

Lesson 2.2 Mechanical Systems

Understandings

1. Energy is the capacity to do work; the use of mechanisms is necessary to transfer energy.
2. Engineers and technologists design mechanisms to change energy by transferring direction, speed, type of movement, and force or torque.
3. Mechanisms can be used individually, in pairs, or in systems.

Knowledge and Skills

It is expected that students will:

- Use ratios to solve mechanical advantage problems.
- Use numerical and algebraic expressions and equations to solve real-life problems, such as gear ratios.
- Use the characteristics of a specific mechanism to evaluate its purpose and applications.
- Apply knowledge of mechanisms to solve a unique problem for speed, torque, force, or type of motion.

Essential Questions

1. Which mechanism would be used to increase speed?
2. Which mechanism would be used to increase torque or force?
3. How do you change types of motion using mechanisms?
4. Where are mechanisms used in real-life applications and what is their purpose?

Key Terms

Term	Definition
Belt & Pulley	The transmission of power between shafts by means of a belt connecting pulleys on the shafts.
Bevel Gear	One of a pair of gears used to connect two shafts whose axes intersect.
Cam & Follower	A pear-shaped disk with an off-center pivot point, used to change rotating motion into reciprocating motion.
Crank & Slider	A pivot pin near the outside edge of a wheel or disk that changes reciprocating motion into rotary motion.
Crown & Pinion	A small cogwheel (pinion gear) that engages or is engaged by a larger cogwheel (crown gear).

Drive Gear	The gear which transmits power and motion to the rest of the system. The input gear.
Driven Gear	The member of a pair of gears to which motion and power are transmitted by the other. The output gear.
Energy	The ability to do work.
Force	A push or pull on an object.
Gear	A toothed wheel that works with others to alter the relation between the speed of an engine and the speed of the driven parts.
Gear Ratio	The ratio of the speed of the driving member of a gear train to that of the driven member.
Idler Gear	A gear between the driver and the driven gear used to change rotational direction.
Input	Something put into a system, such as resources, in order to achieve a result.
Inverse	Opposite in position, direction, order or effect.
Lead Screw	A threaded shaft used to convert rotary movement to linear movement.
Linear Motion	Movement in a straight line.
Mechanism	The part of a machine which contains two or more pieces arranged so that the motion of one compels the motion of the others.
Oscillate	A swing back and forth at a regular rate.
Output	The results of the operation of any system.
Pitch	The distance between adjacent threads in a screw.
Rack & Pinion	A rotating gear that meshes with a bar that has gear teeth along its length. Changes rotating motion into linear motion.
Ratio	The quantitative relation between two amounts showing the number of times one value contains or is contained within the other.
Reciprocating	A back and forth movement.
Rotary Motion	Circular movement.
Simple Gear Train	A combination of two or more gears used to transmit motion between two rotating shafts or between a shaft and a slide.
Torque	A twisting force.
Universal Joint	A joint that allows connected shafts to spin freely while permitting a change in direction.
Work	The application of force that moves an object a certain distance.
Worm & Wheel	A mechanical arrangement consisting of a toothed wheel driven by a short revolving cylinder bearing a screw thread.

Instructional Resources

Presentations

Mechanisms Toybox

Mechanisms

Word Documents

Activity 2.2.1 Observing Mechanisms

Activity 2.2.2 Mechanical Gears

Activity 2.2.2.a Mechanisms Review

Project 2.2.3 Windmill Construction

Project 2.2.4 Pull Toy Construction

Project 2.2.5 Survival Challenge

Answer Keys and Rubrics

Activity 2.2.1 Observing Mechanisms Answer Key

Activity 2.2.2.a Mechanisms Review Answer Key

Project 2.2.4 Pull Toy Construction Rubric

Project 2.2.5 Survival Challenge Rubric

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