ONTARIO COUNCIL FOR TECHNOLOGY EDUCATION

DESIGNING AND TESTING A CRANE

Technological Design
TDJ20
Grade 10
June 2020

ONLINE RESOURCE

takeTECH

Table of Contents

Introduction

Course Code: TDJ20
Broad base Technology: Technological Design
Destination: Open
Grade Level: 10
Online Project Name: Designing and Testing a Crane

Project Outline

By the end of this project students will be familiar with the 6 different simple machines and will be able to identify how these machines are used in products and tools they use on a daily basis. They will investigate how mechanical advantage is achieved using a lever by completing hands on experiments. Students will develop their problem solving skills by working through the design process to design, build and test a crane that meets specified criteria and constraints.

Prior Knowledge

- Students should be familiar with some simple machines from elementary Science and Technology and Exploring Technologies in grade 9.
- Students should be familiar with the design process steps. (Research, brainstorm, concept sketch, choose the best design, build a prototype, test your prototype.)
- Students should have completed isometric and orthographic drawings sketching and drawings.
- Students will have basic understanding of math skills (measuring, units, multiplication)
- Students will have basic research skills.

Student Activities

Activity 1 – Simple Machines Diagnostic

Students will complete a diagnostic worksheet. The task is to try to recall the 6 simple machines and explain how they might work. Using terms like force, load, direction, magnification or multiplication. This will allow teachers to know if they need to spend more time reviewing.

Students can then discuss their answers in small groups before taking up the work as a class.

Below is a thumbnail of the actual worksheet, found in Appendix C and downloadable as full page presentation format.

SIMPLE MACHINES – WHAT I KNOW

NAME: _____ **DATE:** _____

THINK BACK TO PREVIOUS SCIENCE COURSES. WHAT DO YOU KNOW ABOUT SIMPLE AND COMPLEX MACHINES?

Name the simple machines shown in each image. Can you explain how the simple machines helps in accomplishing a task?

Simple Machine #1:
How it works :

Simple Machine #2:
How it Works:

Simple Machine #3:
How it Works:

Simple Machine #4:
How it Works:

Simple Machine #5:
How it Works:

Simple Machine #6:
How it Works:

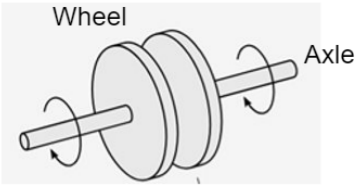
Activity 2– Simple Machines Lesson

This short lesson goes over the fundamentals of simple machines and focuses specifically on levers. It includes the 3 classes of levers and diagrams of how the forces (of the load and effort) are applied relative to the fulcrum.

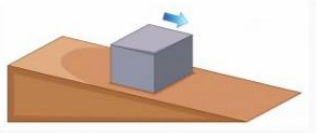
The lesson includes an opportunity for students to work in pairs to come up with examples of the various tools and products used every day that are examples of the 3 classes of levers, then share their knowledge with the class. This lesson also has students apply their knowledge by sketching one of the items / tools they listed and labelling the sketch. This allows them to develop their sketching and communication skills while learning about simple machines.

Below are several sample slides taken out of the PowerPoint presentation that accompanies this activity. Please utilize the entire presentation for all three classes of levers.

Simple Machines - There are 6 types

Lever - A rigid bar that can be turned freely about a fulcrum (fixed point). Levers make work easier by moving the force required a distance away from the fulcrum. There are 3 classes of levers.	**Examples:** wheelbarrow, see-saw, hockey stick, stapler, scissors.	
Wheel and Axle (gear) – Is made up of a round disk (wheel), with a rod through the centre (axle). This simple machine reduces friction and magnifies the input force into the axle by turning a larger diameter wheel.	**Examples:** car, can opener, bicycle, wheelbarrow, shopping cart, suitcase wheels.	
Pulley – Consists of a wheel with a groove in which a rope can run to change the direction or point of application of a force applied to the rope.	**Examples:** sails, flag poles, clothing lines, window shades and blinds, rock climbing gear, elevators.	

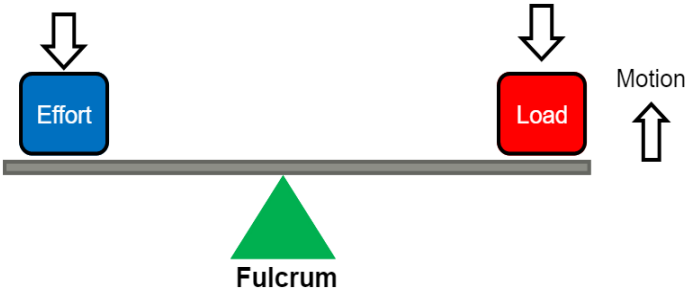
Simple Machines - There are 6 types

Wedge - A wedge is made up of 2 inclined planes used to push objects apart, lift up or hold it in place. A downward or upward force is redirected in a sideways direction.	**Examples:** scissors, axe, nail, zipper, knife, cheese grater, pencil sharpener, shovel.	
Inclined Plane – A ramp or slope that makes moving a load up or down a height (doing work) easier.	**Examples:** ramps, stairs, inclined roads or sidewalks.	
Screw – An inclined plane wrapped around a cylinder. Allowing a small torque to exert a large axial force on a load. It changes rotational motion and force into linear motion and force.	**Examples:** screws, lightbulb , clamps, jars and lids, corkscrew, auger.	

Let's talk about **Levers**

The **fulcrum** is located between the **effort** and the **load**, which move in opposite directions.

Class 1 Lever



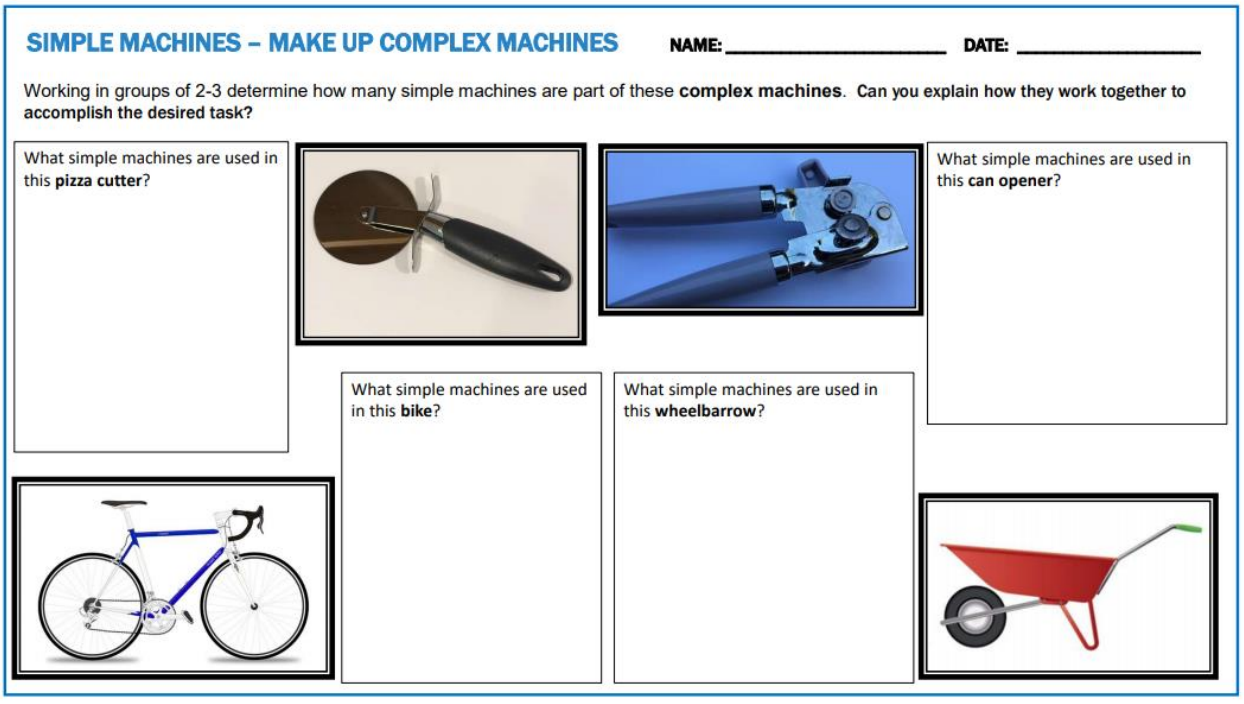
Can you think of a class 1 lever?
Take a minute to **discuss** in your group and produce examples used in everyday life.

Activity 3 – Complex Machines

In this activity students will analyze images of products on the worksheet to understand how many simple machines are incorporated in the various complex machines. They can work in groups of 2 or 3 to complete the task or do the work at home. This activity allows students to apply their understanding and evaluate the function of machines or tools they may use on a daily basis.

Developing the ability to determine which parts are critical in the design and analyze how products work is essential for students to develop design solutions. These are skills required for the culminating crane design challenge.

The "Simple Machines – Make Up Complex Machines" worksheet, similar to the thumbnail below, can be found in Appendix D and downloadable as full page presentation format.



SIMPLE MACHINES – MAKE UP COMPLEX MACHINES NAME: _____ DATE: _____

Working in groups of 2-3 determine how many simple machines are part of these **complex machines**. Can you explain how they work together to **accomplish the desired task?**

What simple machines are used in this **pizza cutter**?

What simple machines are used in this **can opener**?

What simple machines are used in this **bike**?

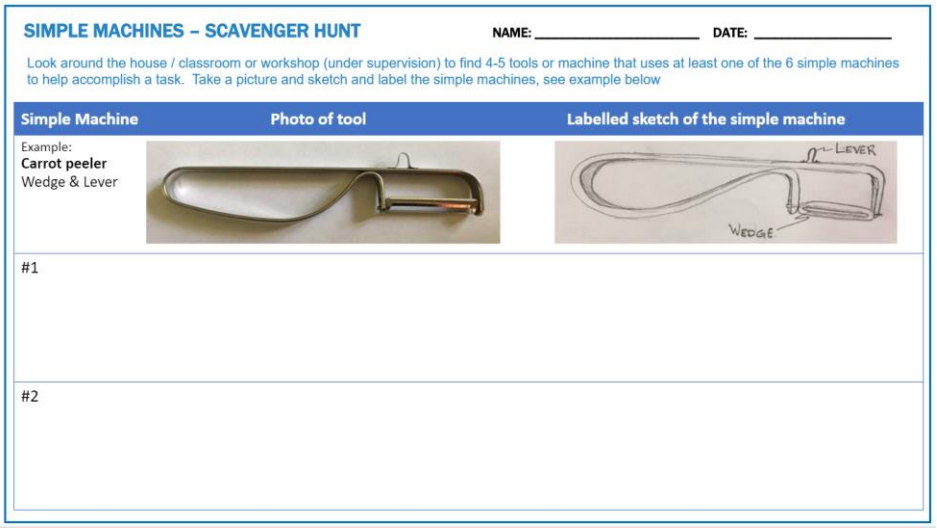
What simple machines are used in this **wheelbarrow**?

Activity 4 – Scavenger Hunt

In this activity students will search around their home/classroom/workshop to find, photograph and sketch simple machines.

Students will work on critical thinking skills by allowing them to apply their knowledge of simple machines as well as develop sketching skills. The task allows students to continue developing their sketching skills for assessment of learning. They will be required to sketch and label their design concepts for the final design challenge. This is an opportunity for teachers to provide students with feedback in preparation for the final culminating activity.

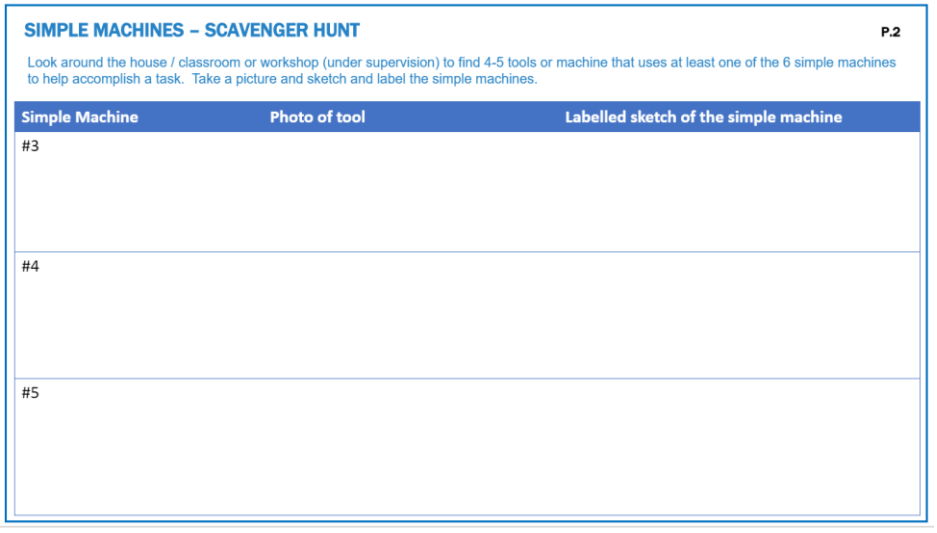
Full size Scavenger Hunt student activity worksheets, similar to the thumbnails below, can be found in Appendix E and downloadable as full page presentation format.



SIMPLE MACHINES – SCAVENGER HUNT NAME: _____ DATE: _____

Look around the house / classroom or workshop (under supervision) to find 4-5 tools or machine that uses at least one of the 6 simple machines to help accomplish a task. Take a picture and sketch and label the simple machines, see example below

Simple Machine	Photo of tool	Labelled sketch of the simple machine
Example: **Carrot peeler** Wedge & Lever		LEVER WEDGE
#1		
#2		



SIMPLE MACHINES – SCAVENGER HUNT P.2

Look around the house / classroom or workshop (under supervision) to find 4-5 tools or machine that uses at least one of the 6 simple machines to help accomplish a task. Take a picture and sketch and label the simple machines.

Simple Machine	Photo of tool	Labelled sketch of the simple machine
#3		
#4		
#5		

Activity 5 – Evolution of Machines Timeline

In this activity, students will conduct research on how a machine or tool has evolved over time and how society has benefited from the technology. By completing this activity students will develop their research and communication skills, while learning about how society influences technological innovation and how technology affects society. This task can be done in class or entirely online. A PowerPoint presentation is also available, see Appendix G.

The evolution of machines

Outline

Use a chronological timeline to present how a simple machine, complex machine or tool has evolved over time and how the technology has affected society.

Learning Goals

- ✓ Describe how society influences technological innovation and how technology affects society.
- ✓ Develop research skills using the internet.
- ✓ Develop communication, summarizing and visual presentation skills.

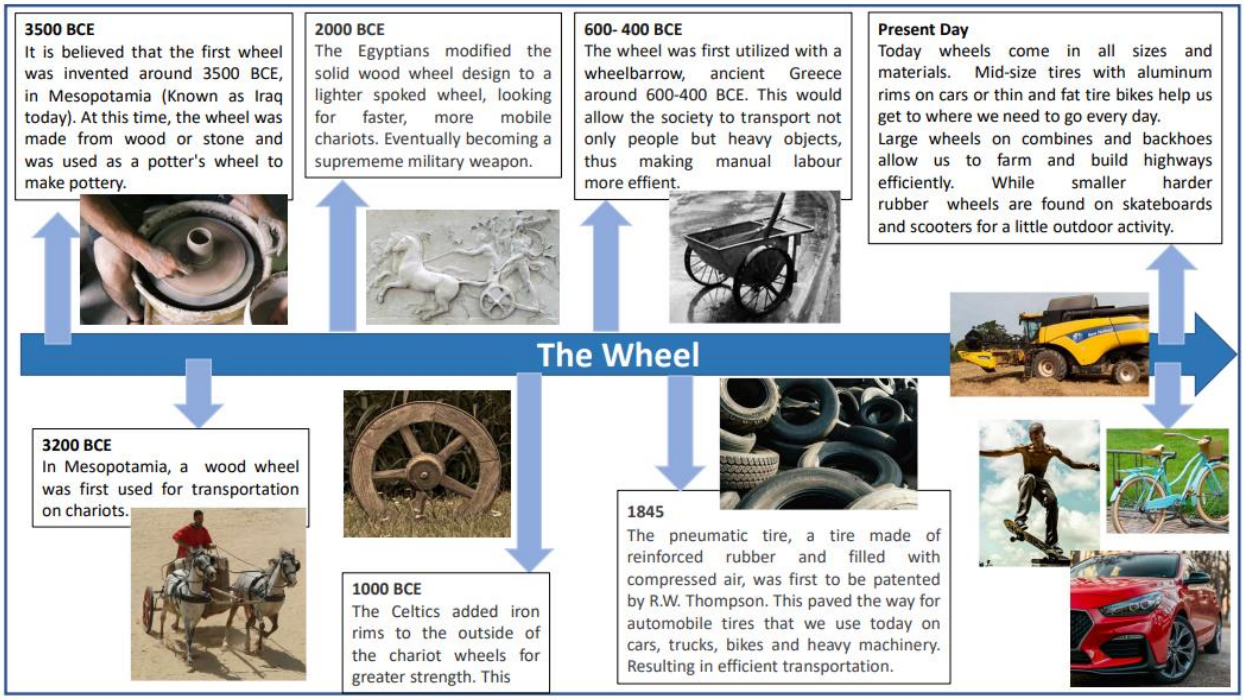
Success criteria

- ❑ Effective communication of your research material.
- ❑ Clearly communicate the importance of the tool/machine, how the machine has evolved, changes in materials, process, shape, function, utilizes a simple machine.
- ❑ Include at least 5 dates, images and chronological summary.
- ❑ Include a minimum of 3 resources to conduct your research.

The suggested method for this activity is to create a chronological timeline of a tool or machine. The timeline would include dates, images, inventors and societies that created/utilized or benefited from the technology. There are many possibilities as a medium to communicate this information. An oral presentation is also possible. An exemplar has been included on the following page.

Evolution of a Machine Exemplar

Below is an exemplar is shown below



Activity 6 – Design Challenge - Build and Test Your Own Crane.

This culminating activity will have students apply their knowledge from the previous activities, while working through the design cycle steps. They will work in teams, to design, build and test a crane that meets the design criteria and constraints. There are many videos available to demonstrate the primary function of a crane and this is a great way to introduce the challenge.

Build your own Crane

Design Challenge

You will take on the role of a junior engineer. Your team (2-3 people) will follow the design process to design, build and test a crane that can meet the challenge constraints outlined.

Objectives

- ✓ Research, plan, and organize projects, using a **design process** and appropriate methods and tools.
- ✓ **Create** and **test models** using a variety of techniques, tools, and materials.
- ✓ Develop **teamwork**, **problem solving** and **collaboration** skills.

Real world application connection

Engineers use simple machines such as levers, pulleys and wheels and axles (and gears) for the mechanical advantage they provide. This mechanical advantage makes doing work faster or easier. Lifting a heavy load from point A to point B for example is done with the use of all 3 simple machines working together. A crane or excavator are examples of such machines.

Design Criteria

- ✓ Lift a container with a minimum mass of 100 g
- ✓ Lift the container with mass at least 300 mm high.
- ✓ Additional challenge is to lift the most weight at the highest height above the minimum criteria.

Constraints:

- ✓ Use at least 50% recycled materials.
- ✓ Use other common materials found around your home.
- ✓ Use the additional hydraulic kit provided by your teacher.
- ✓ Follow the design cycle process in the time provided.

Materials:

Required:	Ideas for additional material:
✓ Cardboard ✓ Syringes (1-2) ✓ Vinyl tubing ✓ Adhesive (glue, tape, hot glue) ✓ Dowel – (For pivot)	✓ Popsicle Sticks ✓ Rope or string ✓ Paper clips ✓ Elastic Band ✓ Plastic bottle (recycled)

Required Tools:

- ✓ Engineering Journal – Take notes throughout the design process (electronic or paper)
- ✓ Ruler
- ✓ Pencil
- ✓ Hot glue gun (if you choose)
- ✓ Scissors or utility knife (if working under teacher or parent supervision)

Design Process:

1. Get into your team and **conduct research**. This can be a search on different types of crane designs and how they work, or a review of the previous simple machine activities completed in the unit
2. **Brainstorm** ideas of possible solutions that meet the design criteria and constraints.
3. Each student is to **sketch** 2 possible solutions. **Remember to include enough detail and notes in your sketch to effectively communicate your ideas.**
4. **Choose the best solution** as a team, using a pros and cons list to evaluate each design against the constraints.
5. Create a **technical drawing** of your final solution - **Technical Drawing:** provide a two-dimensional scale drawing of your design. It should include dimensions and labelled parts/information.
6. **Build a prototype.** Take notes of any issues that you encountered during the build.
7. **Test your prototype**. Make any necessary changes to ensure the design meets the criteria. Note all changes in your journal and mark up your sketch.
8. Finalize your design and test.
9. Write a reflection on the design process by answer questions provided.

Reflection Questions – These are to be typed up and handed in.

1. Did your design meet the criteria outlined in the design challenge? Explain why or why not.

2. What part of the prototype do you think was the most critical? Why?

3. Evaluate your design. What changes would you make to your original design? Why?

4. Name at least 2 benefits to working in a team. Name 1 drawback? Be specific.

5. What skills do you think are the most valuable for a team to be successful in designing a solution to a challenge? Why? (Ex; Collaboration, communication, organization, responsibility, initiative, independent work.)

6. Reflecting on the design process steps, which one do you think is the most critical and why? (Research, brainstorm, concept ideas, choose the best solution, build a prototype, test the prototype, re-evaluate).

Teacher Notes:

Here is a sample of a simple crane.

- First two images below show the crane fully extended and fully retracted.
- This design is basic and uses 2 syringes. More complex designs that mimic an excavator boom (crane) is another option depending on availability of syringes.
- The maximum weight the crane can lift will depend on the size of syringes available.
- The lesson and activities focused on the advantages of simple machines. This crane design also incorporates structures, which is covered in intermediate science. Additional lessons could be added to ensure student understand how to design a rigid enough crane arm that won't buckle. The design shown below has 2 pieces of cardboard hot glued together with the structural members in the vertical direction.

The **head** or attachment was not specified. A specific object, such as a cup with a handle, can be specified. This would create another design challenge constraint for student to incorporate into their design.

Multiple pivot points added to crane arm to allow students to try different lever lengths. This is a critical area where students can optimize the design to meet the criteria for max height and strength.

Planning Notes

1. Review slides and handouts in advance.
2. Review utility knife and hot glue gun safety procedures with the class in advance.
3. Order syringes and vinyl tubing, as most students won't have access to this material.

Resources

Files

There are six activities incorporating handouts, PowerPoint presentations, and lesson plans. Please see each activity as well as the appendices for all associated files.

Lesson Plans

Activity 2 is a lesson plan on simple and complex machines. It also goes into more detail about levers.

Handouts

Self and Peer Assessment for design project (Appendix A)
Simple and Complex Machine worksheet for Activity 1 (Appendix C)
Simple and Complex Machine worksheet for Activity 3 (Appendix D)
Simple and Complex Machine worksheet for Activity 4 (Appendix E)
Design Challenge - Build and Test Your Own Crane. (Activity 6)

Tools/Equipment

Tools required to carry out these activities include a pencil and paper (Activities 1,2,3,4,6); a computer with internet access (Activity 1,3,5); and scissors, utility knife, glue gun or tape, syringes and tubing (Activity 6)

Materials

For Activity 6, at least two syringes and lengths of vinyl tubing are to be provided by the teacher. Cardboard and tape or glue are the minimum materials required. Other materials can be used if available, and as determined by the teacher. The complete materials list is detailed in the handout.

Videos

Ted Ed video on the mighty mathematics of the lever

PBS video about simple machine inventions

PBS Learning Media video on Mechanical Advantage

PBS Learning Media video on Levers: Raising the Moai on Easter Island

PBS Learning Media video on Solving Complex Problems with Simple Machines

PBS Kids video on how levers work

Websites for Teachers

Interactive Lever simulation: Phet Simulation - Levers

Interactive Gear simulation: Gear generator simulation

Teachengineering.org - simple machines

Tryengineering.org

Instructional Strategies

The introduction of this unit can include a video of simple machines along with heavy machinery. Some video links have been included.

The activities can be for online, hybrid or in class learning. For hybrid or in class learning, students can complete the activities in pairs or small groups.

The culminating task is completed through broad based learning.

The Hook / Motivational Strategies

An introduction of a video of heavy machinery can be used to show students how simple machines are utilized to essentially move mountains. From small kitchen appliances, to bikes, trains, cranes and excavators, the mechanical advantage of simple machines can be found everywhere. Students will be working with a team of other junior engineers to apply their knowledge of simple machines to solve a real world problem.

Learning Goals and Success Criteria

Learning goals and success criteria are the foundation on which students base their ability to monitor their learning and determine next steps. Applicable learning goals may include any of the following,

- Students will identify simple machines in items they have in their house
- Students will sketch and make labeled drawings
- Students will develop communication using technological terminology
- By the end of the project, students will learn the steps of the design process
- By the end of the project, students will develop a set of designs to create a crane
- Students will use team work skills in order to build and test a crane
- By the end of the first five activities students will demonstrate sketching, research and presentation skills.
- Working on the design challenge (Activity 6), students will demonstrate an understanding of the design process and problem solving skills, specifically as it relates to building and testing a prototype.

Success criteria may include any of the following,

- I will be able to identify simple machines
- I will be able to correctly identify levers and their class of lever
- I will accurately sketch and make labeled drawings
- I will communicate effectively using technological terminology
- I will apply my knowledge to meet the design challenge
- I will follow the steps of the design process
- I will develop a set of designs to create a crane
- I will develop team work skills to build and test a crane
- I will incorporate recyclable materials in the design of my crane

Overall and Specific Expectations in Support of Ontario Curriculum Grades 9 - 10 Technological Education

Overall Expectations

B2. Apply appropriate methods for generating and graphically representing design ideas and solutions;

B3. Create and test models using a variety of techniques, tools, and materials;

C2. Describe how society influences technological innovation and how technology affects society

Specific Expectations

B2.1 Create freehand sketches of brainstormed design ideas, emphasizing key features (e.g., shapes, texture, materials, protrusions, unusual features).

B3.1 Use appropriate tools, equipment, and materials to create design models and/or prototypes.

B3.2 Use appropriate measuring methods and scales (e.g., metric: 1:10, 1 cm:1 m or 1:100, 1:500; imperial: 1 /2":1' or 1:24) when creating models and prototypes;

B3.3 Assess models and/or prototypes on the basis of prescribed criteria.

C2.1 Describe how society influences the development and use of technology.

Safety Concerns

The most effective way to cut cardboard for the culminating project is to use a utility knife. This can be substituted with scissors if there are any safety concerns around using such a tool.

A hot glue gun is an effective way to put all the pieces together. A bowl of ice water should be nearby and all long hair should be tied back. Masking or duct tape are both good alternatives to using a hot glue fun if there are any safety concerns.

Applicable SAFEDocs and ToolSAFE videos

Please refer to the OCTE SAFEDocs for Technological Design for safety documents in order to properly address any tool safety concerns when instructing this project.

You may also refer to the following ToolSAFE videos,

ToolSAFE video for Hot Glue Guns

ToolSAFE video for Modeling Tools

Project Challenges

The prototype build is most effective if completed in class with team members. However, it could be modified to be completed at home independently.

Differentiation of the Project / Activity

The unit begins with a diagnostic activity to be completed alone or with a partner. Allowing students to review what they have learned from previous sciences classes.

Activities are hands-on and in small groups, to allow for collaboration of ideas.

The lesson includes images and text along with think-pair-share activity to support various learning styles. The teacher will bring student ideas together to allow for deeper understanding of content.

Activity 5 and 6 submissions can be submitted as a video or presented orally.

Assessment and Evaluation

Assessment As Learning

Activity 1 can be used as a diagnostic tool to create a baseline of students' previous knowledge of simple machines.

Activity 2 is a lesson that includes opportunities for students to collaborate and share their ideas. This allows the teacher to assess their knowledge and observe how they apply that knowledge.

Assessment For Learning

Activity 3 and 4 provide students with the opportunity to apply their knowledge and get feedback relative to the theory of simple machines as well as on their sketching skills

Assessment Of Learning

Activity 5 can be used as assessment of learning or for learning, depending on when in the course the project is assigned. Students will demonstrate research and communication skills. Both of which are assessed in the final culminating project, Activity 6.

Activity 6 - Allows students to demonstrate their understanding of the theory and apply their research and sketching skills that they worked on in previous activities. Students will also demonstrate their understanding of the design process through broad based learning.

Career and Industry Extensions

Applying knowledge in real world applications. Students can investigate how simple machines can be utilized to help the elderly or someone with a disability accomplish an otherwise simple task. (Ex, getting out of bed or the car, opening a jar or a door, etc.).

Review videos that explore related careers and create a Venn Diagram to compare necessary skills in 2-3 of the career choices. Career opportunities in fields that use the design process and simple machines.

Example of some videos are:

- Hot Jobs on PBS – Explanation from a Computer, Biomedical and Electrical Engineering students and their final design project. PBSLearning- Engineering Student Projects Video
- PBS Learning - Interview with a mechanical engineer designing bicycles
- Edge factor has spotlight videos on many different careers in trades and tech fields. Edge factor - careers

Environmental Considerations

Students will use at least 50% of recycled materials required for the culminating project.

Reflection or Design Report

Students will reflect on the design process by answering and submitting questions after the build challenge is complete (Activity 6). An extension of the project could be to add a final design report submission.

Appendix A - Design Project - Self and Peer Assessment

Skills - Self and peer assessment **Design Project**

Name:_____ **Peer Assessor Name:_____**

Many skills are required to successfully work in a team to design and build. You will think back to your behaviour throughout the design process and complete a self-assessment and have one team member evaluate the following skills by answering the questions below.

Add an N, S, G or E for each statement.

N = Needs Improvement (rarely)	**S = Satisfactory (sometimes)**
G = Good (usually)	**E = Excellent (always)**

Learning Skills	Behaviour	Self	Peer
Responsibility	I fulfill all individual and team responsibilities and commitments during the design process.		
	I complete and submit all my work on time.		
	I act responsibly and with care towards my team members and other teams.		
	I actively listen during group discussions.		
	I clean up my workspace and put away any tools I used		
Collaboration	I accept different roles and an equitable share of work in a group.		
	I listen and respond respectfully to the ideas, opinions, values, and traditions of others.		
	I interact positively with my team members to resolve problems by compromising.		
	I share information, resources, and expertise to solve problems and make informed design decisions.		
Initiative	I look for and act on new ideas and opportunities for learning.		
	I demonstrate an openness to new ideas and a willingness to take risks.		
	I demonstrate a curiosity and interest in learning, by researching and asking questions.		
	I approach new tasks with a positive attitude.		
	I recognize and speak up appropriately for the rights of myself and others.		
	I complete work at home that did not get done in class, to support the team objectives.		
	I take ownership to get my work started, without being asked.		
Self-regulation	I review my work and improve upon it.		
	I persevere and make an effort when responding to challenges.		
	I ask questions if something is unclear.		
	I complete the assigned task and use my class time wisely		

Appendix B - Design Project Rubric

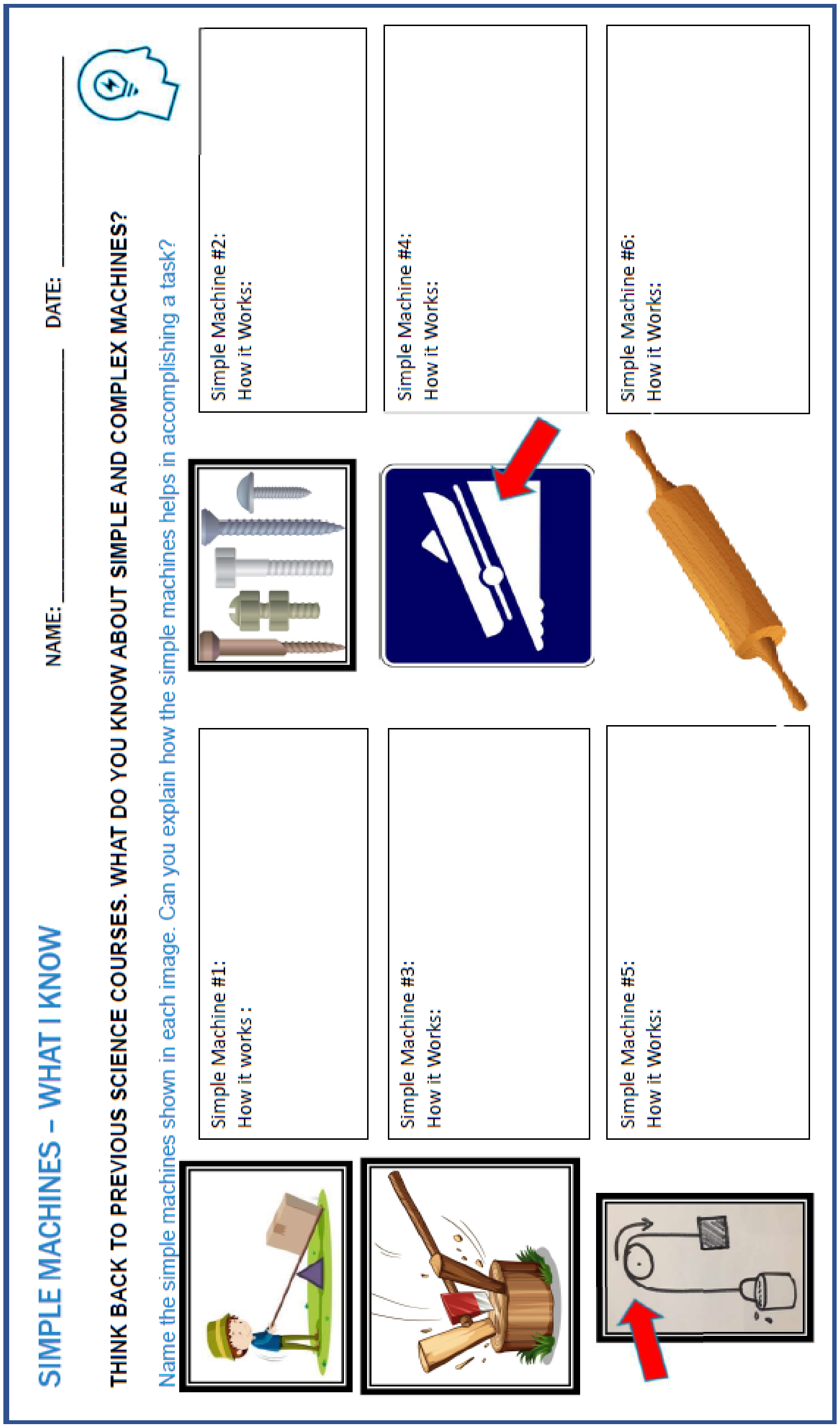
This is a single point rubric. The criteria for a level 3 is defined. If the students' work is above or below the expected level 3 criteria, notes can be added to provide students with specific feedback.

Rubric **Design Project Assignment** **Name:**_____

Concerns – Areas for improvement Below Level 3	Assessment Criteria – Meets Level 3	Advance - Exceeds - Level 4 and above
Research		/5
	Conducts considerable research using at least 3 credible sources.	
Sketching / Concept development		/10
	Demonstrates sketching skills with considerable neatness and attention to detail when concepting potential design solutions	
	Concepts are considerably different from one another.	
	Concepts clearly includes features and aspects from the theory learned in class or the research conducted on existing crane designs.	
	Designs are innovative and not a copy of an existing design.	
Choosing the best design		/5
	Uses concrete rationale based on the design criteria to choose the best solution to move forward with. (I.e. a pros and cons list for each design option.)	
Prototype Build		/20
	Prototype is functional and meets most of the criteria and constraints of the project.	
	The prototype demonstrates that considerable time and care was spent during the build process.	
	Creative design and use of materials that meet the criteria outlined.	
Reflection / Evaluation		/10
	The write up is clearly communicated with few grammar or punctuation mistakes.	
	Considerable evidence is included in the reflection, demonstrating considerable understanding of the design process.	

Final Grade:

Appendix C - Simple and Complex Machine worksheet for Activity 1.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NAME:____________ DATE:____________

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Name the simple machines shown in each image. Can you explain how the simple machines helps in accomplishing a task?

Simple Machine #1:
How it works :

Simple Machine #2:
How it Works:

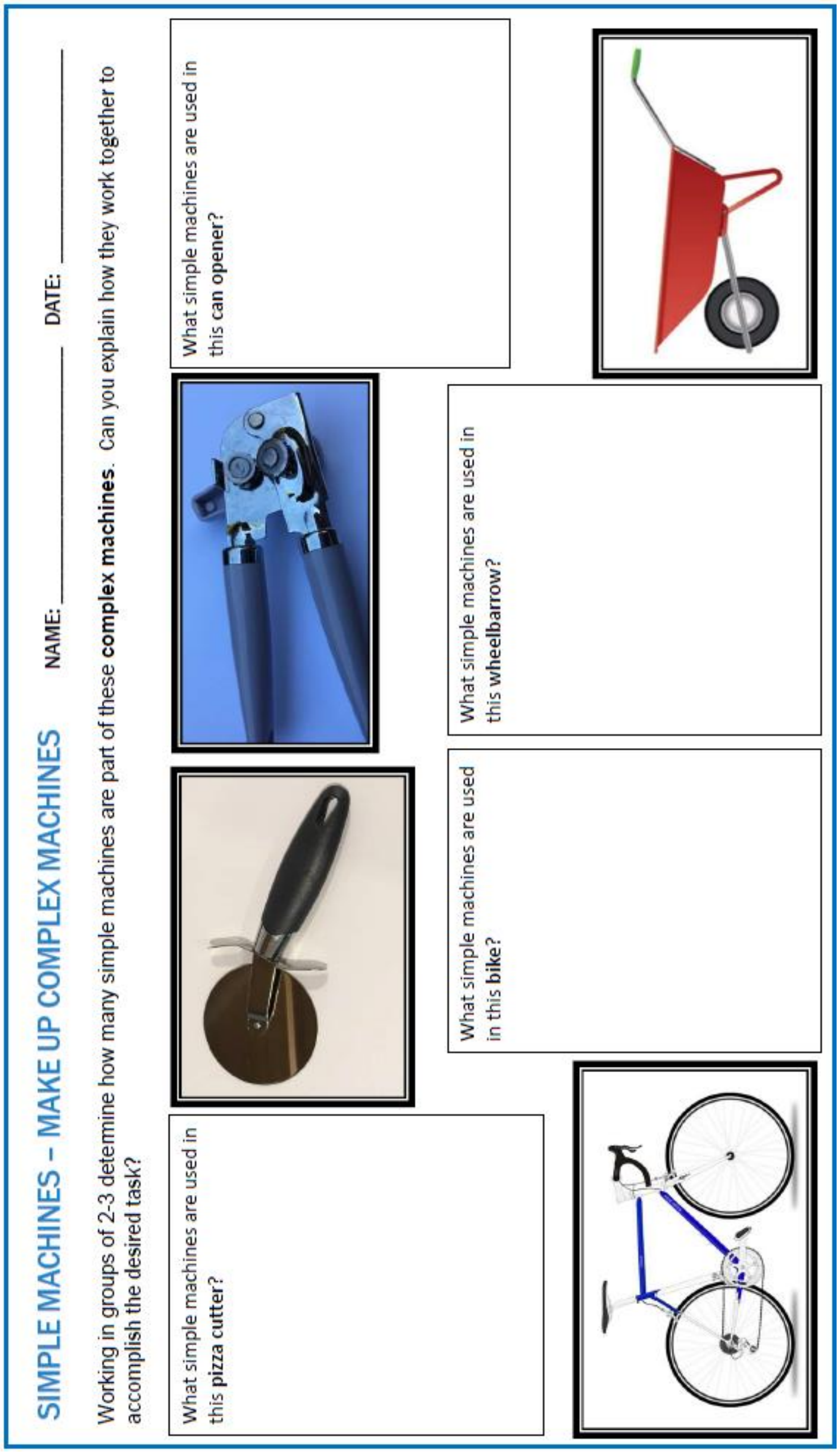
Simple Machine #3:
How it Works:

Simple Machine #4:
How it Works:

Simple Machine #5:
How it Works:

Simple Machine #6:
How it Works:

Appendix D - Simple and Complex Machine worksheet for Activity 3



SIMPLE MACHINES – MAKE UP COMPLEX MACHINES NAME:__________ DATE:__________

Working in groups of 2-3 determine how many simple machines are part of these **complex machines**. Can you explain how they work together to accomplish the desired task?

What simple machines are used in this **pizza cutter?**

What simple machines are used in this **can opener?**

What simple machines are used in this **bike?**

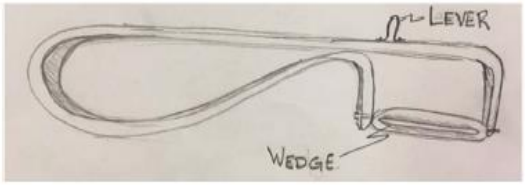
What simple machines are used in this **wheelbarrow?**

Appendix E - Simple and Complex Machine worksheets for Activity 4

SIMPLE MACHINES – SCAVENGER HUNT

NAME: _____ DATE: _____

Look around the house / classroom or workshop (under supervision) to find 4-5 tools or machine that uses at least one of the 6 simple machines to help accomplish a task. Take a picture and sketch and label the simple machines, see example below

Simple Machine	Photo of tool	Labelled sketch of the simple machine
Example: **Carrot peeler** Wedge & Lever		
#1		
#2		

SIMPLE MACHINES – SCAVENGER HUNT

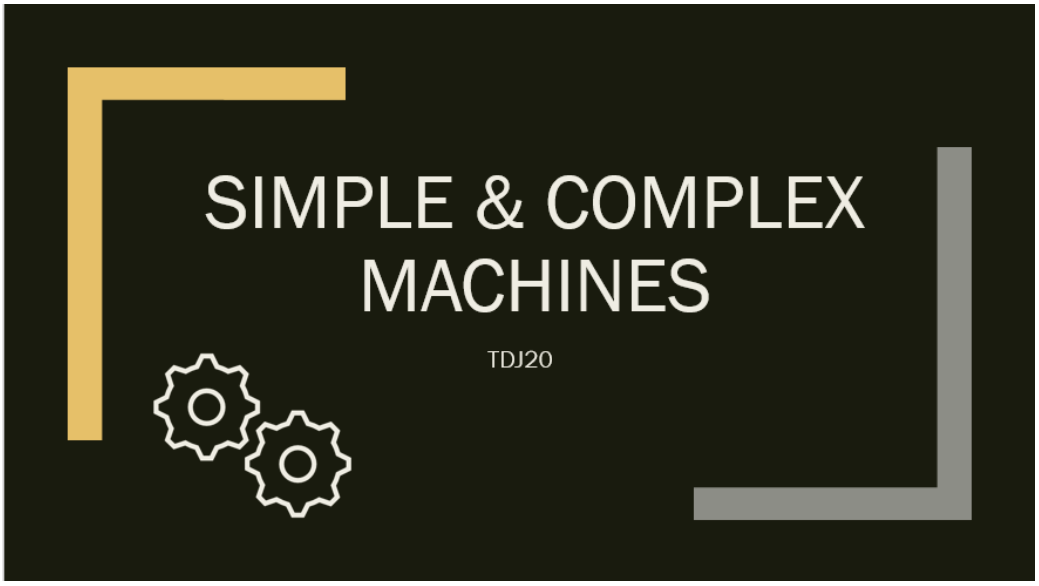
P.2

Look around the house / classroom or workshop (under supervision) to find 4-5 tools or machine that uses at least one of the 6 simple machines to help accomplish a task. Take a picture and sketch and label the simple machines.

Simple Machine	Photo of tool	Labelled sketch of the simple machine
#3		
#4		
#5		

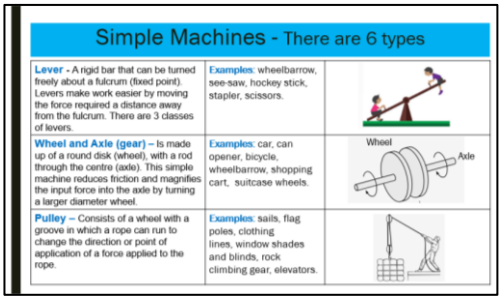
Appendix F – Simple Machines PowerPoint (Activity 2)

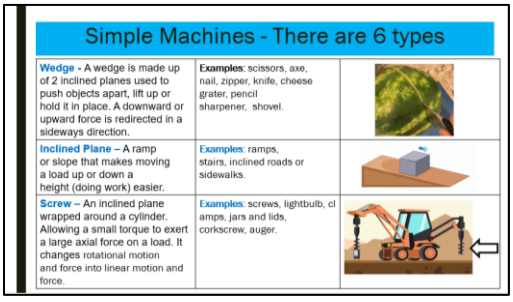
Simple Machines PowerPoint presentation

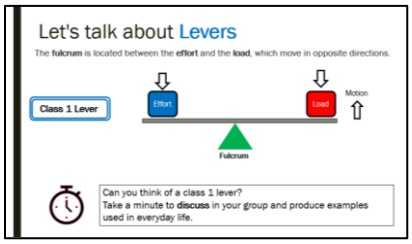


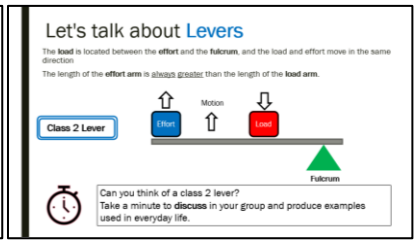
https://www.octe.ca/application/files/3115/9745/6853/Activity_2_-_Simple_Machines.pptx

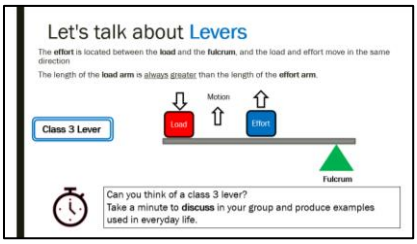
Teacher are invited to use this PowerPoint presentation during Activity 2. The presentation outlines the 6 types of simple machines and covers the 3 classes of levers.











Appendix G –Evolution of Machines Timeline Assignment PowerPoint (Activity 5)

https://www.octe.ca/application/files/3615/9701/6505/The_Evolution_of_Machines_-_Activity_5.pptx

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