

# Unit 03: Cams/Gears

Content Area: **Template**  
Course(s):  
Time Period: **Full Year**  
Length: **FY**  
Status: **Published**

## Standards Alignment

---

### New Jersey Student Learning Standards

---

#### Practice 8. Obtaining, evaluating, and communicating information

Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.

Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

### Integration of Career Readiness, Life Literacies and Key Skills

---

12.9.3.ST	Science, technology, engineering & mathematics
12.9.3.ST.1	Apply engineering skills in a project that requires project management, process control and quality assurance.
12.9.3.ST.3	Describe and follow safety, health and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.
12.9.3.ST-ET	Engineering & Technology Career Pathway
12.9.3.ST-ET.2	Display and communicate STEM information.
12.9.3.ST-ET.5	Apply the knowledge learned in STEM to solve problems.
12.9.3.ST-ET.6	Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner.
12.9.3.ST-SM	Science & Mathematics Career Pathway
12.9.3.ST-SM.2	Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP3	Attend to personal health and financial well-being.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.

CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP10	Plan education and career paths aligned to personal goals.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

---

## **Technology / Integration of Computer Science and Design Thinking**

TECH.8.2.12	Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.
TECH.8.2.12.C	Design: The design process is a systematic approach to solving problems.
TECH.8.2.12.C.4	Explain and identify interdependent systems and their functions.
TECH.8.2.12.C.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
TECH.8.2.12.C.7	Use a design process to devise a technological product or system that addresses a global problem, provide research, identify trade-offs and constraints, and document the process through drawings that include data and materials.
TECH.8.2.12.D	Abilities for a Technological World: The designed world is the product of a design process that provides the means to convert resources into products and systems.
TECH.8.2.12.D.1	Design and create a prototype to solve a real world problem using a design process, identify constraints addressed during the creation of the prototype, identify trade-offs made, and present the solution for peer review.
TECH.8.2.12.D.3	Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system.

---

## **Interdisciplinary Connections: NJSLs for ELA, Social Studies, Science and/or Math Section**

LA.K-12.NJLSA.SL	Speaking and Listening Comprehension and Collaboration
LA.K-12.NJLSA.SL1	Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
LA.SL.11-12.1.A	Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well reasoned exchange of ideas.
LA.SL.11-12.1.B	Collaborate with peers to promote civil, democratic discussions and decision-making, set clear goals and assessments (e.g., student developed rubrics), and establish individual roles as needed.

---

## **Integration of Diversity, Equity and Inclusion; Climate Change; Informational and Media LiteracyNew Section**

see Crosswalks

## **21st Century Life and Careers**

---

### **Stage I: Desired Results**

---

#### **Transfer/Overview/Rationale**

##### **Transfer / Overview / Rationale**

Unit Rationale

The purpose of this unit...

**This unit will allow students to explore how cams, shafts, and gears work in the real world.**

#### **Meaning**

---

#### **Essential Questions**

---

Essential Questions

- Why is it important to have multiple systems work together?
- How are the use of cams, gears, and shafts necessary in the real world?
- How can each independent function contribute to the success of the product?

#### **Enduring Understanding/Indicators of Understanding**

---

Enduring Understanding/Indicators of Understanding

- Cams, gears, and shafts are used to transition motion from rotational to linear such as in vehicles.
- When working with cams, shafts and gears it is important to have each system to work properly as one whole. If one part is malfunctioning it will affect the rest of the system.
- Each component of a product has a unique function that contributes to the whole product's success. This requires each function to work well independently to achieve the overall function.

## **Acquisition (Student Learning Objectives)**

---

### **Knowledge**

---

Knowledge

Students will know...

- **Difference in types of cams**
  - Snail dropcam
  - 3 and 5 lobed cam
  - Eccentric cam
- **How a functioning crank operates**
- **How a rack and pinion operates**

### **Skills**

---

Skills

Student will be skilled at ...

- **Properly and safely use materials and equipment in the classroom.**
- **Properly construct a design that uses cams, shafts, and gears.**
- **Apply knowledge of cams, shafts, and gears to a design problem.**
- **Complete 2D and 3D drawings.**
- **Select and utilize resources that have been modified by digital tools (e.g., CNC equipment, CAD software) in the creation of a technological product or system.**
- **Develop a model to explain the uses and features of the residence.**
- **Write a self- and design-evaluation for the project.**

## **Stage 3: Learning Plan**

---

## Resource and Mentor Texts

---

### Resources and Mentor Texts

- <http://newmediaartist.org/index.php/chapter-15/143-three>
- CTE Curriculum
- Youtube.com
- TED talks
- <https://www.youtube.com/watch?v=lzJTbc3wkJ8>
- [https://www.youtube.com/watch?v=ll11qkwt\\_Dw](https://www.youtube.com/watch?v=ll11qkwt_Dw)
- <http://newmediaartist.org/index.php/chapter-15/144-two>

## Formative Assessment Strategies

---

### Formative Assessment Strategies

- Exit ticket
- Engineering notebooks
- Notebook checks
- Design sketches
- Twitter board
- Teacher-led questions and discussion
- Morph chart
- Peer feedback
- Scale model
- What did we learn? chart
- KWL chart
- Daily design logs
- Feedback meetings with teacher
- Self rating on cleanup/organization
- Presentation run-throughs
- Thumbs up/down/sideways

## Learning Activities/Unit of Study

---

### Learning Activities/Unit of Study

- Do Now--Review questions, take out materials from the previous day, log on to computers and open up documents, small activity to recap the day before
- Review - recap on material that has been covered (questions, discussion, whiteboard)
- Lecture on cams, shafts, and gears.
- Demos- teacher will show student new skills by going through them step by step(illustrator skills, machine demos, brainstorming techniques, tutorials)

- Partners/teams - students will work in teams for projects, receive feedback, and complete other assignments
- Board/White Board Work - (solve problems/practice skills at board, or at seat with individual white boards).
- Review and practice skills using a variety of materials - (machines, programs, brainstorming techniques, work through design challenges/projects)
- Student led instruction
- Thumbs up/down/sideways - quick formative assessment to gauge students level of understanding
- Jeopardy style review games.
- Students “as teachers” where they present a design ideas they have brainstormed and researched
- Feedback- meet with teacher to receive feedback on each part of the assignment before moving forward.
- Testing and evaluation- students along with the teacher will test student projects and evaluate the projects success.

## **Modifications and/or Accommodations**

---

### **Suggested Modifications (ELL, Sp. Ed, Gifted, At-risk of Failure)**

#### **English Language Learners**

Native language support: The teacher provides auditory or written content to students in their native language.

Adjusted Speech: The teacher changes speech patterns to increase student comprehension. This could include facing the students, paraphrasing, clearly indicating the most important ideas, and speaking more slowly.

Visuals: The teacher uses graphics, pictures, visuals, and manipulatives. This helps ELL students better understand and comprehend the subjects at hand.

Front-Loading Vocabulary: The teacher front loads vocabulary. This means providing students with a list of important vocabulary words they will need to know for a book, lesson, etc. prior to the lesson being taught. Including pictures to go with the vocabulary words is also very beneficial for the students.

#### **Special Education Students**

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer

questions. It is important to give students enough time to process their thoughts.

**Oral Reading:** The teacher will read work orally to students. Class work such as tests and literature circles may need to be read aloud to the student.

**Timers:** The teacher will use timers as an instructional tool. The use of timers is beneficial for students who have trouble completing tasks. Timers can be helpful so the student is aware of how much time they have to complete an assignment.

## **Students with 504 Plans**

**Chunking:** The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

**Checking for Understanding:** It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

**Extra time:** The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

## **Gifted & Talented Strategies**

**Extensions/Enrichments:** Teachers will provide gifted and talented students with extension/enrichment projects. Students will be challenged to further their understanding, to apply acquired knowledge, and/or to produce something in reference to acquired knowledge.

**Modify/Change Activities:** Teachers will monitor and modify activities to accommodate those students who need to be challenged further. Additional reading, problem-solving, writing, or project work is necessary for those students who are ready to move on at a rate more accelerated than their peers. In this way, G & T students are provided the same opportunity for support as special needs students.

## **Students at Risk of School Failure**

**Directions or Instructions:** Make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten.

**Peer Support:** Peers can help build confidence in other students by assisting in peer learning. Many teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to

have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

**Alternate or Modified Assignments:** Always ask yourself, "How can I modify this assignment to ensure the students at risk are able to complete it?" Sometimes you'll simplify the task, reduce the length of the assignment or allow for a different mode of delivery. For instance, many students may hand something in, the at-risk student may jot notes and give you the information verbally. Or, it just may be that you will need to assign an alternate assignment.

**Increase One to One Time:** When other students are working, always touch base with your students at risk and find out if they're on track or needing some additional support. A few minutes here and there will go a long way to intervene as the need presents itself.

**Contracts:** It helps to have a working contract between you and your students at risk. This helps prioritize the tasks that need to be done and ensure completion happens. Each day write down what needs to be completed, as the tasks are done, provide a checkmark or happy face. The goal of using contracts is to eventually have the student come to you for completion sign-offs.

**Hands On:** As much as possible, think in concrete terms and provide hands-on tasks. This means a child doing math may require a calculator or counters. The child may need to tape record comprehension activities instead of writing them. A child may have to listen to a story being read instead of reading it him/herself.

**Tests/Assessments:** Tests can be done orally if need be. Break tests down in smaller increments by having a portion of the test in the morning, another portion after lunch and the final part the next day.

**Seating:** Seat students near a helping peer or with quick access to the teacher. Those with hearing or sight issues need to be close to the instruction which often means near the front.