pairs, the students will be required to build a variety of joints and frames and to test each for strength and stability. For each construction the class should make observations before the testing is started. Compare the designs created and identify the geometric shape common to each structure (triangle) that makes it strong and stable. What weight/mass will the structure bear before it shows signs of stress or it collapses?

Skill Builder 1: There are two kinds of joints: overlapping joints, and butt joints (two pieces of material joined end to end) with gusset corners (a right angle triangular shape made of paper used to strengthen a joint - see joints blackline master). For each frame created, three samples should be made: overlapping joint, butt joint, and butt joint with gusset corners. Test each structure for strength by applying

Groupings
Students Working In Pairs

Teaching / Learning Strategies
Brainstorming
Model Making
Inquiry

Assessment

Students should record results of their investigations in their Science Journals, and indicate what makes a structure strong and stable. Teacher uses classroom list to note understanding of strength and stability, using anecdotal records when needed.

Assessment Strategies
Observation
Learning Log

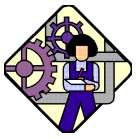
Assessment Recording Devices
Checklist
Anecdotal Record

Adaptations

pressure to the top and side of the various frames. Placing a weight on the top will provide a measurable amount to test. Increasing the mass of the weight will provide a way to measure the strength of the frame.

Skill Builder 2: Develop a five column chart that will allow the student to record and compare results of the testing on each truss made (shape, force, test, range of strength, modifications - Truss Test BLM 10). Forces to apply could be: moving air (use a hair dryer), compression (use a vice and measure the distance between the sides, or place a small kitchen scale that indicates the amount of weight withstood when pressure is applied to the top of the scale), suspended weight (hang a weight from the central part of the shape), and tension (use a spring weight hooked onto the shape and pull noting the measure).
Show pictures of the various kinds of trusses (Truss Types blackline master) and, using straws or popsicle sticks and glue guns, build a model of each. The distance between straws or popsicle sticks should be 8 cm. Students should trim the ends of the popsicle sticks to avoid overlap, and strive to achieve symmetry.
When a part fails a test, explore how modifications could make a new structure stronger, retesting after making each modification.

Skill Builder 3:
Students will design and build a 3-D structure that will support the greatest possible mass. The structure will be a maximum of 40 cm tall. Students will test and record the amount of mass the structure will bear (This structure may be used later in their Culminating Performance Task).



Resources

Joints	Joints.cwk
Truss Test	Truss Test BLM 10.cwk
Truss Types	TrussBeamBridges.cwk
Skill Builder #1	Skill Builder1.cwk
glue gun	1
popsicle sticks	many
metric masses-various	
hair dryer	1
vice	1
Blackline Master of trusses	1
straws	many

Notes to Teacher

Teacher Reflections

May The Force Move You

Forces Acting on Structures & Mechanisms; Motion **A Unit for Grade 5/6** **120 mins**

Description

Key Learnings:
Motion can be classified into four types: linear, rotational, reciprocating and oscillating.
The motion of an object, stationary or moving, can be changed by applying a force.
Mechanisms change one type of motion into another and transfer one type of energy into another.
Forces acting on structures and mechanisms can be countered.

Students will investigate how the direction, speed or type of motion can be changed. These may be set up as centres, or each group may do the same activity at the same time.

Expectations

6s79 A • design and make mechanical devices, and investigate how mechanisms change one type of motion into another and transfer energy from one form to another;

6s80 A • identify modifications to improve the design and method of production of systems that have mechanisms that move in different ways.

6s81 A – describe, using their observations, ways in which mechanical devices and systems produce a linear output from a rotary input (e.g., screw, crank and slider, rack and pinion, cam and cam follower);

Teaching / Learning

Students will perform the following activities to investigate how the direction, speed or type of motion can be changed. These may be set up as centres, or each group may do the same activity at the same time (See Motion Changes BLM 10.6 for diagrams).

Activity 1: A) Linking Levers: Students use tongue depressors or stiff cardboard strips of the same length joined with split pins/brads producing linking levers.
(Change in direction at every fulcrum) Note that in this example the fulcrum is a linkage. Teacher indicates that a first class lever is an example of how direction is changed.

B) To show change in direction with gears, simply link two gears side-by-side on the cardboard (by attaching them to cardboard with split pins/brass fasteners), and notice that the gears turn in opposite directions. Then link a third gear and describe the direction that each gear turns. (See Activity Cards

Groupings
Students Working In Pairs

Teaching / Learning Strategies
Brainstorming
Inquiry
Model Making

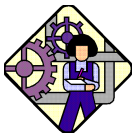
Assessment

Students should record the results of their investigations in their Science Journal and give three examples of how motion can be changed or altered. Teacher uses classroom list to note understanding of the types of motion and how they can be changed, using anecdotal records when needed.

Assessment Strategies
Observation
Learning Log

Assessment Recording Devices
Checklist
Anecdotal Record

Adaptations



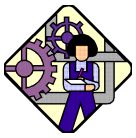
BLM)

Activity 2: Gear Systems: Students use 3 gears (or make them from cardboard) of different sizes and connect them on a piece of wood or cardboard side-by-side. As they turn the largest gear they will notice that the gears rotate at different speeds. Have the students count how many turns the smaller gears make for every one turn the largest gear makes (Change in Speed). (See Activity cards BLM)

Activity 3: Changing Motion: Students join two gears the same size on a piece of cardboard. To the second gear they join a strip of cardboard that is linked to a cardboard 'hammer'. As they turn the first gear the second gear moves. This causes the cardboard strip to move up and down which in turn causes the hammer to move up and down. This demonstrates a change in type of motion (rotational to reciprocating and oscillating) and change in direction. (See Activity Cards and Gear Template BLMs)

Resources

Motion Changes BLM 10.6	ChangesDSM.cwk
Change in Motion Activity Cards	Change in motion activCards.cwk
Gear Template	Gear Template BLM.cwk
cardboard	lots
popsicle sticks	lots

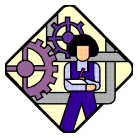


split pins/brads	many
toothpicks	many
commercial gears	6

Notes to Teacher

Choose the centres that suit the materials available to you, as well as the needs of your students. Ensure that one activity from each section is performed or demonstrated.

Teacher Reflections



Description

Key Learnings

Grade 5	**Grade 6**
There are many types of forces that can act upon an object: air pressure, mass, compression, tension.	Motion can be classified into four types: linear, rotational, reciprocating and oscillating.
Different forces have different effects on different be structures and mechanisms.	The motion of an object, stationary or moving, can changed by applying a force.
Mechanisms can change the amount of effort another required to move an object or load.	Mechanisms change one type of motion into and transfer one type of energy into another.
Forces acting on structures and mechanisms be can be both identified and measured.	Forces acting on structures and mechanisms can countered.
There are skills and strategies required for scientific inquiry and technological design.	There are skills and strategies required for scientific inquiry and technological design.

Working in cross-grade groups students will construct a flagpole that rests on a load bearing structure. Grade 5 students will be responsible for constructing the load bearing structure and insuring that it is stable and strong enough to support the working flagpole. Grade 6 students will be responsible for insuring that the completed model will change rotational motion into linear motion and raise the flag.

Expectations

5s78 A	• design and make load-bearing structures and different mechanisms, and investigate the forces acting on them;
5s79 A	• evaluate the design of systems that include structures and mechanisms, and identify modifications to improve their effectiveness.
5s91 A	– design and make a frame structure that can support a load (e.g., a bridge);
5s93	– cut, join, and rearrange pliable and rigid materials to make an object (e.g., cut wood at a 45º angle to make a mitre joint; make a mould for a face mask);
6s79 A	• design and make mechanical devices, and investigate how mechanisms change one type of motion into another and transfer energy from one form to another;
6s80 A	• identify modifications to improve the design and method of production of systems that have mechanisms that move in different ways.
6s87	– design and make mechanical devices that change the direction and speed of an input to

Groupings

Students Working In Small Groups

Teaching / Learning Strategies

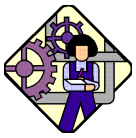
Brainstorming
Experimenting
Inquiry
Model Making

Assessment

Students should record the results of their work in their Science Journals, using the "Design Process" sheet as a guide. Teacher records achievement level from rubric; the individual descriptors in this rubric can also be used to provide ongoing feedback to the students as they work on this task.

Assessment Strategies

Observation



produce a desired output and that perform a useful function (e.g., a clothesline);

Teaching / Learning

Teacher poses the following problem: Your school has been awarded a flag in recognition of its superb fitness program. A flagpole is needed to fly this flag in the place of honour at the front of the school. Your job is to design and construct a working model of this flag pole. Each group will be given a miniature flag (16 cm by 8 cm) to fly. The flagpole is to be free-standing. Teacher shares with students the rubric to be used, and highlights criteria.

Teacher distributes the Flagpole worksheet to each student, and explains that although they will be working in groups, each student is responsible for recording his/her own work.

1) Working in groups, students brainstorm possible solutions/plans for the problem.

2) Students decide on the best solution.

3) Students make a plan on paper that includes: a labeled diagram with estimated measurements and a list of materials.

4) Students construct the model of their plan.

5) Students test their design (raise and lower flag pole; try to blow it over with hair dryer).

6) Students make modifications to their model as necessary.

7) Students keep a log of daily activities.

Criteria: (Students could also answer these questions in their science journal)

Grade 5: Is the structure stable?
Is the structure strong; does it support the mass of the flag and pole as well as withstand other
natural forces such as wind and the motion of cranking the flag?

Grade 6: Does the flag rise and descend with ease?
Can you explain the change in motion that occurs?

Both Grades: Is it aesthetically pleasing and visible?

Learning Log
Exhibition/demonstration

Assessment Recording Devices
Rubric

Adaptations

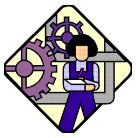
Did you work cooperatively?

Resources

Raise the Flag!	
Flagpole worksheet	Flagpole worksheet.cwk
polar fleece/velvet	1 flag
graph paper	
readily available materials	
hair dryer	

Notes to Teacher

Teacher Reflections



May The Force Move You

Forces Acting on Structures & Mechanisms; Motion **A Unit for Grade 5/6** **300 mins**

Description

Key Learnings

Grade 5

There are many types of forces that can act upon an object: air pressure, mass, compression, tension.

Different forces have different effects on different structures and mechanisms.

Mechanisms can change the amount of effort required to move an object or load.

Forces acting on structures and mechanisms can be both identified and measured.

There are skills and strategies required for scientific inquiry and technological design.

Grade 6

Motion can be classified into four types: linear, rotational, reciprocating and oscillating.

The motion of an object, stationary or moving, can be changed by applying a force.

Mechanisms change one type of motion into another and transfer one type of energy into another.

Forces acting on structures and mechanisms can be countered.

There are skills and strategies required for scientific inquiry and technological design.

Students work on their Culminating Performance Tasks:

An Uplifting Experience--Grade 5

The McPaz Amusement Park is sending out tenders/requests for an engineering firm who can make their park more accessible to those who require a wheelchair. The park is built on two levels so as not to interfere with the natural elevation of the area. The contract will be awarded to the firm whose design can lift the greatest load with the least amount of force. Your task will be to submit a labeled diagram of your plan that will lift a measured load from one level to another. You will need to create a working scale model along with a list of materials required for its construction. You will be required to test this design and make and record modifications where necessary.

An Amusing Adventure--Grade 6

You are an engineer who has been contracted by the Ballenson Amusement Park to design a new

Expectations

5s77 A • demonstrate an understanding of the effect of forces acting on different structures and mechanisms;

5s78 A • design and make load-bearing structures and different mechanisms, and investigate the forces acting on them;

5s79 A • evaluate the design of systems that include structures and mechanisms, and identify modifications to improve their effectiveness.

6s78 A • demonstrate an understanding of different kinds of motion (linear, rotational, reciprocating, oscillating);

6s79 A • design and make mechanical devices, and investigate how mechanisms change one type of motion into another and transfer energy from one form to another;

Groupings

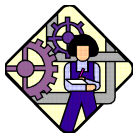
Students Working Individually

Teaching / Learning Strategies

Direct Teaching
Model Making
Problem-solving Strategies

Assessment

Teacher uses rubrics (see Resources) to provide ongoing feedback of the process of working on the Culminating Performance Tasks, and to evaluate the final product (both the built model and the presentation of the model).



6s80 A • identify modifications to improve the design and method of production of systems that have mechanisms that move in different ways.
5m37 • demonstrate an understanding of and ability to apply appropriate metric prefixes in measurement and estimation activities;
6m42 • demonstrate an understanding of and ability to apply appropriate metric prefixes in measurement and estimation activities;

Teaching / Learning

1) Teacher goes over Culminating Performance Tasks with students.

2) Teacher reviews the rubrics (see Resources) with students, drawing attention to what a level three project will look like and how it will function.

3) Teacher reviews safety precautions/use of tools, and discusses with students how the room will be set up (see Subtask Notes). Teacher reminds students which tools will be available to use. (All tools with which they have had experience can be used).

4) Teacher reminds students that they will be following the design process.

Day One: Students define the problem and brainstorm possible solutions in their science journal.

Day Two: Students continue brainstorming if necessary, and decide on a plan. Begin developing a plan (working drawings, written plans, materials needed).

Day Three: Continue developing a plan. Check with teacher when plan is completed. Begin building model.

Day Four: Continue building--make modifications where necessary.

Day Five: Continue building--make modifications where necessary.

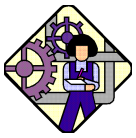
Day Six and Seven: Conclude building and present models. During presentations, grade five students will test their structures for strength and stability. Grade six students will explain the change in motion that their model demonstrates.

5) At the end of each day, students should write in their

Assessment Strategies
Performance Task

Assessment Recording Devices
Rubric

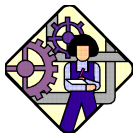
Adaptations



Learning Log and discuss the progress made during that day.

Resources

	**An Uplifting Experience - Grade 5**	
	**An Amusing Adventure - Grade 6**	
	**Student initiated materials**	
	**Design Process Sheet**	1
	**Copy of Culminating Task**	1
	**Copy of Rubric for Culminating Task**	1
	**Standard design and build tools and materials**	
	**Commercial gears and pulleys**	



Notes to Teacher

Safety precautions to review with students before they begin working on their project:

In general:

When using the tools (**saw and drill**) students should always wear the safety goggles.

When working at their desk, if they prefer to stand they should tuck in their chair and stand behind it to avoid having others trip over chairs when trying to pass.

Obviously, there should be no fast movement (including running) in the classroom.

Using the tools:

Drilling: Be sure to drill straight up and down. It is helpful to have two students involved.

Sawing: Slide back and forth with gentle, consistent pressure. Applying too great a pressure will not cut through the wood faster; in fact it will cause the saw to get stuck.

Bench Hook/Mitre Board: Be sure that it is on a flat surface with a straight edge onto which it may be hooked. It may be clamped to a table to provide extra stability.

Glue Gun: Never touch the tip! Allow glue gun to cool before returning to the storage bin.

Remember: "Righty tightly--Lefty Loosey" This saying seems to help students remember which way to turn screws in order to tighten or loosen them.

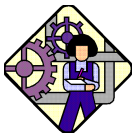
Suggestions for setting up the room for the building portion of this unit:

1) Move desks into groups of four to provide larger working areas and more space to walk around within the classroom.

2) Have stations that are clearly marked.

a) Set up a gluing station on a table near outlets in order that the glue guns can be plugged in and rest on the table (maximum 4 students using glue guns). Keep gussets and joiners at this location as well.

b) Set up a drilling station at a table that has vice clamps attached. Keep drill bits, rulers and safety goggles handy at this station (maximum 4 students).

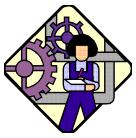


c) Set up a sawing station (maximum 4 students). Keep wood, dowel, rulers and safety goggles handy. *

d) Set up an area that can be used to store works in progress.

* Gluing using the wood glue may be done at their desk. Sawing may also be done at their seat as long as they have a bench hook, and they are reminded to be careful when walking with tools.

Teacher Reflections



Description

Students put together a model amusement park using their Culminating Performance Task models.

Expectations

5s90 – communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, written notes and descriptions, drawings, charts, and oral presentations (e.g., give a presentation on the process of designing and making a specific structure);

6s92 – communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, written notes and descriptions, charts, drawings, and oral presentations (e.g., describe how a product was created from the first idea to the final model; produce a set of instructions to control the sequence of movements of a mechanical device).

5m50 – estimate the amount of money in collections of coins and bills to $1000 and count to determine the total value;

5m52 – make purchases of and change for items up to $100;

6m50 – represent amounts of money under $100 using the smallest possible number of coins and bills;

6m52 – estimate and count amounts of money to $10 000, using a calculator for most calculations;

5a26 • produce two- and three-dimensional works of art that communicate a range of ideas (thoughts, feelings, experiences) for specific purposes and to specific audiences;

6a25 • produce two- and three-dimensional works of art that communicate a range of ideas (thoughts, feelings, experiences) for specific purposes and to specific audiences, using a variety of familiar art tools, materials, and techniques;

Teaching / Learning

To celebrate the culmination of a successful unit, students and teacher will cooperatively put together a model amusement park using their models from the Culminating Performance Task in this display.

You may consider inviting parents, other classes, or media to celebrate with you!

NOTE: Math connection--make popcorn and sell it

Groupings

Students Working As A Whole Class
Students Working In Small Groups

Teaching / Learning Strategies

Community Involvement
Collaborative/cooperative Learning

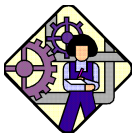
Assessment

This is time to celebrate learning without concern for how it will be assessed or evaluated; by this time in the unit more than adequate evidence would have been gathered to enable the teacher to make thoughtful evaluations of the students' learning.

Assessment Strategies

Assessment Recording Devices

Adaptations

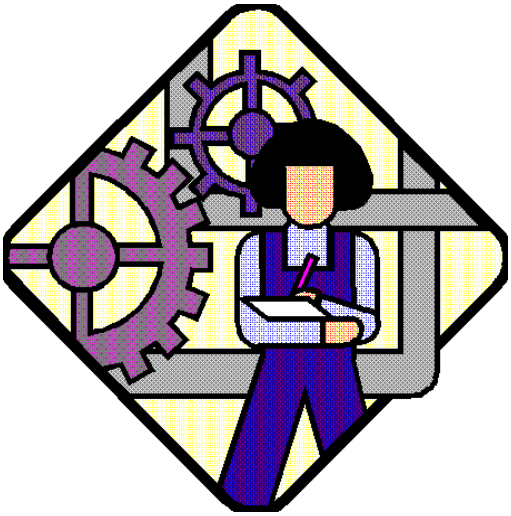


Art connection--make posters to advertise the opening of the McPaz/Ballenson Amusement Park

Resources

Notes to Teacher

Teacher Reflections



Appendices

May The Force Move You

Forces Acting on Structures & Mechanisms; Motion

Resource List:

Black Line Masters:

Rubrics:

Unit Expectation List and Expectation Summary:

May The Force Move You

Forces Acting on Structures & Mechanisms; Motion A Unit for Grade 5/6

Rubric

- ☐ **An Amusing Adventure - Grade 6** **ST 2**
  2
  Rubric for the Grade 6 Culminating Performance Task "An Amusing Adventure"; specific desrcriptors can also be used to provided ongoing feedback throughout the unit
- ☐ **An Amusing Adventure - Grade 6** **ST 12**
  2
  Rubric for the Grade 6 Culminating Performance Task "An Amusing Adventure"; specific desrcriptors can also be used to provided ongoing feedback throughout the unit
- ☐ **An Uplifting Experience - Grade 5** **ST 2**
  2
  Rubric for the Grade 5 Culminating Performance Task, "An Uplifting Experience"; specific desrcriptors can also be used to provided ongoing feedback throughout the unit
- ☐ **An Uplifting Experience - Grade 5** **ST 12**
  2
  Rubric for the Grade 5 Culminating Performance Task, "An Uplifting Experience"; specific desrcriptors can also be used to provided ongoing feedback throughout the unit
- ☐ **Learning Log** **ST 1**
  3
  Suggested rubric to be used to assess (use specific descriptors to provide ongoing feedback) and evaluate learning log entries.
- ☐ **Raise the Flag!** **ST 11**
  3
  Rubric to be used with Subtask 11.

Blackline Master / File

- ☐ **Change in Motion Activity Cards** **ST 10.6**
  Change in motion activCards.cwk
- ☐ **Classifying Simple Machines** **ST 1**
  Simple Machines BLM.cwk
  This suggests a variety of simple machines as a resource for the teacher (taken from the Halton District School Board's document, Simple Machines [for the Junior Division]).
- ☐ **Culminating Performance Task** **ST 2**
  CulPerfTasks.cwk
  This is a blackline master to use to create versions of the Culminating Performance Task for students.
- ☐ **Design Process** **ST 7**
  DesignProcess BLM7.cwk
  A commonly used version of the Design Process (as it relates to Technological Design)
- ☐ **Flagpole worksheet** **ST 11**
  Flagpole worksheet.cwk
- ☐ **Force Activity Cards** **ST 8.5**
  Force Activity Cards.cwk
- ☐ **Gear Template** **ST 10.6**
  Gear Template BLM.cwk
  Enlarge or shrink the template to provide for gears of different sizes.
- ☐ **Grade 5 Walk** **ST 6**
  Walking BLM6.cwk
  Student recording sheet
- ☐ **Grade 5 Walk Answers** **ST 6**
  WalkingAnswersBLM6a.cwk
  Answer sheet for Grade 5 Walk
- ☐ **Grade 6 Hike** **ST 6**
  Hike BLM66.cwk
  Student recording sheet
- ☐ **Grade 6 Hike Answers** **ST 6**
  HikeAnswers BLM66a.cwk
  Answers for Grade 6 Hike
- ☐ **Joints** **ST 10.5**
  Joints.cwk
  Illustrated descriptions of overlapping and butt joints, including gusset corners
- ☐ **Lever Set-up BLM 4.52** **ST 4.5**
  Lever set_up2.cwk
  Diagrams depicting setting up lever investigations
- ☐ **Lever Set-up BLM 4.62** **ST 4.6**
  Grade six_lever set_up.cwk
  Diagrams depicting how to set up lever investigations
- ☐ **Motion Changes BLM 10.6** **ST 10.6**
  ChangesDSM.cwk
  Diagrams illustrating changes in speed, direction, and type of motion
- ☐ **Motion Diagrams for Set-up** **ST 8.6**
  Motion diagrams.cwk

May The Force Move You

Forces Acting on Structures & Mechanisms; Motion A Unit for Grade 5/6

- ☐ **Motion Quiz** **ST 9.6**
  Motion Quiz - BLM96.cwk
- ☐ **Scientific Method** **ST 8.5**
  ScientificMethod BLM8.cwk
  Outlines one approach to experimentation
- ☐ **Skill Builder #1** **ST 10.5**
  Skill Builder1.cwk
- ☐ **Strong Shape Chart** **ST 5**
  BLM5Stable Shapes.cwk
  Student recording sheet
- ☐ **Teacher Resource 1 - Simple Machines** **ST 1**
  TR 1_Simple Machines.cwk
  Examples of simple machines
- ☐ **Teacher Resource 4 - Levers** **ST 4.5**
  TR Types of Levers.cwk
  Examples of the three classes of levers
- ☐ **Teacher Resource - Learning Centers** **ST 8.5**
  Learning Centres.cwk
  This is the same information as in the Unit Notes
- ☐ **Teacher Resource - Strong Shapes** **ST 5**
  TR #5 Stable Shapes.cwk
  Examples of stable shapes
- ☐ **Teacher Resource - Types of Levers** **ST 4.6**
  TR Types of Levers.cwk
  Everyday examples of the three classes of levers as well as diagrams of these levers.
- ☐ **Testing First Class Levers BLM 4.51** **ST 4.5**
  TestingFirst ClassLevers4_5.cwk
- ☐ **Testing Levers BLM 4.61** **ST 4.6**
  Testing LeversBLM4.6.cwk
- ☐ **Testing Pulleys BLM 3.1** **ST 3**
  Testing Pulleys BLM3.cwk
- ☐ **Truss Test** **ST 10.5**
  Truss Test BLM 10.cwk
- ☐ **Truss Types** **ST 10.5**
  TrussBeamBridges.cwk
  Illustrations of various types of trusses in the form of truss beam bridges
- ☐ **Types of Forces Quiz** **ST 9.5**
  TypesofForces BLM9.cwk
- ☐ **Types of Pulleys BLM 3.2** **ST 3**
  Types of Pulleys.cwk
- ☐ **Unit-Wide Glossary** **Unit**
  GLOSSARY.cwk
- ☐ **Unit-Wide Web sites** **Unit**
  Unit_Wide Websites.cwk

Licensed Software

- ☐ **1998 Candian and World Enclyclopedia** **ST 5**
- ☐ **Neighborhood Walks** **ST 5**
- ☐ **The Way Things Work, 2.0** **ST 5**

Print

- ☐ **Everything You Need to Know about Science Homework** **Unit**
  Anne Zeman/Kate Kelly
  0-590-49357-4
  Desk Reference for students, teachers and parents.
- ☐ **Focus On Science** **Unit**
  Frank Flanagan/Alexander Teliatnik
  0-669-95035-1
  Science Text
- ☐ **Focus on Science** **ST 3**
  Frank J. Flanagan/Alexander Teliantnik
  0-669-95035-1
  Scienct Text Book. Refer to chaper on Forces and Machines. In particular, see pages 28-31.
- ☐ **Force and Motion** **Unit**
  JoAnne Merrell
  1-55734-647-X
  Reproducible Teacher/Student Workbook
- ☐ **Getting Assessment Right: Science and Technology Grades 1-8** **Unit**
  Ron Ballentine/Ruth Dawson
  1-894369-04-1
  Teacher Assessment Resource
- ☐ **Innovations in Science** **Unit**
  Denis Cooke/Barbara Purkis
  0-03-922276-4
  Science Text
- ☐ **Science and Technology** **Unit**
  Brian Williams
  0-439-09966-8
  Reference Book
- ☐ **Science and Technology: Forces on Structures--5** **ST 3**
  Steve Campbell et. al.
  0-201-64988-8
  Science Text. Refer to pages 6-7 (using a spring scale), 18-21 (using machines to lift loads).
- ☐ **Science and Technology:Motion-6** **ST 4.6**
  Steve Campbell et. al.
  0-201-61405-7
  Science Text. Refer to pages 24 to 27 for description of three classes of levers.

May The Force Move You

Forces Acting on Structures & Mechanisms; Motion A Unit for Grade 5/6

- ☐ **Science and Technology-Forces on Structures-5** **Unit**
  Steve Campbell et. al.
  0-201-64988-8
  Science Text
- ☐ **Science and Technology-Motion-6** **Unit**
  Steve Campbell et. al.
  0-201-61405-7
  Science Text
- ☐ **Science Everywhere-5** **Unit**
  Les Asselstine/Rod Peturson
  0-7747-0558-2
  Science Text
- ☐ **Science Is...** **Unit**
  Susan V. Bosak
  0-590-74070-9
  Science Activity Resource Book
- ☐ **Simple Machines** **Unit**
  Paul and Clair Reid
  1-55035-584-8
  Teacher Blackline Master Activity Book
- ☐ **The Usborne Big Book of Experiments** **Unit**
  Alastair Smith
  0-590-97320-7
  Science Reference Book

Media

- ☐ **Bill Nye The Science Guy** **ST 5**
  KCTS Television (with Rabbit Ears Productions & Walt Disney Television)
  Bib Key 354692
  Addresses balance and centre of gravity, and tension and compression in structures
- ☐ **How Do They Build Bridges** **ST 5**
  Hearst Broadcasting Products, 1996
  Bib Key 364125
  Shows examples of famous bridges, and bridges being built and destroyed; one of the Popular Mechanics for Kids series

Material

- ☐ **1 m length of masking tape** **ST 7**
  1
  per group
- ☐ **1 m length of string** **ST 4.5**
  1
  per group
- ☐ **1m length of masking tape** **ST 8.5**
  1
  per group
- ☐ **1m length of string** **ST 4.6**
  1
  per group
- ☐ **balloon** **ST 7**
  1
  per group
- ☐ **Balloons** **ST 8.6**
  many
  per group
- ☐ **Blackline Master of trusses** **ST 10.5**
  1
  per group
- ☐ **cardboard** **ST 10.6**
  lots
  per class
- ☐ **cardboard--30 cm by 30 cm (approximately)** **ST 7**
  1
  per group
- ☐ **chairs** **ST 8.6**
  2
  per group
- ☐ **circular cardboard disc** **ST 8.6**
  1
  per group
- ☐ **commercial gears** **ST 10.6**
  6
  per group
- ☐ **Copy of Culminating Task** **ST 12**
  1
  per person
- ☐ **Copy of Rubric for Culminating Task** **ST 12**
  1
  per person
- ☐ **deflated basketball and bicycle pump** **ST 8.5**
  1
  per class
- ☐ **Design Process Sheet** **ST 12**
  1
  per person
- ☐ **desk** **ST 4.5**
  1
  per group

May The Force Move You

Forces Acting on Structures & Mechanisms; Motion A Unit for Grade 5/6

- ☐ **door bolt** — **ST 8.6**
  1
  per group
- ☐ **dowel/teacher's pointer** — **ST 8.6**
  1
  per group
- ☐ **elastic bands** — **ST 8.6**
  1
  per group
- ☐ **Examples of simple machines** — **ST 1**
  6-10 per group
  per group
  See Teacher Resource #1 for examples of simple machines. Ensure that there is an example of each simple machine on each tray.
- ☐ **fulcrum** — **ST 4.5**
  1
  per group
  Suggested fulcrums: chalk board eraser, tin can, wooden block
- ☐ **fulcrum** — **ST 4.6**
  1
  per group
  Examples of Fulcrums: tin can, chalk board eraser, wooden block
- ☐ **glue gun** — **ST 10.5**
  1
  per group
- ☐ **graph paper** — **ST 7**
  3sheets
  per group
- ☐ **graph paper** — **ST 11**
  per group
- ☐ **hair dryer** — **ST 8.5**
  1
  per class
- ☐ **hair dryer** — **ST 10.5**
  1
  per group
- ☐ **keyboard** — **ST 8.6**
  1
  per class
- ☐ **masking tape** — **ST 8.6**
  per group
- ☐ **metre stick** — **ST 4.5**
  1
  per group
- ☐ **metre stick** — **ST 4.6**
  1
  per group
- ☐ **metre stick per group** — **ST 3**
  1
  per group
- ☐ **metric masses--various** — **ST 8.5**
  1
  per group
- ☐ **metric masses-various** — **ST 10.5**
  per group
- ☐ **pail or garbage can** — **ST 8.5**
  1
  per group
- ☐ **paper fasteners/brads** — **ST 5**
  15
  per group
- ☐ **pencil** — **ST 8.6**
  1
  per group
- ☐ **pennies** — **ST 7**
  several
  per group
- ☐ **plastic drinking glass** — **ST 8.5**
  1
  per group
- ☐ **plasticene ball--10 cm in diameter** — **ST 7**
  1
  per group
- ☐ **plasticene--3 cm in diameter** — **ST 8.5**
  1
  per group
- ☐ **polar fleece/velvet** — **ST 11**
  1 flag
  per group
- ☐ **popsicle sticks** — **ST 10.5**
  many
  per group
- ☐ **popsicle sticks** — **ST 10.6**
  lots
  per group
- ☐ **pulleys per group** — **ST 3**
  2
  per group
- ☐ **readily available materials** — **ST 11**
  per group
  wood dowelling, 1 cm X 1 cm wood, scrap wood, straws, string, screw eyes, glue, thick cardboard
- ☐ **ruler** — **ST 5**
  2
  per group
- ☐ **saw and wood** — **ST 8.6**
  1
  per group
- ☐ **scissors** — **ST 5**
  2
  per group
- ☐ **sheets of newspaper** — **ST 8.5**
  10
  per group
- ☐ **shoe with laces** — **ST 4.5**
  1
  per group

May The Force Move You

Forces Acting on Structures & Mechanisms; Motion A Unit for Grade 5/6

- ☐ **shoe with laces** **ST 4.6**
  1
  per group
- ☐ **shoe with laces per group** **ST 3**
  1
  per group
- ☐ **small metric mass** **ST 8.5**
  1
  per group
- ☐ **split pins/brads** **ST 10.6**
  many
  per group
- ☐ **spring scale** **ST 4.5**
  1
  per group
- ☐ **spring scale** **ST 4.6**
  1
  per group
- ☐ **spring scale per group** **ST 3**
  1
  per group
- ☐ **straw** **ST 7**
  1
  per group
- ☐ **straw** **ST 8.6**
  1
  per group
- ☐ **straws** **ST 8.5**
  50
  per group
- ☐ **straws** **ST 10.5**
  many
  per group
- ☐ **string--1m long** **ST 8.5**
  1
  per group
- ☐ **string/fishing line--3m long** **ST 8.6**
  1
  per group
- ☐ **strips of card stock 3cm by 15 cm** **ST 5**
  30
  per group
- ☐ **Student initiated materials** **ST 12**
  per person
  Materials determined by students as needed for work on their Culminating Performance Task
- ☐ **thick string 2 m long per group** **ST 3**
  1
  per group
- ☐ **tinfoil--30 cm by 30 cm square** **ST 7**
  1
  per group
- ☐ **toothpicks** **ST 10.6**
  many
  per group
- ☐ **vice** **ST 10.5**
  1
  per group
- ☐ **washers** **ST 8.6**
  5
  per group

Equipment / Manipulative

- ☐ **Commercial gears and pulleys** **ST 12**
  If the school does not have these and/or is unable to acquire some, student-made gears and pulleys can be used.
- ☐ **hair dryer** **ST 11**
  per class
- ☐ **Standard design and build tools and materials** **ST 12**
  Junior hacksaws, drills, bench hooks, mitre boxes, paper gussets, joiners, wood glue, glue guns, C-clamps, vices, 1 cm X 1 cm wood, .5 cm X 1 cm wood, wooden dowelling, art straws, various wheels (wooden, cardboard), cardboard

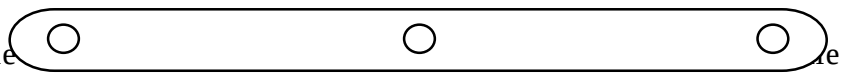
Problem: In what ways can motion be changed?

Hypothesis: (Make an educated guess with reasons to support your ideas)

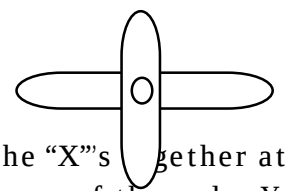
Materials: tongue depressors or cardboard strips, wood or hole punch, brass fasteners, three gears of different sizes, cardboard, gear template, scissors.

Procedure #1--Linking levers

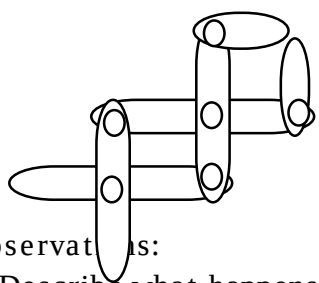
1. Take 4 tongue depressors or cardboard strips and punch hole at each end and the middle of each one. (use wood punch for tongue depressors)



2. Take e using the brass fasteners. (to make two "X"s)



3. Link the "X"s gether at the ends. Cut the final tongue depressor in half and attach to one of the ends. You will need to punch a hole in the rounded end of each half.



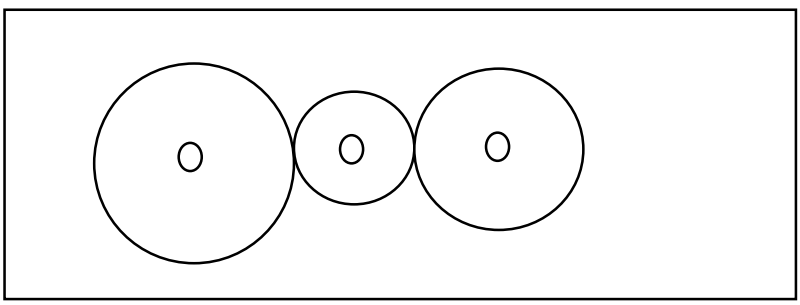
Observat s:
1. Describe what happens when the ends are brought together and then opened again.
2. Is motion changing speed, direction or type? How do you know?

Conclusion:

Procedure #2--Getting the Gears

1. Take three gears of different sizes. Attach the largest gear to a rectangular piece of cardboard by pushing a brass fastener through the middle of the gear and through the cardboard.

2. Attach the next two gears in the same manner, making certain that the gear teeth mesh.



Observations:

1. Turn the largest gear clockwise. In what direction are the other two gears moving? ?

2. Is this a change in speed, direction or type of motion? How do you know?

3. Turn the largest gear 3 full revolutions. How many revolutions does the small gear make? the medium gear?

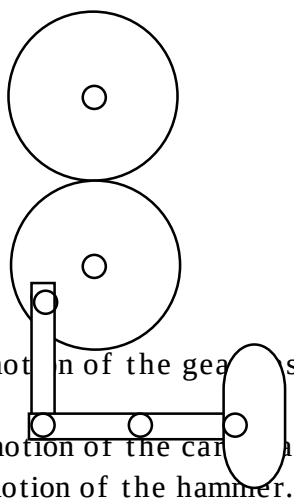
4. Is this a change in speed, direction or type of motion? How do you know?

Conclusion:

Procedure #3--Hammer Time

1. Trace two copies of the gear template onto paper. Glue the paper onto cardboard and then cut out the gears. Punch a hole through one of the gears half way between

the centre and the outer edge.
2. Attach these gears one on top of the other using brass fasteners. Be sure that the teeth mesh and the one with the hole punched in it is on the bottom.
3. Take two cardboard strips and punch holes in both ends. Take on strip and attach it to the bottom gear through the hole in the gear but NOT through the cardboard backing.
4. Punch a hole in the middle of the last cardboard strip. Cut out and glue on the shape of a hammer head onto one end of this cardboard strip. (or fasten with brass fastener)
5. Attach the hammer to the other cardboard strip but NOT through the cardboard backing.
6. Attach the hammer to the cardboard backing using the hole in the middle.

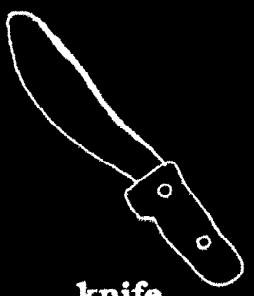


Observations:

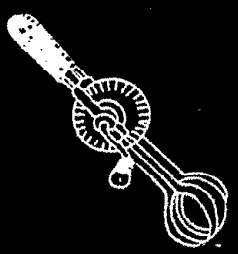
1. Describe the motion of the gears you turn the top gear in a clockwise direction.
2. Describe the motion of the cardboard strip attached to the gear.
3. Describe the motion of the hammer.

Conclusion:

BLM # 1--Classifying Simple Machines

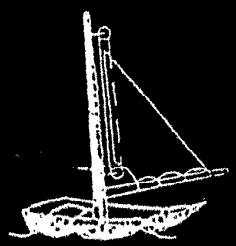


knife

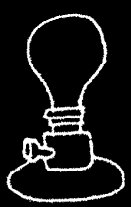


hand beater

crowbar

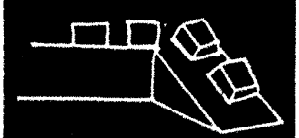


sailboat

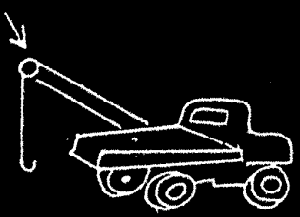


light bulb

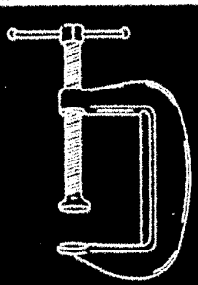
screw



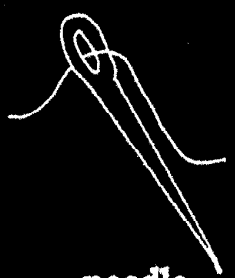
loading ramp



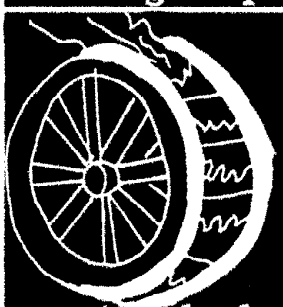
tow truck



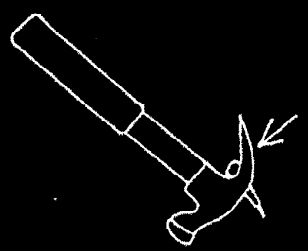
clamp



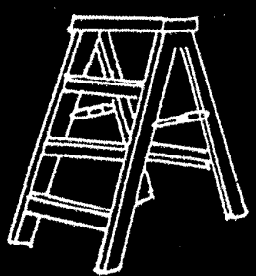
needle



water wheel

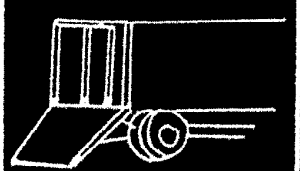


hammer

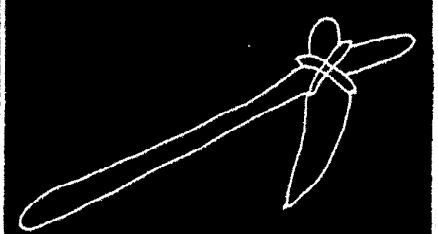


ladder

roller skates

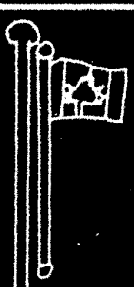


moving van

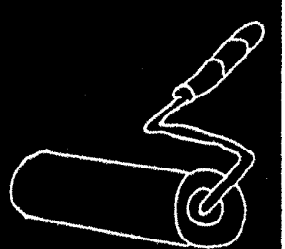


axe

wheelchair



flagpole



roller

bottle opener

Culminating Performance Tasks

An Uplifting Experience - Grade 5

The McPaz Amusement Park is sending out tenders for an engineering firm who can make their park more accessible to those who require a wheelchair. The park is built on two levels so as not to interfere with the natural elevation of the area. The contract will be awarded to the firm whose design can lift the greatest load with the least amount of force. Following the design process, your task will be to submit a labeled diagram of your plan that will lift a measured load (1 kg) from one level to another (30 cm). You will need to create a working scale model along with a list of materials required for its construction. You will be required to test this design and make and record modifications where necessary.

An Amusing Adventure - Grade 6

You are an engineer who has been contracted by the Ballenson Amusement Park to design a new feature attraction. Following the design process, your task will be to submit a labeled diagram of this feature attraction that includes at least one change in motion, speed or direction. You will need to create a working scale model (no more than 25 cm high), along with a list of materials required for its construction. During the construction you will be required to test this design and make and record modifications where necessary.

Design Process

Define Problem

Brainstorm Possible Solutions

Choose One Solution

Design Structure or Device;
Make Plan After Necessary Research
(Working Drawings, Plans, Materials;
Paper or Computer)

Construct/Create Solution

Test Structure or Device;
Evaluate Plan

Improve/modify Structure or Device

Communicate

Flagpole Challenge

Design Challenge:
Your school has been awarded a flag in recognition of its superb fitness program. A flagpole is needed to fly this flag in a place of honour at the front of the school. Your job is to design and construct a working model of this flag pole. Each group will be given a miniature flag (16 cm by 8 cm) to fly. The flagpole is to be free standing.

Brainstorm possible solutions:

Our Solution:

Diagram of our flagpole, list of materials used:

Construction Observations:

Testing Results:

Modifications/Improvements:

Communicate: Is your plan successful? How do you know? How did your group work together?

Activity Centre #1

Problem: What happens when tension (pulling) and compression (pushing) are applied to a shape?

Hypothesis/Guess:

Materials: plasticiene or play dough or silly putty

Procedure:
1. Form the plasticiene into a cube. Apply tension and compression to the shape.

Observations: What happens to the shape when each force is acted upon the cube?

Conclusion: What conclusion can you make about the effect of a force on a shape?

OR

Activity Centre #1

Problem: What happens when tension (pulling), compression (pushing), and air pressure are applied to a structure? Which structure can withstand the greatest force of wind (air pressure), and load (weights)?

Hypothesis/Guess:

Materials: 50 straws or ten sheets of newspaper, one metre of masking tape, hair dryer, metric masses

Procedure: As a group, design and build a bridge 35 cm long that will withstand the force of wind and support a load. Suspending the weight from the centre of the bridge will be the load test (pulling on the bridge beam). Using a hair dryer set at a constant high speed will test the effect of wind (compression/pushing on the bridge).

Observations: What happens to the structure when a force is acted upon it? What were the limits of your structure?

Conclusion: What conclusion can you make about the effect of a force on a structure?

Activity Centre #2

Problem: Does air have pressure?

Hypothesis/Guess:

Materials: Drinking glass, water, cue/index card that will fit over the top of the glass, pail/garbage can/aquarium

Procedure:
1. fill the glass about 2/3 full of water
2. wet the rim of the glass
3. hold the cueindex card tightly against the mouth of the glass (no air bubbles should enter between the card and the glass)
4. while holding the glass with the cue/index card on top over a pail, turn the glass upside down
5. gently let go of the cue/index card

Observations: What happens to the water in the glass?

Conclusions: Why do you think this happened?

OR

Activity Centre #2

Problem: Does air have pressure?

Hypothesis/Guess:

Materials: basketball, pump pin, bicycle pump

Procedure:
1. deflate the basketball by inserting the moistened pin into the valve
2. have a group member sit on the basketball
3. attach a bicycle pump to the pin
4. inflate the basketball

Observations: What happens to the student?

Conclusion: Why do you think this happens?

Activity Centre #3

Problem: What effect does air resistance have on gravity?

Hypothesis/Guess:

Materials: small mass, string, paper ball, flat piece of paper, stop watch

Procedure:
1. While standing on a chair, drop the small mass--remembering from where it is dropped. Time how long it takes to get to the floor.
2. Cut four pieces of string the same length and tape one end of each string to the paper ball and the other ends to the small mass. Drop from same height and record time to reach the ground.
3. Cut four pieces of string the same length and tape one end of each string to each corner of the flat paper and the other ends to the small mass. Drop from same height and record time to reach the ground.

Observations: What do you notice about each time of descent? Why do you think this is so?

Conclusions: What conclusions can be made about the effect of air resistance on gravity?

OR

Activity Centre #3

Problem: Is it easier to move with or against gravity:

Hypothesis/Guess:

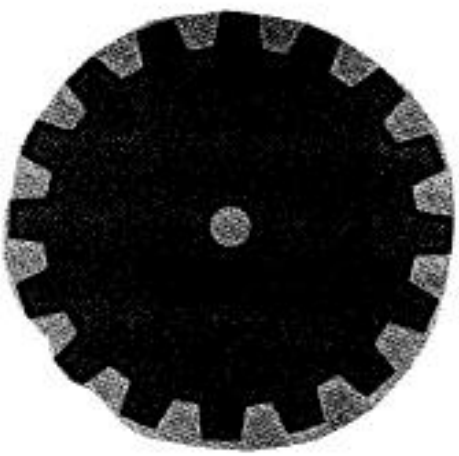
Materials: chair, crate or step

Procedure:
1. Stand on the step/chair/crate and jump off.
2. Jump up onto the step/chair/crate.

Observations: What do you notice about the ease it takes to do each activity?

Conclusion:

Gear Template



While I was Walking.....

Pulleys	1st Class Levers	Strong shapes; Stable objects	Forces in Action

While I was Walking.....

Pulleys	1st Class Levers	Strong shapes; Stable Figures	Forces in Action
flagpole	see saw	roof rafters	vehicle moving
clothesline	brake on bicycle	truss bridge	pushing a child carrier pulling a wagon
bicycle (gears) crane	shovel	frame of new building	wind on a sail, flag, leaves, hair
well sailboat mast		swing set tower	starting a machine with a pull cord kite flying

Take a Hike

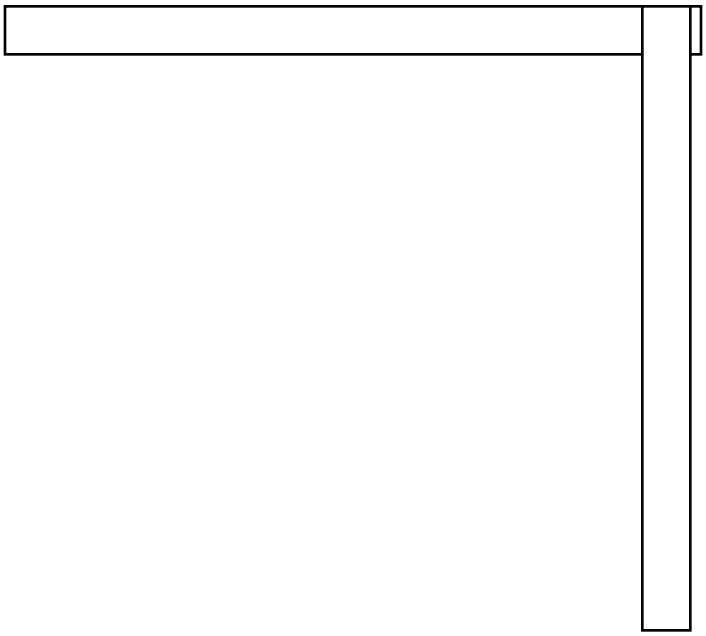
Pulleys	Different Classes of Levers	Strong shapes; Stable Objects	Examples of Motion

Take a Hike

Pulleys	Different Classes of Levers	Strong shapes; Stable Objects	Examples of Motion
flag pole	see saw (1st)	roof rafters	linear--walking, biking airplain flying
clothes line	shovel (1st)	new building frame	rotational--wheels turning
bicycle (gears)	wheel barrow (2nd)	truss bridge	oscillating--swinging sprinkler
well sail mast crane	bicycle break (3rd)	tower	

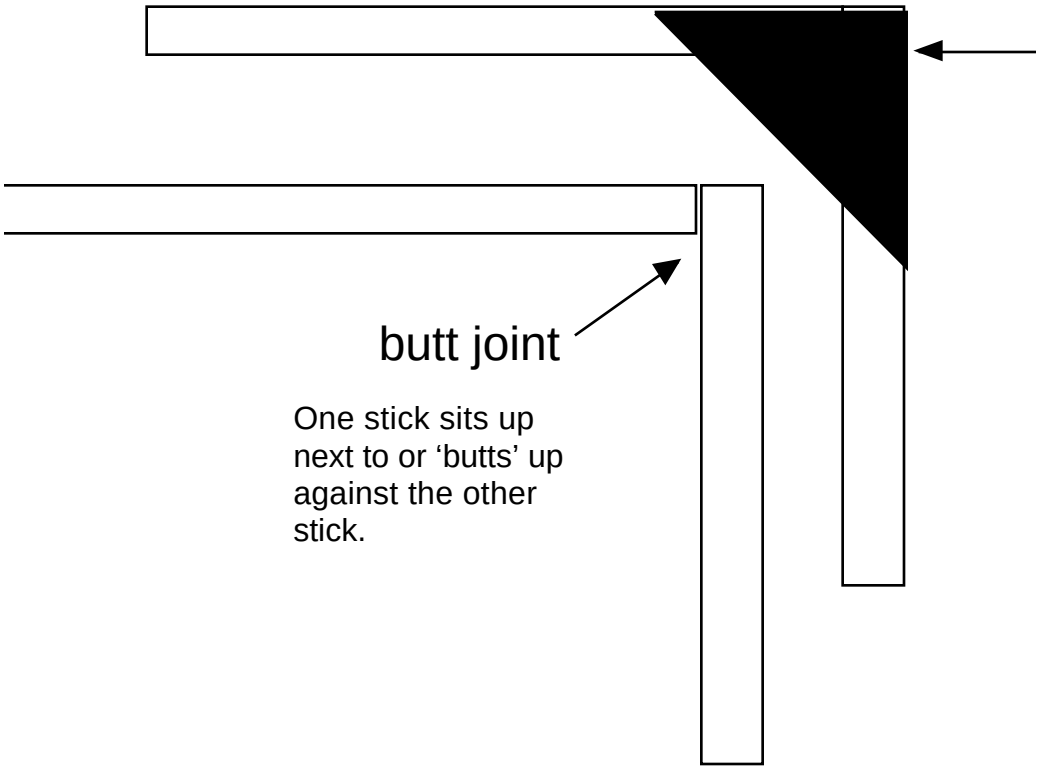
JOINTS

Overlapping Joints



One piece of wood or popsicle stick sits on top of or ‘overlaps’ the other stick.

Butt Joints with Gusset Corners



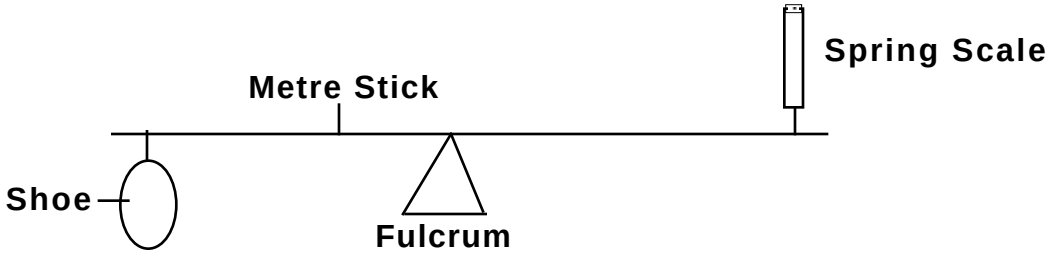
gusset corner
shown covering a butt joint. Gussets may be made of index card paper, bristol board, or firm card paper

butt joint

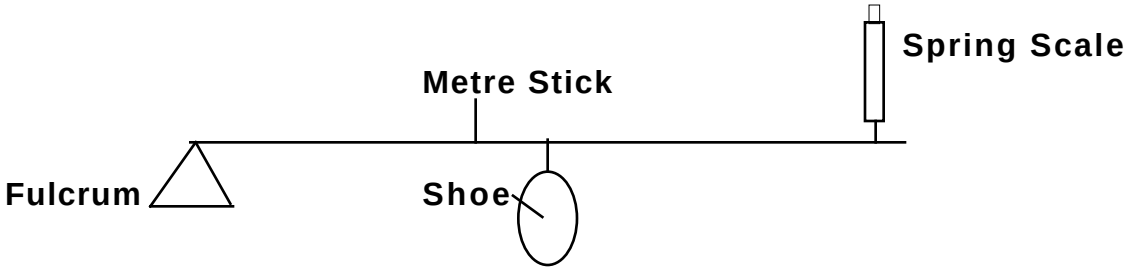
One stick sits up next to or ‘butts’ up against the other stick.

Lever Set-up

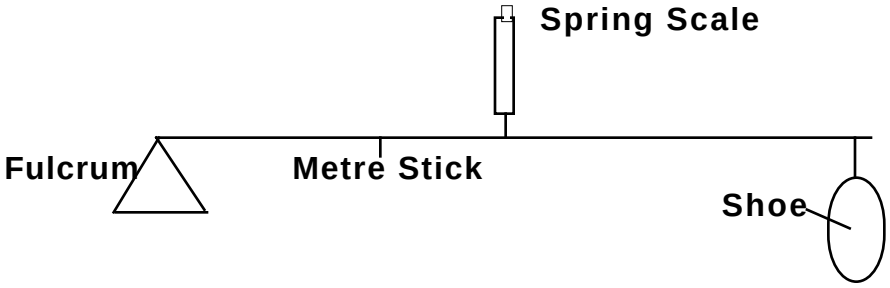
1. First Class Lever--Fulcrum in the middle



2. Second Class Lever--Load in the middle



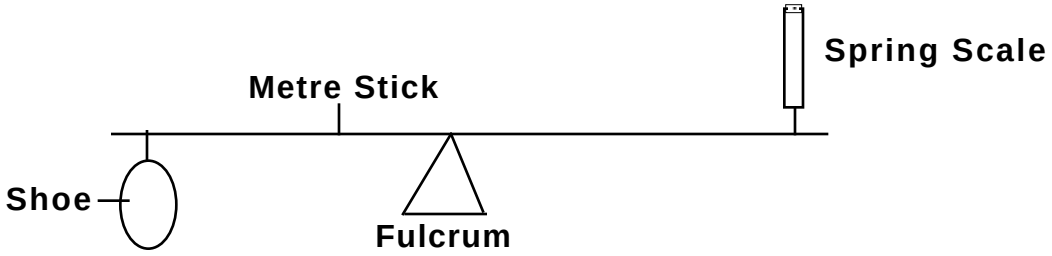
3. Third Class Lever--Effort in the middle



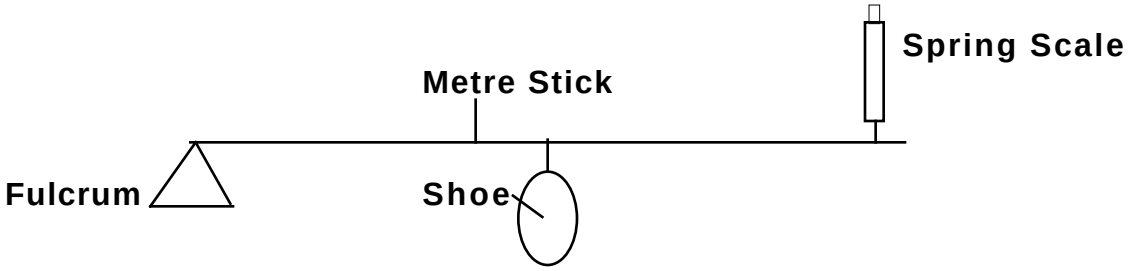
NOTE: For each diagram, the LOAD is the shoe, the EFFORT is where the force to lift is applied (and measured) which is the spring scale, and the FULCRUM is one of the suggested objects used to support the lever arm (metre stick).

Lever Set-up

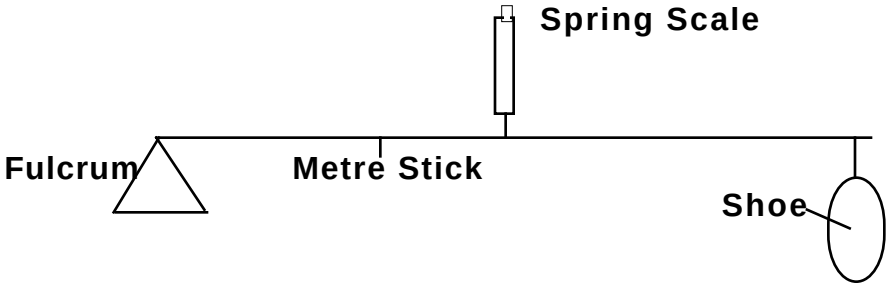
1. First Class Lever--Fulcrum in the middle



2. Second Class Lever--Load in the middle

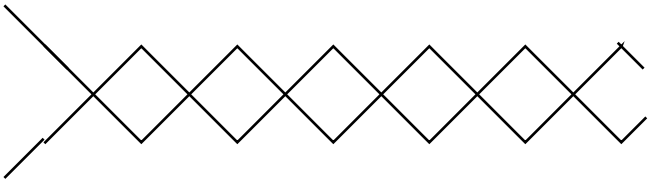


3. Third Class Lever--Effort in the middle



NOTE: For each diagram, the LOAD is the shoe, the EFFORT is where the force to lift is applied (and measured) which is the spring scale, and the FULCRUM is one of the suggested objects used to support the lever arm (metre stick).

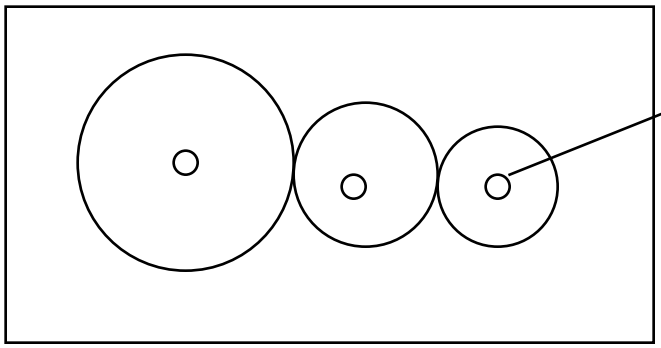
Linking Levers: Changing Direction



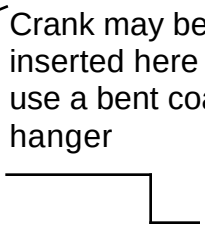
Use tongue depressors or strips of cardboard, and fasten with split pins at every intersection

Gear Systems: Changing Speed

Brads / split pins go where small circles are

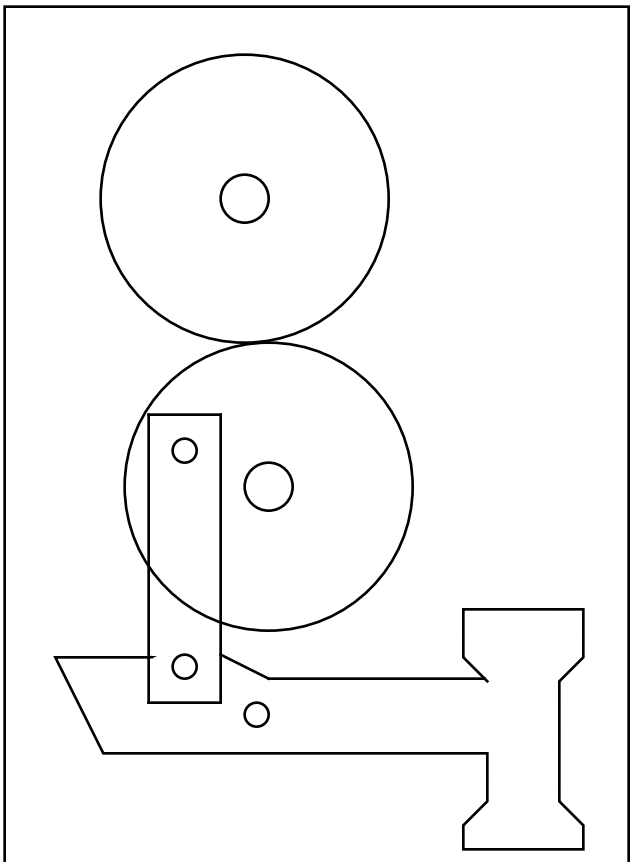


Crank may be inserted here - use a bent coat hanger



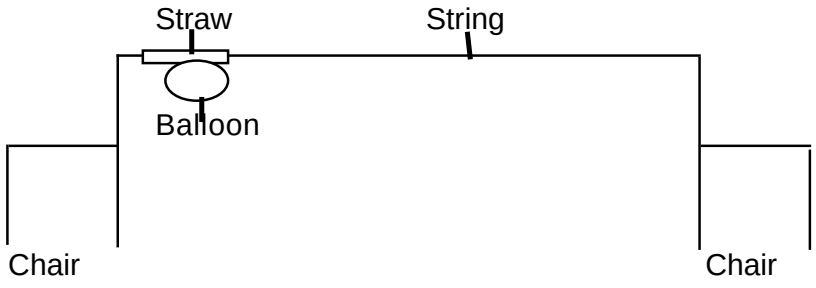
Changing Type of Motion

Brads/split pins go where small circles are - attach to cardboard

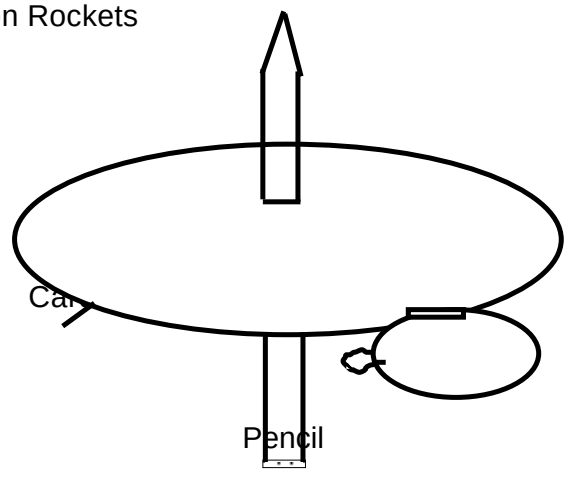


Diagrams for Motion Activities

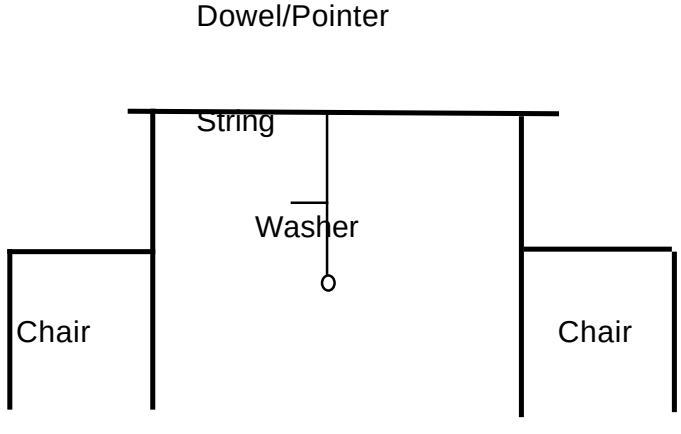
1. Balloon Rockets



2. Circular Balloon Rockets



4. Pendulum



Subtask 9.6 BLM 9.6 Types of Motion Name: _____

MOTION: Complete this chart showing the four kinds of motion, the characteristics of each type of motion, and outside world examples of each type of motion.

Type of Motion	Characteristics	Outside World Examples

Motion Quiz-(Modified) Name: _____

Match the type of motion to the appropriate definition:

RECIPROCATING ___ a) Motion along a straight line path as in a tight rope walker

LINEAR ___ b) Motion along a curved path as in a ferris wheel

OSCILLATING ___ c) Motion back and forth in a straight line as in a plunger

ROTATIONAL ___ d) Motion back and forth around a central point as

SCIENTIFIC METHOD

Problem:

Hypothesis:

Materials:

Procedure:

Observations:

Conclusions:

Applications:

There are two kinds of joints: overlapping joints and butt joints (two pieces of material joined end to end). Joints can be reinforced with gusset corners (a right angled triangle shape made of paper that is used to strengthen o joint. Please refer to the joints BLM # 10.51)

SKILL BUILDER # 1

PROBLEM: Which rectangular prism will be able to demonstrate the ability to withstand the greatest amount of strength? (choice: overlapped corners, butt corners, butt corners with gussets)

HYPOTHESIS / GUESS:

MATERIALS:
* glue (glue gun or wood glue)
* popsicle sticks - with rounded edges trimmed off
* paper gussets
* weights (eg. books, bricks, metal weights)
* string

PROCEDURE:
* design on paper a rectangular prism (cube) using a popsicle stick as length of the sides
* starting with four sticks, create a square using overlapping joints to attach the sticks together at the corners and glue
* continue to build the prism using overlapping joints to attach the sticks at each corner. Set aside to dry.
* repeat the procedure using butt joints at each corner. Set aside to dry before testing.
* repeat the procedure using butt joints with gusset at each corner. Set aside to dry before testing.
* once the prisms are dry, test to see which can hold the greatest weight using the weights to determine the strongest structure.

OBSERVATIONS: What do you notice about the strength of the two structures?

CONCLUSIONS: Using the weight numbers you have recorded, what conclusions can you make regarding the structures that you created?

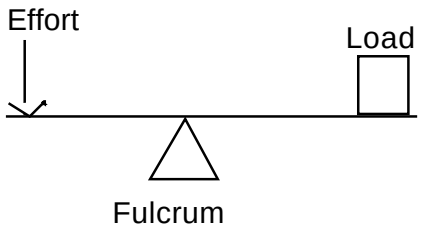
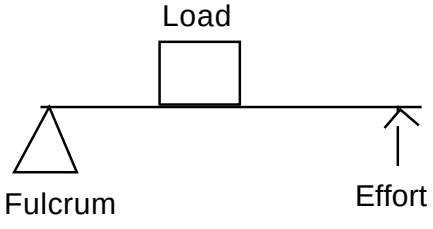
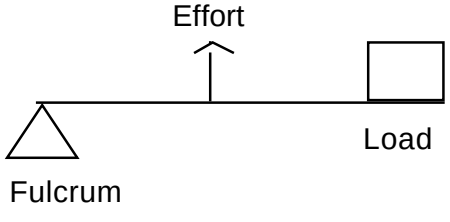
Strong Shapes

Diagram of Shape Tried	Was it Strong?	Changes needed for increased strength

Teacher Resource #1 (**Consider pictures if item not available**)

Simple Machine	**Every day examples**
1) Pulley	**Block and Tackle** **Toy truck with crane** **Flag pole** **Pulley**
2) Lever	**Scissors** **See-saw (toy)** **Hammer** **Equal arm balance scale**
3) Wheel and Axle	**Door knob** **Toys with wheels** **Toys with cranks** **Pencil Sharpener**
4) Inclined Plane	**Ramp (pictures)** **Door stop** **Dump truck** **Stairs**
5) Wedge	**Saw** **Scissors** **Plastic knife** **Letter opener**
6) Screw	**Screw** **Cork screw** **Screw cap on bottle**

Classes of Levers and Some Common Examples

Class	Diagram	Everyday Examples
First Class		Scales (balance), scissors (two first class levers joined at the fulcrum), hammer, see-saw.
Second Class		Spoon, paper cutter, wheel barrow, nutcracker
Third Class		Baseball bat, broom, rake, hammer (when used to drive nails), stapler, tweezers, tongs

Learning Centres

Learning Centres are a way to cope with fewer materials. Only enough materials for one group are needed, and groups of students rotate to each centre.

Learning Centres do require table space. Clearly indicate where each centre is to be performed and group a minimum of four desks together to provide a working space if tables are not available.

Learning Centres do work best if students are independent. Students are required to keep track of results of centres and, as they are not doing the same investigation as the other groups they must remain focused on their own task.

Learning Centres do require preparation time by the teacher. However, once they are set up you only need to replenish used materials. (e.g. balloons) It may take awhile to feel comfortable with students doing different things at the same time.

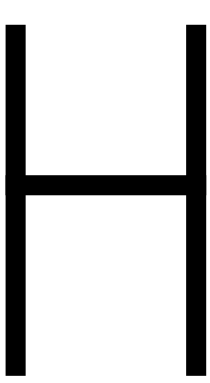
Learning Centres sometimes work better when you have a tracking sheet for each student. That way, when finished a centre, students check off which one was completed and the teacher can easily see who has fallen behind. The teacher may also want to create a Learning Centre Wheel that indicates the order in which students will perform each centre.

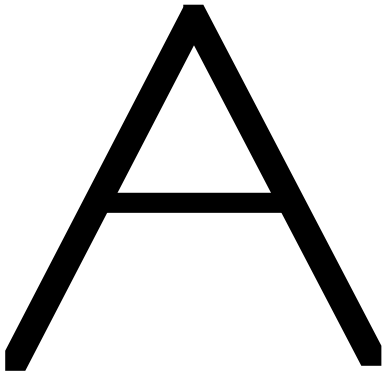
Learning Centres can be fun, but only do what you are comfortable with--you do have a combined grade after all.

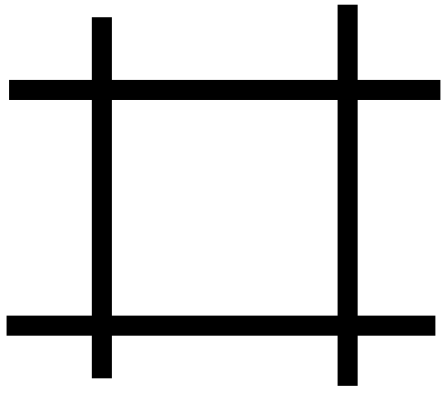
Strong Shapes

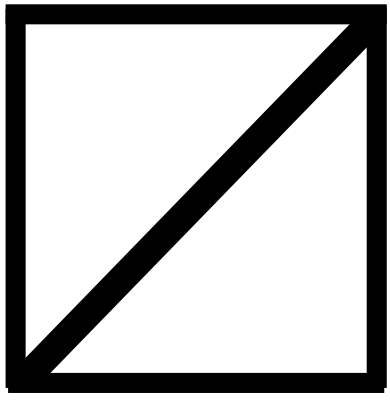
These are some shapes that students may construct.

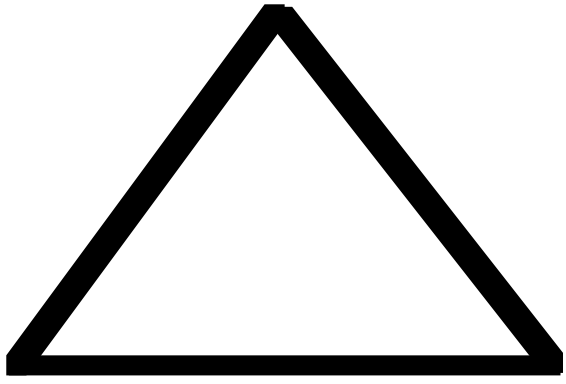
Each shape offers strength although some are stronger than others. Students should notice that shapes containing triangles withstand applied forces most effectively.



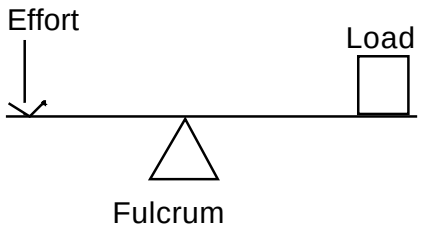
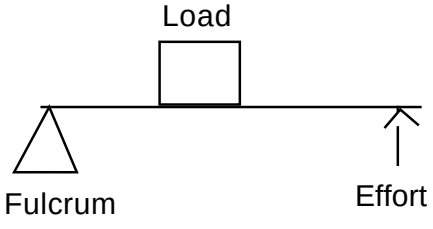
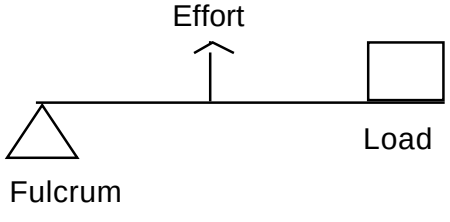








Classes of Levers and Some Common Examples

Class	Diagram	Everyday Examples
First Class		Scales (balance), scissors (two first class levers joined at the fulcrum), hammer, see-saw.
Second Class		Spoon, paper cutter, wheel barrow, nutcracker
Third Class		Baseball bat, broom, rake, hammer (when used to drive nails), stapler, tweezers, tongs

Testing 1st Class Levers		
Set-up	Resistance (N)	Effort (N)
Fulcrum at 50 cm mark		
Fulcrum at 30 cm mark		
Fulcrum at 15 cm mark		

Testing Classes of Levers

Set-up	Resistance (N)	Effort (N)
1st Class Fulcrum at 50 cm mark Load at 10 cm mark Force Meter at 90 cm		
1st Class Fulcrum at 30 cm mark Load at 10 cm mark Force meter at 90 cm		
2nd Class Fulcrum at 10 cm mark Load at 50 cm mark Force meter at 90 cm		
2nd Class Fulcrum at10 cm mark Load at 30 cm mark Force meter at 90 cm		
3rd Class Fulcrum at 10 cm mark Load at 90 cm mark Force meter at 50 cm		
3rd Class Fulcrum at 10 cm mark Load at 90 cm mark Force meter at 70 cm		

Testing Pulleys		
Set-up	Resistance (N)	Effort (N)
Without a pulley		
With a fixed pulley		
With a movable pulley		
Fixed-Movable Combination		

BLM 10 Subtask 10.5

TRUSS TEST

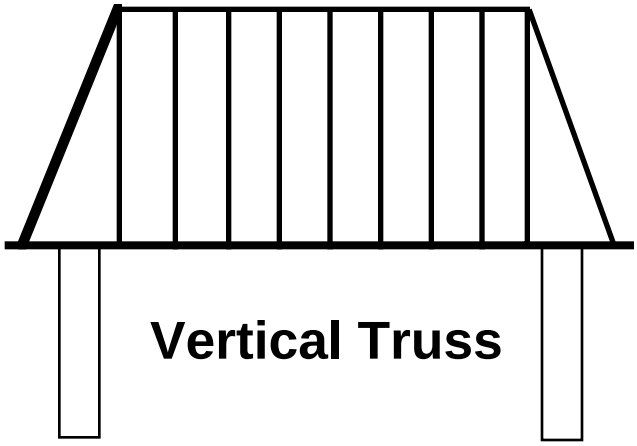
Test the shapes that you have made for the following characteristics:

Shape draw & label shape	**Force**	**Test**	**Range of Strength**	**Modifications**

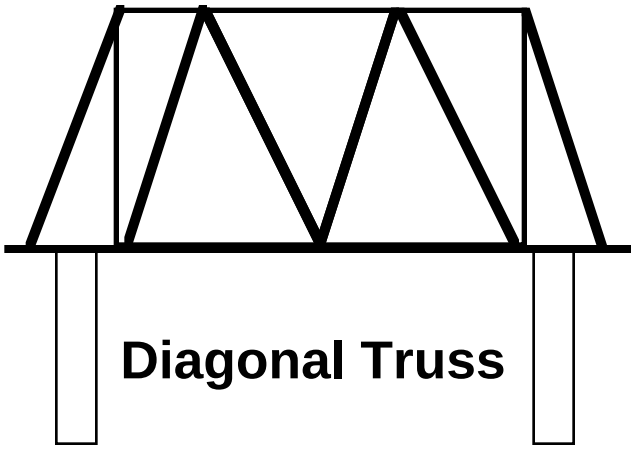
Types of

TRUSS BEAM BRIDGES

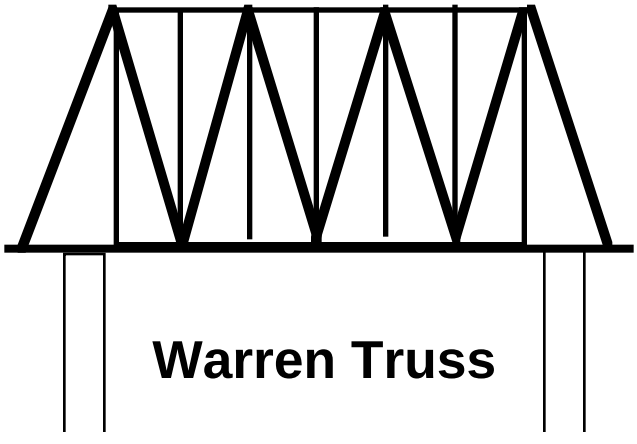
There are many different types of designs used in the truss beam bridge.
Every design uses a series of triangular shapes to help distribute the load.



Vertical Truss



Diagonal Truss

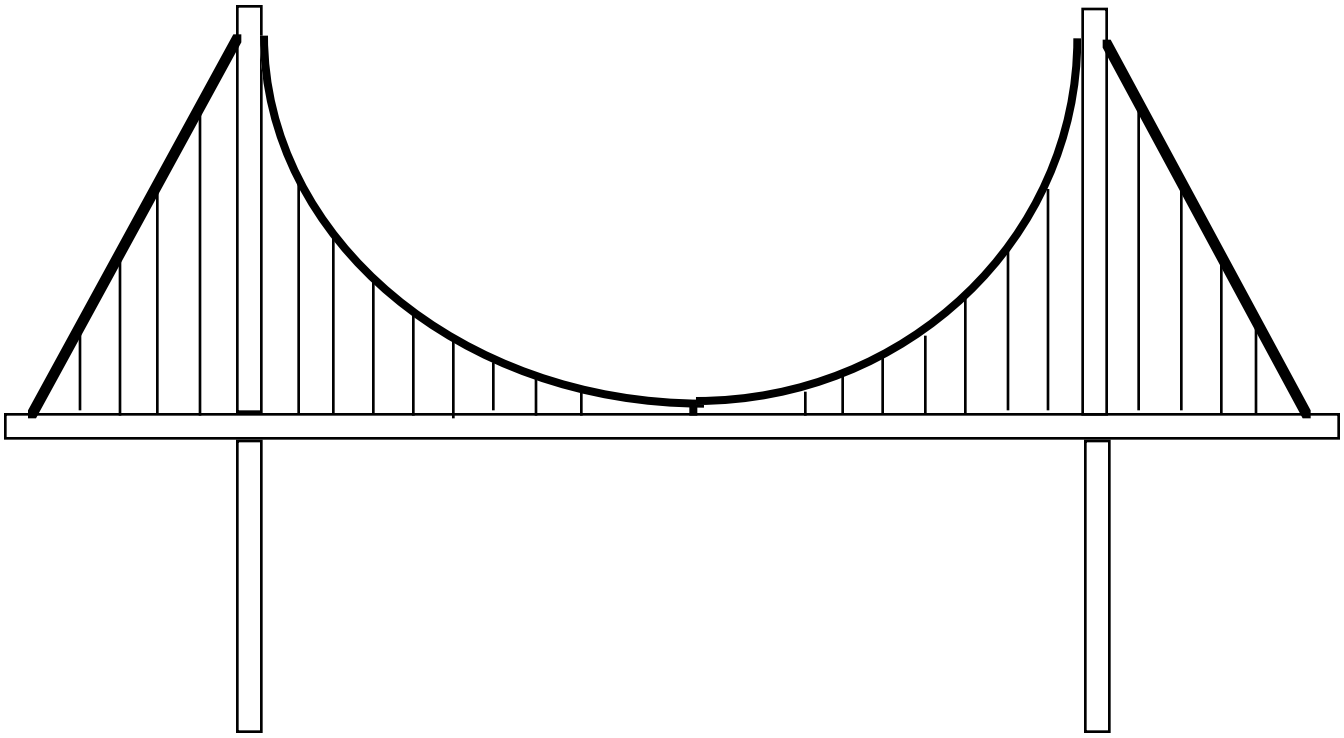


Warren Truss

Subtask 9.5 BLM 9.5 **Types of Forces**

Name: _____

You have been studying two types of force. In the space below, label where the two types of force are acting on the suspension bridge that is shown.
(tension and compression)

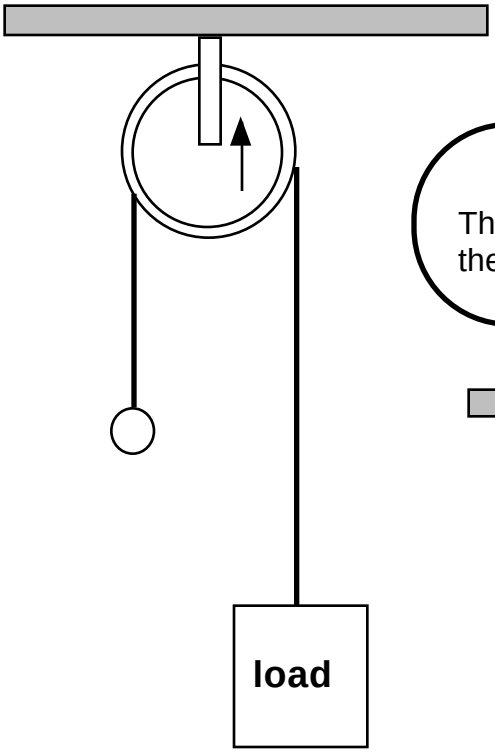


Using a marshmallow as the object, draw a picture of it under the influence the these four forces.:

tension

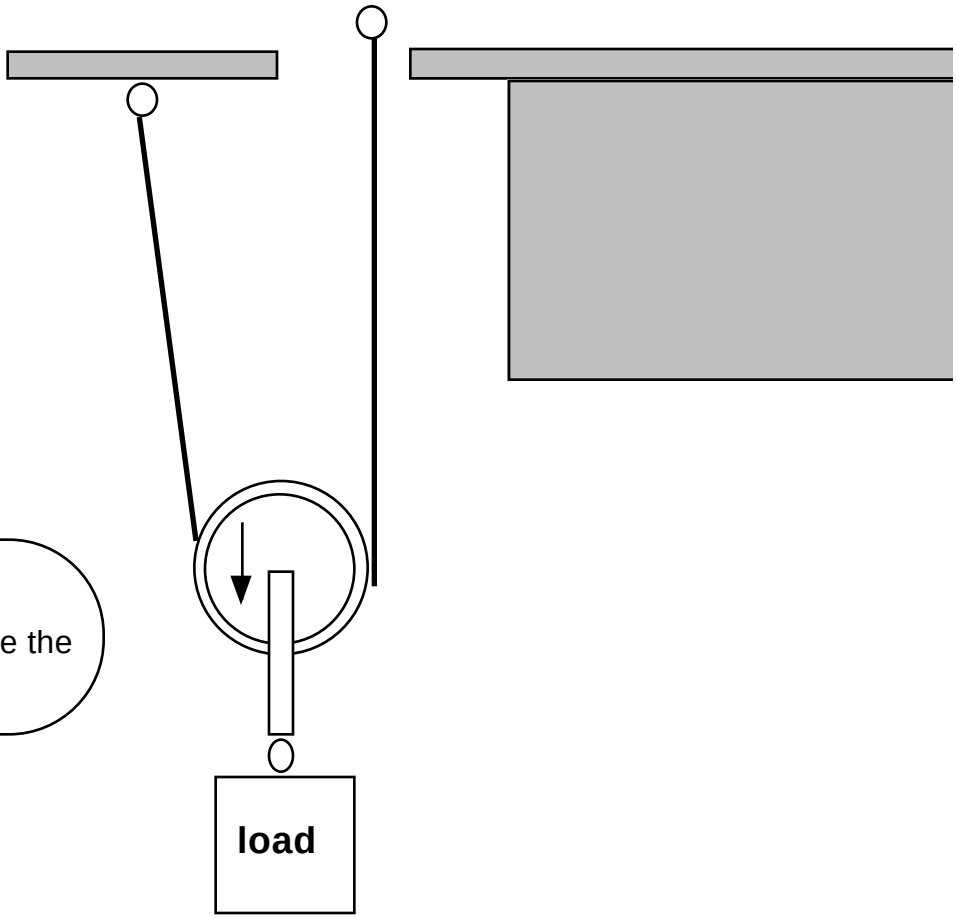
compression

Types of Pulleys



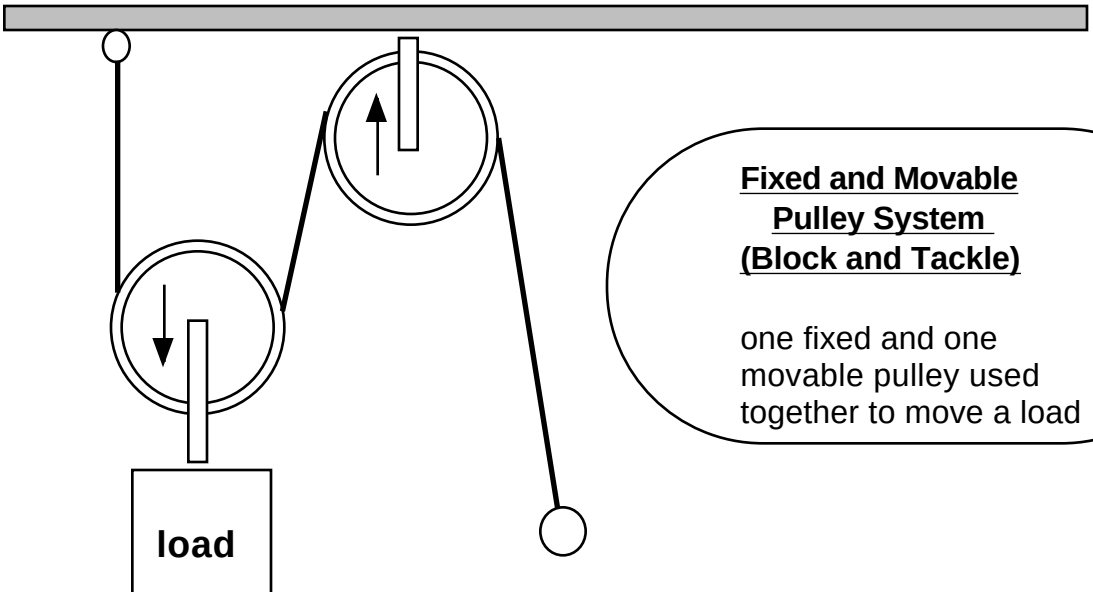
Fixed Pulley

The wheel turns but the arm holding the wheel is fixed in one place.



Movable Pulley

moves up or down while the wheel turns



Fixed and Movable Pulley System (Block and Tackle)

one fixed and one movable pulley used together to move a load

Glossary of Terms

for

Forces Acting on Structures and Mechanisms and Motion

Axle - Bar or shaft on which or with which a wheel turns

Beam - A large long piece of wood or other material used as a support in withstanding a force

Bridge - A structure built over a river, road, etc so that people, cars, trains, etc can get across

Buoyancy - The ability to float

Buoyant force - The upward force on objects submersed in fluids; for some objects it can be sufficient to overcome completely the force of gravity and cause the object to float

Butt Joint - Two pieces of material joined end to end - also a form of support joint used to strengthen a structure

Cam and Cam Follower - A mechanism that changes rotary (circular) motion into linear motion (motion in a straight line)

Compression - The act or state of being pressed together or into a smaller space

Design Process - The stages of development of a product or process, including identifying a problem, developing a plan to solve the problem, building a structure or mechanism to solve the problem, testing the structure or mechanism, and communicating results and reflections on the process and the product

Effort - The force supplied to a machine in order to produce an action or work

Frame - Structure which serves as an underlying support

Friction - The resistance to motion from surfaces that touch; resistance of a body in motion to the air, water, other surfaces, etc.

Follower - A gear, wheel, or other machine part that is given motion by another

part

Force - Power or energy acting against something to move it or hold it in place; a push or a pull

Gantry - A bridge like framework for supporting a movable object

Gear - A rotating wheel-like object with teeth around its rim; a gear is used to transmit force to another gear with matching teeth

Gear Train - A group of two or more gears

Gravity - The natural force that causes objects to move or tend to move toward the centre of the earth; gravity causes objects to have weight

Guide - Part of a machine for directing or regulating motion or action

Gusset - A plate that is used to strengthen truss joints

Hinge - That on which something turns; a joint on which a door, gate, cover, lid, etc., swings back and forth

Incline - A slope or slant

Lever - A bar which turns on a fixed support called a fulcrum and is used to transmit effort and motion; it is a simple machine.

Lift - Upward force on a forward-moving object that results when the air flow around the top of the object is faster than the air flow beneath it

Load - The weight of an object that is moved by a machine, or the resistance to movement that a machine has to overcome

Mass - The amount of matter in an object; mass is usually measured in grams or kilograms

Motion - Change of position or place

Pivot - A shaft, pin, or point on which something turns

Pressure - A pressing force acting upon a surface
(pressure = force ÷ area)

Pulley - A wheel with a grooved rim in which a rope, belt, or piece of string can be run and so change the direction of a pull and lift weights; it is a simple machine

Resistance - Any force tending to hinder motion

Screw Eye - Screw with a head shaped like a loop

Stability - The capacity of an object to maintain or return to its original position; the state of being balanced in a fixed position

Strength - The capacity of an object to sustain the application of force without yielding or breaking

Stress - A force created inside a material or an object (that tends to deform it) by other outside forces acting on it

Structure - A group of related parts organized to hold together; a supporting framework (e.g., a bridge or building that is built to sustain a load)

Strut - A part of a structure whose function is to resist compression; a member in a framework designed to relieve pressure or weight and prevent the framework from collapsing

Tie - A part of a structure that resists tension; beams or rods (including wire, rope, or string) that prevent parts of a structure from separating

Tension - A force that stretches an object

Triangulation - A way of strengthening a structure involving the use of triangular support pieces, such as trusses

Truss - A structural element made up of a series of triangular frames

Wedge - A piece of wood, metal, or other material, tapering to a thin edge used in splitting, separating, etc.

Weight - The pull of gravity on an object; unlike mass, weight changes with location

Wheel - A round frame turning on a pin or shaft in the centre

Winch - A machine for lifting or pulling; turned with a crank or engine

Unit-Wide Web sites

www.ask.com - You go to Kids Ask and then ask questions about forces or motion

tlc.ai.org/gravity.htm

www.physics.uogueloh.ca/tutorials

www.kids.earth.nasa.gov/archive/air_pressure/index,html

www.stemnet.nf.ca/cite/flightsc.htm

http://kapili.com/physics4kids/motion/force.html

www.gravities.com/collegepark/den/2335/Newton.htm - Newton's Laws of Motion

www.tric.cc.oh.us/metio/faculty/gram/web/newton.htm - Forces and motion

www.galaxy.net/~k12/machines--Marvelous Machines

www.howstuffworks.com--How Stuff Works

www.howthingswork.virginia.edu--How Things Work

www.youcan.com/lever--Levers

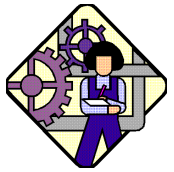
www.teachers.net/lessons/posts/215--Simple Machines

Student Name:_____
Date:_____

An Uplifting Experience - Grade 5

for use with Subtask 2 : Introduction to Culminating Performance Tasks - 5/6

from the Grade 5/6 Unit: **May The Force Move You**



Expectations for this Subtask to Assess with this Rubric:

5s77 • demonstrate an understanding of the effect of forces acting on different structures and mechanisms;

5s78 • design and make load-bearing structures and different mechanisms, and investigate the forces acting on them;

5s79 • evaluate the design of systems that include structures and mechanisms, and identify modifications to improve their effectiveness.

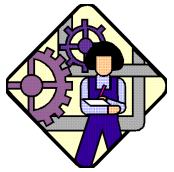
Category/Criteria	Level 1	Level 2	Level 3	Level 4
Developing a Plan	-plan is minimal, but may contain some diagrams, a very limited material list and little written description	-plan is partially complete: contains some labeled diagrams, a limited material list and written description	-plan is complete: contains several labelled diagrams, an accurate and complete material list, and a written description of how plsn will solve the problem	-plan is complete: contains many labeled diagrams, an accurate and complete material list, and a detailed description of how plan will solve the problem
Using the Design Process	-uses few steps of the design process -rarely uses equipment, tools and materials safely	-uses some steps of the design process -occasionally uses equipment, tools and materials safely	-uses most steps of the design process -usually uses equipment, tools and materials safely	-uses all steps of the design process -consistently uses equipment, tools and materials safely
The Model	-model lifts a load of less than standard weight, and has limited stability -model shows little similarity to the design	-model lifts a standard load, and is stable for some of the trials -model shows some similarity to the design	-model lifts a standard load with reduced effort, and is stable for all of the trials -model reflects the design	-model lifts more than a standard load with reduced effort, and is stable for all of the trials -model accurately reflects the design includingmodifications
Communicating the Results	-communicates few of the effects of forces on structures with limited clarity and rarely uses appropriate scientific language	-communicates some of the effects of forces on structures with some clarity and occasionally uses appropriate scientific language	-communicates many of the effects of forces on structures clearly and uses appropriate scientific language	-communicates all or almost all of the effects of forces on structures clearly and precisely and always uses appropriate scientific language

Student Name:_____
Date:_____

An Amusing Adventure - Grade 6

for use with Subtask 2 : Introduction to Culminating Performance Tasks - 5/6

from the Grade 5/6 Unit: **May The Force Move You**



Expectations for this Subtask to Assess with this Rubric:

6s78 • demonstrate an understanding of different kinds of motion (linear, rotational, reciprocating, oscillating);

6s79 • design and make mechanical devices, and investigate how mechanisms change one type of motion into another and transfer energy from one form to another;

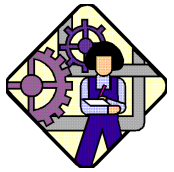
6s80 • identify modifications to improve the design and method of production of systems that have mechanisms that move in different ways.

Category/Criteria	Level 1	Level 2	Level 3	Level 4
Developing a Plan	-plan is minimal, but may contain some diagrams, a very limited material list and little written description	-plan is partially complete: contains some labeled diagrams, a limited material list and written description	-plan is complete: contains several labelled diagrams, an accurate and complete material list, and a written description of how plsn will solve the problem	-plan is complete: contains many labeled diagrams, an accurate and complete material list, and a detailed description of how plan will solve the problem
Using the Design Process	-uses few steps of the design process -sometimes uses equipment, tools and materials safely	-uses some steps of the design process -usually uses equipment, tools and materials safely	-uses most steps of the design process -uses equipment, tools and materials safely	-uses all steps of the design process -consistently uses equipment, tools and materials safely, and instructs others
The Model	-model demonstrates a type of motion -model shows little similarity to the design	-model demonstrates more than one type of motion, but they are not linked to one another -model shows some similarity to the design	-model demonstrates a change in motion, speed or direction -model reflects the design	-model demonstrates more than one change in motion, speed or direction -model accurately reflects the design including required modifications
Communicating the Results	-communicates limited knowledge of the four types of motion with limited clarity while rarely using appropriate scientific language	-communicates some knowledge of the four types of motion with some clarity while occasionally using appropriate scientific language	-communicates adequate knowledge of the four types of motion clearly while using appropriate scientific language	-communicates detailed knowledge of the four types of motion clearly and precisely while always using appropriate scientific language

An Uplifting Experience - Grade 5

Student Name: for use with Subtask 12 : Apply (Culminating Performance Task) - On Your Mark, Get Set, GO! - 5/6
Date:_____

from the Grade 5/6 Unit: **May The Force Move You**



Expectations for this Subtask to Assess with this Rubric:

5s77 • demonstrate an understanding of the effect of forces acting on different structures and mechanisms;

5s78 • design and make load-bearing structures and different mechanisms, and investigate the forces acting on them;

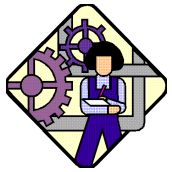
5s79 • evaluate the design of systems that include structures and mechanisms, and identify modifications to improve their effectiveness.

Category/Criteria	Level 1	Level 2	Level 3	Level 4
Developing a Plan	-plan is minimal, but may contain some diagrams, a very limited material list and little written description	-plan is partially complete: contains some labeled diagrams, a limited material list and written description	-plan is complete: contains several labelled diagrams, an accurate and complete material list, and a written description of how plsn will solve the problem	-plan is complete: contains many labeled diagrams, an accurate and complete material list, and a detailed description of how plan will solve the problem
Using the Design Process	-uses few steps of the design process -rarely uses equipment, tools and materials safely	-uses some steps of the design process -occasionally uses equipment, tools and materials safely	-uses most steps of the design process -usually uses equipment, tools and materials safely	-uses all steps of the design process -consistently uses equipment, tools and materials safely
The Model	-model lifts a load of less than standard weight, and has limited stability -model shows little similarity to the design	-model lifts a standard load, and is stable for some of the trials -model shows some similarity to the design	-model lifts a standard load with reduced effort, and is stable for all of the trials -model reflects the design	-model lifts more than a standard load with reduced effort, and is stable for all of the trials -model accurately reflects the design includingmodifications
Communicating the Results	-communicates with limited clarity while rarely using appropriate scientific language	-communicates with some clarity while occasionally using appropriate scientific language	-communicates clearly while using appropriate scientific language	-communicates clearly and precisely while always using appropriate scientific language

An Amusing Adventure - Grade 6

Student Name: for use with Subtask 12 : Apply (Culminating Performance Task) - On Your Mark, Get Set, GO! - 5/6
Date:_____

from the Grade 5/6 Unit: **May The Force Move You**



Expectations for this Subtask to Assess with this Rubric:

6s78 • demonstrate an understanding of different kinds of motion (linear, rotational, reciprocating, oscillating);

6s79 • design and make mechanical devices, and investigate how mechanisms change one type of motion into another and transfer energy from one form to another;

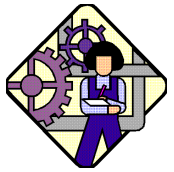
6s80 • identify modifications to improve the design and method of production of systems that have mechanisms that move in different ways.

Category/Criteria	Level 1	Level 2	Level 3	Level 4
Developing a Plan	-plan is minimal, but may contain some diagrams, a very limited material list and little written description	-plan is partially complete: contains some labeled diagrams, a limited material list and written description	-plan is complete: contains several labelled diagrams, an accurate and complete material list, and a written description of how plsn will solve the problem	-plan is complete: contains many labeled diagrams, an accurate and complete material list, and a detailed description of how plan will solve the problem
Using the Design Process	-uses few steps of the design process -sometimes uses equipment, tools and materials safely	-uses some steps of the design process -usually uses equipment, tools and materials safely	-uses most steps of the design process -uses equipment, tools and materials safely	-uses all steps of the design process -consistently uses equipment, tools and materials safely, and instructs others
The Model	-model demonstrates a type of motion -model shows little similarity to the design	-model demonstrates more than one type of motion, but they are not linked to one another -model shows some similarity to the design	-model demonstrates a change in motion, speed or direction -model reflects the design	-model demonstrates more than one change in motion, speed or direction -model accurately reflects the design including required modifications
Communicating the Results	-communicates with limited clarity while rarely using appropriate scientific language	-communicates with some clarity while occasionally using appropriate scientific language	-communicates clearly while using appropriate scientific language	-communicates clearly and precisely while always using appropriate scientific language

Student Name:_____
Date:_____

Learning Log

for use with Subtask 1 : Explore - Simple Machines - 5 /6
from the Grade 5/6 Unit: **May The Force Move You**



Expectationsfor this Subtask to Assess with this Rubric:

5s88 – use appropriate vocabulary, including correct science and technology terminology, in describing their investigations and observations (e.g., use terms such as component, subsystem, and device when describing systems);

5s90 – communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, written notes and descriptions, drawings, charts, and oral presentations (e.g., give a presentation on the process of designing and making a specific structure);

6s90 – use appropriate vocabulary, including correct science and technology terminology, in describing their investigations and observations (e.g., use terms such as fulcrum, pivot, rack and pinion, belt);

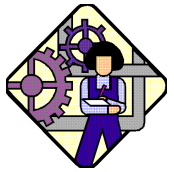
6s92 – communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, written notes and descriptions, charts, drawings, and oral presentations (e.g., describe how a product was created from the first idea to the final model; produce a set of instructions to control the

Category/Criteria	Level 1	Level 2	Level 3	Level 4
Using Science and Technology terminology	-rarely uses appropriate science and technology terminology and units of measurement.	-sometimes uses appropriate science and technology terminology and units of measurement.	-usually uses appropriate science and technology terminology and units of measurement.	-consistently uses appropriate science and technology terminology and units of measurement.
Recording Observations	-rarely records information in a clear and organized manner -requires assistance to use diagrams and/or graphic organizers to enhance record of observations	-sometimes records information in a clear and organized manner -sometimes uses diagrams and/or graphic organizers to enhance record of observations	-usually records information in a clear and organized manner -usually uses appropriate diagrams and/or graphic organizers to enhance record of observations	-consistently records information in a clear and organized manner -effectively uses appropriate diagrams and/or graphic organizers to enhance record of observations
Relating science and technology to the world around them	-shows little understanding of connections between science and technology and the world around them in familiar contexts	-shows some understanding of connections between science and technology and the world around them in familiar contexts	-shows understanding of connections between science and technology and the world around them in familiar contexts	-shows understanding of connections between science and technology and the world around them in familiar and unfamiliar contexts

Student Name:_____
Date:_____

Raise the Flag!

for use with Subtask 11 : Apply - Flagpole Construction - 5/6
from the Grade 5/6 Unit: **May The Force Move You**



Expectationsfor this Subtask to Assess with this Rubric:

5s78 • design and make load-bearing structures and different mechanisms, and investigate the forces acting on them;

5s79 • evaluate the design of systems that include structures and mechanisms, and identify modifications to improve their effectiveness.

6s79 • design and make mechanical devices, and investigate how mechanisms change one type of motion into another and transfer energy from one form to another;

6s80 • identify modifications to improve the design and method of production of systems that have mechanisms that move in different ways.

Category/Criteria	Level 1	Level 2	Level 3	Level 4
Is the structure strong and stable?	-Structure withstands a few tries, before collapsing -Structure initially stands but falls over easily when first blown on (by hair dryer)	-Structure withstands several tries, before collapsing -Structure initially stands but falls over when blown on repeatedly (by hair dryer)	-Structure withstands all tries during the course of the demonstration -Structure stands while being blown on (by hair dryer)	-Structure withstands unlimited use -Structure stands while being blown on at the highest speed (by hair dryer)
Does the flag rise and descend with ease?	-Flag rises/descends a few times -Flag rises/descends in a jerky manner (gets stuck)	-Flag rises/descends several times -Flag rises/descends smoothly some of the time	-Flag rises/descends during all demonstrations -Flag rises/descends smoothly most of the time	-Flag rises and descends at any time, including during stability tests (blown on by hair dryer at highest speed) -Flag rises/descends smoothly all of the time, and has modifications to improve its performance
Do students use the design process?	-uses few steps of the design process - sometimes uses tools, equipment and materials in a safe and accurate manner	-uses some steps of the design process - usually uses tools, equipment and materials in a safe and accurate manner	-uses most steps of the design process -uses tools, equipment and materials in a safe and accurate manner	-uses all steps of the design process - consistently uses tools, equipment and materials in a safe and accurate manner, and instructs others

May The Force Move You

Forces Acting on Structures & Mechanisms; Motion A Unit for Grade 5/6

		Selected	Assessed
Mathematics---Data Management and Probability			
☐ **5m113**	– design surveys, collect data, and record the results on given spreadsheets or tally charts;	1	
☐ **5m114**	– display data on graphs (e.g., line graphs, bar graphs, pictographs, and circle graphs) by hand and by using computer applications;	1	
☐ **6m114**	– design surveys, organize the data into self-selected categories and ranges, and record the data on spreadsheets or tally charts;	1	
☐ **6m115**	– experiment with a variety of displays of the same data using computer applications, and select the type of graph that best represents the data;	1	
Mathematics---Geometry and Spatial Sense			
☐ **5m65**	• identify, describe, compare, and classify geometric figures;	1	
☐ **5m66**	• draw and build three-dimensional objects and models;	2	
☐ **6m64**	• identify, describe, compare, and classify geometric figures;	1	
Mathematics---Measurement			
☐ **5m37**	• demonstrate an understanding of and ability to apply appropriate metric prefixes in measurement and estimation activities;	2	
☐ **5m38**	• identify relationships between and among measurement concepts (linear, temporal, monetary);	1	
☐ **5m50**	– estimate the amount of money in collections of coins and bills to $1000 and count to determine the total value;	1	
☐ **5m52**	– make purchases of and change for items up to $100;	1	
☐ **6m42**	• demonstrate an understanding of and ability to apply appropriate metric prefixes in measurement and estimation activities;	3	
☐ **6m43**	• identify relationships between and among measurement concepts (linear, square, cubic, temporal, monetary);	1	
☐ **6m50**	– represent amounts of money under $100 using the smallest possible number of coins and bills;	1	
☐ **6m52**	– estimate and count amounts of money to $10 000, using a calculator for most calculations;	1	
Science and Technology---Structures and Mechanisms			
☐ **5s77**	• demonstrate an understanding of the effect of forces acting on different structures and mechanisms;	2	5
☐ **5s78**	• design and make load-bearing structures and different mechanisms, and investigate the forces acting on them;		6
☐ **5s79**	• evaluate the design of systems that include structures and mechanisms, and identify modifications to improve their effectiveness.	1	5
☐ **5s80**	– identify and measure forces acting on a structure (e.g., mass, air pressure), and describe the effects of their application;	2	2
☐ **5s81**	– identify the parts of a structure that are under tension and those that are under compression when subjected to a load (e.g., the wires in a suspension bridge are under tension; a ladder bearing a mass is under compression);		1
☐ **5s83**	– describe, using their observations, the advantages and disadvantages of using different types of mechanical systems (e.g., a single-pulley system has no mechanical advantage; a pulley system with two or more pulleys has a mechanical advantage);	1	
☐ **5s86**	– formulate questions about and identify needs and problems related to structures and mechanisms in the outdoor environment, and explore possible answers and solutions (e.g., construct a bridge that must support a given load across a given distance; determine which surface of a cantilever bridge or beam is under tension and which is under compression);	1	
☐ **5s87**	– plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure a fair test and identifying criteria for assessing solutions;	1	
☐ **5s88**	– use appropriate vocabulary, including correct science and technology terminology, in describing their investigations and observations (e.g., use terms such as component, subsystem, and device when describing systems);	1	1
☐ **5s90**	– communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, written notes and descriptions, drawings, charts, and oral presentations (e.g., give a presentation on the process of designing and making a specific structure);	3	
☐ **5s91**	– design and make a frame structure that can support a load (e.g., a bridge);	1	1
☐ **5s93**	– cut, join, and rearrange pliable and rigid materials to make an object (e.g., cut wood at a 45º angle to make a mitre joint; make a mould for a face mask);	1	
☐ **5s98**	– identify modifications intended to improve the performance, aesthetic appeal, and impact on the environment of a product they designed;	1	
☐ **6s78**	• demonstrate an understanding of different kinds of motion (linear, rotational, reciprocating, oscillating);	1	4
☐ **6s79**	• design and make mechanical devices, and investigate how mechanisms change one type of motion into another and transfer energy from one form to another;		5
☐ **6s80**	• identify modifications to improve the design and method of production of systems that have mechanisms that move in different ways.	1	4
☐ **6s81**	– describe, using their observations, ways in which mechanical devices and systems produce a linear output from a rotary input (e.g., screw, crank and slider, rack and pinion, cam and cam follower);	1	1
☐ **6s82**	– describe, using their observations, the purposes or uses of three classes of simple levers (e.g., wheelbarrow, tongs, seesaw);	1	1

May The Force Move You

Forces Acting on Structures & Mechanisms; Motion A Unit for Grade 5/6

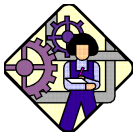
			Selected	Assessed
☐	6s87	– design and make mechanical devices that change the direction and speed of an input to produce a desired output and that perform a useful function (e.g., a clothesline);	2	1
☐	6s88	– formulate questions about and identify needs and problems related to structures and mechanisms in the environment, and explore possible answers and solutions (e.g., describe how a system, such as a plumbing system, could be modified to meet different needs);	1	
☐	6s89	– plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure a fair test and identifying criteria for assessing solutions;	1	
☐	6s90	– use appropriate vocabulary, including correct science and technology terminology, in describing their investigations and observations (e.g., use terms such as fulcrum, pivot, rack and pinion, belt);	2	1
☐	6s92	– communicate the procedures and results of investigations for specific purposes and to specific audiences, using media works, written notes and descriptions, charts, drawings, and oral presentations (e.g., describe how a product was created from the first idea to the final model; produce a set of instructions to control the sequence of movements of a mechanical device).	2	
☐	6s95	– write a plan outlining the different materials and processes involved in producing a product (e.g., resources, equipment, marketing);		1

The Arts---Visual Arts

☐	5a26	• produce two- and three-dimensional works of art that communicate a range of ideas (thoughts, feelings, experiences) for specific purposes and to specific audiences;	1	
☐	6a25	• produce two- and three-dimensional works of art that communicate a range of ideas (thoughts, feelings, experiences) for specific purposes and to specific audiences, using a variety of familiar art tools, materials, and techniques;	1	

Expectation Summary

Selected **Assessed**



May The Force Move You

Forces Acting on Structures & Mechanisms; Motion A Unit for Grade 5/6

English Language

5e1	5e2	5e3	5e4	5e5	5e6	5e7	5e8	5e9	5e10
5e11	5e12	5e13	5e14	5e15	5e16	5e17	5e18	5e19	5e20
5e21	5e22	5e23	5e24	5e25	5e26	5e27	5e28	5e29	5e30
5e31	5e32	5e33	5e34	5e35	5e36	5e37	5e38	5e39	5e40
5e41	5e42	5e43	5e44	5e45	5e46	5e47	5e48	5e49	5e50
5e51	5e52	5e53	5e54	5e55	5e56	5e57	5e58	5e59	5e60
5e61	5e62	5e63	5e64	5e65	5e66				

French as a Second Language

5f1	5f2	5f3	5f4	5f5	5f6	5f7	5f8	5f9	5f10
5f11	5f12	5f13	5f14	5f15	5f16	5f17	5f18		

Mathematics

5m1	5m2	5m3	5m4	5m5	5m6	5m7	5m8	5m9	5m10
5m11	5m12	5m13	5m14	5m15	5m16	5m17	5m18	5m19	5m20
5m21	5m22	5m23	5m24	5m25	5m26	5m27	5m28	5m29	5m30
5m31	5m32	5m33	5m34	5m35	5m36	5m37 **2**	5m38 **1**	5m39	5m40
5m41	5m42	5m43	5m44	5m45	5m46	5m47	5m48	5m49	5m50 **1**
5m51	5m52 **1**	5m53	5m54	5m55	5m56	5m57	5m58	5m59	5m60
5m61	5m62	5m63	5m64	5m65 **1**	5m66 **2**	5m67	5m68	5m69	5m70
5m71	5m72	5m73	5m74	5m75	5m76	5m77	5m78	5m79	5m80
5m81	5m82	5m83	5m84	5m85	5m86	5m87	5m88	5m89	5m90
5m91	5m92	5m93	5m94	5m95	5m96	5m97	5m98	5m99	5m100
5m101	5m102	5m103	5m104	5m105	5m106	5m107	5m108	5m109	5m110
5m111	5m112	5m113 **1**	5m114 **1**	5m115	5m116	5m117	5m118	5m119	5m120
5m121	5m122	5m123	5m124						

Science and Technology

5s1	5s2	5s3	5s4	5s5	5s6	5s7	5s8	5s9	5s10
5s11	5s12	5s13	5s14	5s15	5s16	5s17	5s18	5s19	5s20
5s21	5s22	5s23	5s24	5s25	5s26	5s27	5s28	5s29	5s30
5s31	5s32	5s33	5s34	5s35	5s36	5s37	5s38	5s39	5s40
5s41	5s42	5s43	5s44	5s45	5s46	5s47	5s48	5s49	5s50
5s51	5s52	5s53	5s54	5s55	5s56	5s57	5s58	5s59	5s60
5s61	5s62	5s63	5s64	5s65	5s66	5s67	5s68	5s69	5s70
5s71	5s72	5s73	5s74	5s75	5s76	5s77 **2** **5**	5s78 **6**	5s79 **1** **5**	5s80 **2** **2**
5s81 **1**	5s82	5s83 **1**	5s84	5s85	5s86 **1**	5s87 **1**	5s88 **1** **1**	5s89	5s90 **3**
5s91 **1** **1**	5s92	5s93 **1**	5s94	5s95	5s96	5s97	5s98 **1**	5s99	5s100
5s101	5s102	5s103	5s104	5s105	5s106	5s107	5s108	5s109	5s110
5s111	5s112	5s113	5s114	5s115	5s116	5s117	5s118	5s119	5s120
5s121	5s122	5s123	5s124	5s125	5s126	5s127	5s128		

Social Studies

5z1	5z2	5z3	5z4	5z5	5z6	5z7	5z8	5z9	5z10
5z11	5z12	5z13	5z14	5z15	5z16	5z17	5z18	5z19	5z20
5z21	5z22	5z23	5z24	5z25	5z26	5z27	5z28	5z29	5z30
5z31	5z32	5z33	5z34	5z35	5z36	5z37	5z38	5z39	5z40
5z41	5z42	5z43	5z44	5z45	5z46	5z47	5z48		

Health & Physical Education

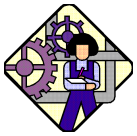
5p1	5p2	5p3	5p4	5p5	5p6	5p7	5p8	5p9	5p10
5p11	5p12	5p13	5p14	5p15	5p16	5p17	5p18	5p19	5p20
5p21	5p22	5p23	5p24	5p25	5p26	5p27	5p28	5p29	5p30
5p31	5p32	5p33	5p34	5p35	5p36	5p37	5p38	5p39	5p40

The Arts

5a1	5a2	5a3	5a4	5a5	5a6	5a7	5a8	5a9	5a10
5a11	5a12	5a13	5a14	5a15	5a16	5a17	5a18	5a19	5a20
5a21	5a22	5a23	5a24	5a25	5a26 **1**	5a27	5a28	5a29	5a30
5a31	5a32	5a33	5a34	5a35	5a36	5a37	5a38	5a39	5a40
5a41	5a42	5a43	5a44	5a45	5a46	5a47	5a48	5a49	5a50
5a51	5a52	5a53	5a54	5a55	5a56	5a57	5a58	5a59	5a60
5a61	5a62	5a63	5a64	5a65	5a66	5a67	5a68	5a69	

Expectation Summary

Selected **Assessed**



May The Force Move You

Forces Acting on Structures & Mechanisms; Motion A Unit for Grade 5/6

English Language

6e1	6e2	6e3	6e4	6e5	6e6	6e7	6e8	6e9	6e10
6e11	6e12	6e13	6e14	6e15	6e16	6e17	6e18	6e19	6e20
6e21	6e22	6e23	6e24	6e25	6e26	6e27	6e28	6e29	6e30
6e31	6e32	6e33	6e34	6e35	6e36	6e37	6e38	6e39	6e40
6e41	6e42	6e43	6e44	6e45	6e46	6e47	6e48	6e49	6e50
6e51	6e52	6e53	6e54	6e55	6e56	6e57	6e58	6e59	6e60
6e61	6e62	6e63	6e64	6e65	6e66				

French as a Second Language

6f1	6f2	6f3	6f4	6f5	6f6	6f7	6f8	6f9	6f10
6f11	6f12	6f13	6f14	6f15	6f16	6f17	6f18		

Mathematics

6m1	6m2	6m3	6m4	6m5	6m6	6m7	6m8	6m9	6m10
6m11	6m12	6m13	6m14	6m15	6m16	6m17	6m18	6m19	6m20
6m21	6m22	6m23	6m24	6m25	6m26	6m27	6m28	6m29	6m30
6m31	6m32	6m33	6m34	6m35	6m36	6m37	6m38	6m39	6m40
6m41	6m42 **3**	6m43 **1**	6m44	6m45	6m46	6m47	6m48	6m49	6m50 **1**
6m51	6m52 **1**	6m53	6m54	6m55	6m56	6m57	6m58	6m59	6m60
6m61	6m62	6m63	6m64 **1**	6m65	6m66	6m67	6m68	6m69	6m70
6m71	6m72	6m73	6m74	6m75	6m76	6m77	6m78	6m79	6m80
6m81	6m82	6m83	6m84	6m85	6m86	6m87	6m88	6m89	6m90
6m91	6m92	6m93	6m94	6m95	6m96	6m97	6m98	6m99	6m100
6m101	6m102	6m103	6m104	6m105	6m106	6m107	6m108	6m109	6m110
6m111	6m112	6m113	6m114 **1**	6m115 **1**	6m116	6m117	6m118	6m119	6m120
6m121	6m122	6m123	6m124	6m125					

Science and Technology

6s1	6s2	6s3	6s4	6s5	6s6	6s7	6s8	6s9	6s10
6s11	6s12	6s13	6s14	6s15	6s16	6s17	6s18	6s19	6s20
6s21	6s22	6s23	6s24	6s25	6s26	6s27	6s28	6s29	6s30
6s31	6s32	6s33	6s34	6s35	6s36	6s37	6s38	6s39	6s40
6s41	6s42	6s43	6s44	6s45	6s46	6s47	6s48	6s49	6s50
6s51	6s52	6s53	6s54	6s55	6s56	6s57	6s58	6s59	6s60
6s61	6s62	6s63	6s64	6s65	6s66	6s67	6s68	6s69	6s70
6s71	6s72	6s73	6s74	6s75	6s76	6s77	6s78 **1** **4**	6s79 **5**	6s80 **1** **4**
6s81 **1** **1**	6s82 **1** **1**	6s83	6s84	6s85	6s86	6s87 **2** **1**	6s88 **1**	6s89 **1**	6s90 **2** **1**
6s91	6s92 **2**	6s93	6s94	6s95 **1**	6s96	6s97	6s98	6s99	6s100
6s101	6s102	6s103	6s104	6s105	6s106	6s107	6s108	6s109	6s110
6s111	6s112	6s113	6s114	6s115	6s116	6s117	6s118	6s119	6s120
6s121	6s122	6s123	6s124						

Social Studies

6z1	6z2	6z3	6z4	6z5	6z6	6z7	6z8	6z9	6z10
6z11	6z12	6z13	6z14	6z15	6z16	6z17	6z18	6z19	6z20
6z21	6z22	6z23	6z24	6z25	6z26	6z27	6z28	6z29	6z30
6z31	6z32	6z33	6z34	6z35	6z36	6z37	6z38	6z39	6z40
6z41	6z42	6z43	6z44	6z45	6z46	6z47	6z48		

Health & Physical Education

6p1	6p2	6p3	6p4	6p5	6p6	6p7	6p8	6p9	6p10
6p11	6p12	6p13	6p14	6p15	6p16	6p17	6p18	6p19	6p20
6p21	6p22	6p23	6p24	6p25	6p26	6p27	6p28	6p29	6p30
6p31	6p32	6p33	6p34						

The Arts

6a1	6a2	6a3	6a4	6a5	6a6	6a7	6a8	6a9	6a10
6a11	6a12	6a13	6a14	6a15	6a16	6a17	6a18	6a19	6a20
6a21	6a22	6a23	6a24	6a25 **1**	6a26	6a27	6a28	6a29	6a30
6a31	6a32	6a33	6a34	6a35	6a36	6a37	6a38	6a39	6a40
6a41	6a42	6a43	6a44	6a45	6a46	6a47	6a48	6a49	6a50
6a51	6a52	6a53	6a54	6a55	6a56	6a57	6a58	6a59	6a60
6a61	6a62	6a63	6a64	6a65	6a66	6a67	6a68	6a69	6a70
6a71									

May The Force Move You

Forces Acting on Structures & Mechanisms; Motion A Unit for Grade 5/6

Analysis Of Unit Components

17 Subtasks
64 Expectations
43 Resources
104 Strategies & Groupings

-- Unique Expectations --
38 Science And Tech Expectations

Resource Types

1 Rubrics
14 Blackline Masters
0 Licensed Software
1 Print Resources
0 Media Resources
0 Websites
0 Material Resources
0 Equipment / Manipulatives
0 Sample Graphics
3 Other Resources
0 Parent / Community
0 Companion Bookmarks

Groupings

6 Students Working As A Whole Class
4 Students Working In Pairs
8 Students Working In Small Groups
4 Students Working Individually

Teaching / Learning Strategies

6 Brainstorming
3 Classifying
3 Collaborative/cooperative Learning
1 Community Involvement
1 Demonstration
3 Direct Teaching
8 Discussion
5 Experimenting
1 Field Trip
7 Inquiry
2 Learning Log/ Journal
1 Mini-lesson
3 Model Making
6 Note-making
2 Retelling

Assessment Recording Devices

2 Anecdotal Record
7 Checklist

Assessment Strategies

8 Learning Log
1 Response Journal