1.0 Machines are tools that help humans do work
Key Concepts
• systems and subsystems
• transmission of force and motion
• simple machines

What is a machine designed to do?
____________________________________________________________________________________

How did ancient machines pave the way for improvements?
____________________________________________________________________________________

What is a simple machine?
____________________________________________________________________________________

Describe the different types of simple machines and give examples of each type

<table>
<thead>
<tr>
<th>Machine</th>
<th>Description</th>
<th>Illustration</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>lever</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>inclined plane</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wedge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>screw</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pulley</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>wheel and axle</td>
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</tbody>
</table>
Illustrate and give examples of the three classes of levers.

<table>
<thead>
<tr>
<th>Lever Type</th>
<th>Illustration</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Class</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd Class</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd Class</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Simple machines can be used to obtain 4 different effects! Briefly describe each effect.

1. __________________________________________________________________________

2. __________________________________________________________________________

3. __________________________________________________________________________

4. __________________________________________________________________________

Identify the different machines that make a bicycle

[Diagram of a bicycle with labeled parts]
What are the functions of linkages?
______________________________________________________________________________________
______________________________________________________________________________________

What are the functions of transmissions?
______________________________________________________________________________________
______________________________________________________________________________________

What are gears used for in mechanical devices?
______________________________________________________________________________________
______________________________________________________________________________________

Illustrate the following types of gear trains and briefly explain what they would be used for.

<table>
<thead>
<tr>
<th>Parallel Gears</th>
<th>Multiplying Gears</th>
<th>Reducing Gears</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<td></td>
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<td></td>
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</tbody>
</table>
2.0 An understanding of mechanical advantage and work helps to determine the efficiency of machines.

Key Concepts
- mechanical advantage, speed ratios and force ratios
- mechanical advantage and hydraulics
- measurement of work in joules

What is **mechanical advantage**?

_____________________________________________________________________________________

_____________________________________________________________________________________

How do you calculate **mechanical advantage**?

_____________________________________________________________________________________

What is **speed ratio**?

_____________________________________________________________________________________

_____________________________________________________________________________________

How do you calculate **speed ratio**?

_____________________________________________________________________________________

What is the **disadvantage of a force advantage** in a machine?

_____________________________________________________________________________________

_____________________________________________________________________________________

What machine has a **mechanical advantage of less than 1** – why would it be useful?

_____________________________________________________________________________________

_____________________________________________________________________________________

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_____________________________________________________________________________________
Describe the difference between real mechanical advantage and speed ratio.

_____________________________________________________________________________________
_____________________________________________________________________________________

What effect does friction have on a machine?

_____________________________________________________________________________________

How is the efficiency of a machine calculated?

_____________________________________________________________________________________

What is the scientific definition of work?

_____________________________________________________________________________________
_____________________________________________________________________________________

How is work calculated?

_____________________________________________________________________________________

Why is work done with a machine is the same as work done without a machine?

_____________________________________________________________________________________
_____________________________________________________________________________________

How does friction affect the equality between work input and work output in real situations?
What is a **hydraulic system**?

_____________________________________________________________________________________

How does it work?

_____________________________________________________________________________________
_____________________________________________________________________________________

What does **Pascal’s Law** state in relation to fluids in an enclosed system?

_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

How is **mechanical advantage** determined in hydraulic systems?

_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

Illustrate and Calculate the mechanical advantage of a sample hydraulic lift:

**Input piston** has an area of 1.5m² - **Output piston** has an area of 30m²
Force applied on the **Input piston** is 25N - How much of a load can be lifted?

What is the **mechanical advantage** of this hydraulic system?
3.0 **Science, society, and the environment are all important in the development of mechanical devices and other technologies.**

### Key Concepts
- design and function
- social and environmental impacts

What criteria are usually used to evaluate a mechanical device?

_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

Describe the evolution of the pop can opener which lead to improvements in design.

<table>
<thead>
<tr>
<th>Can Opener Design</th>
<th>Advantage (What improvement it made)</th>
<th>Disadvantage (Reason for Redesign)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hammer and Chisel</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1800’s</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Church Key</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1950’s</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Removable Pull Tab</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1963</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Push Button Tabs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid 1970’s</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Non-removable Pull Tab</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td></td>
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</tr>
</tbody>
</table>

Efficiency described **qualitatively** – efficiency is when a task is easier and quicker to do using a machine.

Your new and Improved Pop Can Design
**Technology develops through change!**
Technology development is influenced by scientific knowledge, trial and error and changes in society and the environment

Describe how each of the following results in new technologies being developed.

<table>
<thead>
<tr>
<th>Invention</th>
<th>Advances in Science</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Windshield wiper blade</em></td>
<td><em>Magnetic Levitation Trains</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Changes in Society</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Robots</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Changes in the environment</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Oil Spill Skimmer</em></td>
</tr>
</tbody>
</table>