Kinnelon Public Schools

Curriculum Scope and Sequence

for

Power, Energy and Transportation Technology
Grade 9-12

General Overview, Course Description or Course Philosophy
This semester course emphasizes the application of integrated STEM (Science, Technology, Engineering and Mathematics) principles and the design method to invent solutions to real world problems. Students will identify problems, research, design and fabricate solutions. Problem solving, critical thinking and design skills are taught through a variety of activities. Hands-on themes include utilizing mechanisms and simple machines to create mechanical advantage, fluid power systems, and structural design. This course provides all students with valuable skills such as: problem solving, design, creative thinking, systems thinking, teamwork, documentation, and computer applications.

Created by	Jason Potzer	**Date**	06/25/2018	**Board Approval Date**	09/27/2018

CURRICULUM SCOPE AND SEQUENCE			
Content Area	Technology	**Course Title/Grade Level**:	Power, Energy and Transportation Technology/9-12

GENERAL OVERVIEW AND PACING		
	Topic/Unit Name	**Suggested Pacing (Days/Weeks/Periods)**
Topic/Unit 1	Lab/Machine Safety and Material Processing	3 weeks
Topic/Unit 2	Design Loop	2 weeks
Topic/Unit 3	Orthographic Drawing	2 weeks
Topic/Unit 4	Levers and Linkages	2 weeks
Topic/Unit 5	Engineering Logs	1 week
Topic/Unit 6	Fluid Power	2 weeks
Topic/Unit 7	Design a Solution to a Problem - Hydraulic Arm	2 weeks
Topic/Unit 8	Mechanical Advantage in Gears and Pulleys	3 weeks
Topic/Unit 9	Design a Solution to a Problem - Crane	3 weeks

Unit/Topic Title	Lab/Machine Safety and Material Processing	Approximate Pacing	3 weeks

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Students will understand:

- Lab, machine and eye safety policies and procedures.
- How to properly utilize safety equipment, hand and machine tools.
- The appropriate procedures for processing material utilizing hand tools and machines.
- How to create and maintain a safe working environment for a students, teachers and guests.

CONTENT AREA STANDARDS

NJSLS #	Standard Language
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.

RELATED STANDARDS

(e.g., Technology Standard 8, 21st Century Life and Careers, Standard 9, NJSLS ELA Companion Standards are required for all 6-12 non-ELA courses, and/or others: ISTE, AASL, etc.)

NJSLS #	Standard Language
CRP2	Apply appropriate academic and technical skills.

STUDENT LEARNING TARGETS

Declarative Knowledge	Procedural Knowledge
Students will know: ● Identify the rules associated with lab, eye and machine safety. ● Identify how to use safety equipment, hand tools and all machines. ● Identify errors when processing material.	***Students will be able to:*** ● Demonstrate the ability to utilize lab equipment properly, following and applying safety principles. ● Select the best method for machining a part.

EVIDENCE OF LEARNING

Formative Assessments (Ongoing during the unit; link formative data tracking forms and/or samples of formative assessments)	● Observation of students using safety equipment, hand tools and machines. ● Quizzes - General lab safety, Eye Safety, Hand tools, Drill Press, Band Saw, Scroll Saw, Compound Miter Saw, Disc and Belt Sander. ● Observation of material processing project
Summative Assessments (At the end of the unit; link samples of summative assessments)	● Material Processing Widget (Hands on Project Based Rubric Assessment)

RESOURCES

- Eye, lab and machine safety notes and quizzes.
- Eye safety policy.

DIFFERENTIATED INSTRUCTIONAL STRATEGIES / RESOURCES / MATERIALS

Students may be provided with extra time and/or printed notes. The unit is structured to support students at various level of skill and knowledge of the topic.

Unit/Topic Title	Design Loop	Approximate Pacing	2 weeks

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Students will understand:

- The importance of utilizing the eleven steps of the design loop when designing a solution to a problem..
- The significance of ignoring specific steps of the design loop.
- The design loop is not linear.

CONTENT AREA STANDARDS

NJSLS #	Standard Language

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.
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.

RELATED STANDARDS

(e.g., Technology Standard 8, 21st Century Life and Careers, Standard 9, NJSLS ELA Companion Standards are required for all 6-12 non-ELA courses, and/or others: ISTE, AASL, etc.)

NJSLS #	Standard Language
CRP6	Language from the standards (Copy and paste recommended. Remove formatting before pasting into this document)
CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.

STUDENT LEARNING TARGETS

Declarative Knowledge	Procedural Knowledge
Students will know: ● State, recognize and identify the 11 steps of the design loop. ● Describe how skipping design loop steps can negatively affect the process..	***Students will be able to:*** ● Select the best solution when designing a prototype/problem solving ● Test and evaluate designs/prototypes. ● Research how to improve current designs/prototypes.

EVIDENCE OF LEARNING

Formative Assessments (Ongoing during the unit; link formative data tracking forms and/or samples of formative assessments)	Design Loop Quiz, Hands-on project observation
Summative Assessments (At the end of the unit; link samples of summative assessments)	Bridge/Tower Design Project Rubric

RESOURCES

- Teacher Presentations, Quiz and Project Rubric

DIFFERENTIATED INSTRUCTIONAL STRATEGIES / RESOURCES / MATERIALS

Students may be provided with extra time and/or printed notes. The unit is structured to support students at various level of skill and knowledge of the topic.

Unit/Topic Title	Orthographic Drawing	Approximate Pacing	2 weeks

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Students will understand:

- The difference between drawing and sketching.
- Which tools to use, and how to use them properly when creating drawings.
- How to draw visible, hidden, and centerlines properly.
- How to properly measure and annotate drawings.
- How to properly align views in an orthographic drawing.

CONTENT AREA STANDARDS

NJSLS #	Standard Language
8.2.12.C.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.

RELATED STANDARDS

(e.g., Technology Standard 8, 21st Century Life and Careers, Standard 9, NJSLS ELA Companion Standards are required for all 6-12 non-ELA courses, and/or others: ISTE, AASL, etc.)

NJSLS #	Standard Language
CRP4	Communicate clearly and effectively and with reason.
CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.

STUDENT LEARNING TARGETS	
Declarative Knowledge	**Procedural Knowledge**
Students will know: ● State how to draw visible, hidden and centerlines. ● List the tools required to create an orthographic drawing.	***Students will be able to:*** ● Edit and revise orthographic drawings. ● Select the best front view for starting a drawing. ● Distinguish when to use visible vs. hidden lines.

EVIDENCE OF LEARNING	
Formative Assessments (Ongoing during the unit; link formative data tracking forms and/or samples of formative assessments)	Worksheets 101 and 102, Observation of Widget drawings (2)
Summative Assessments (At the end of the unit; link samples of summative assessments)	Widget Drawings (2)

RESOURCES

- Orthographic worksheets 101 and 102
- Teacher Presentation

DIFFERENTIATED INSTRUCTIONAL STRATEGIES / RESOURCES / MATERIALS

Students may be provided with extra time and/or printed notes. The unit is structured to support students at various level of skill and knowledge of the topic.

Unit/Topic Title	Levers and Linkages	Approximate Pacing	2 weeks

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Students will understand:

- How levers are used to increase power in a technological system.
- How linkages are used to change direction of motion in a technological system.
- How to calculate mechanical advantage in levers.
- How to design and linkages to create different types of motion.

CONTENT AREA STANDARDS

NJSLS #	Standard Language
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.

RELATED STANDARDS

(e.g., Technology Standard 8, 21st Century Life and Careers, Standard 9, NJSLS ELA Companion Standards are required for all 6-12 non-ELA courses, and/or others: ISTE, AASL, etc.)

NJSLS #	Standard Language
CRP2	Apply appropriate academic and technical skills.
CRP6	Demonstrate creativity and innovation
CRP11	Use technology to enhance productivity.
MP1	Make sense of problems and persevere in solving them.
MP3	Construct viable arguments and critique the reasoning of others.
MP4	Model with mathematics.

STUDENT LEARNING TARGETS

Declarative Knowledge	Procedural Knowledge
Students will know: ● Identify different types of linkages and how they change motion.. ● Explain how to change motion in linkages.. ● Recognize the difference between fixed and moveable joints.	***Students will be able to:*** ● Demonstrate the ability to design, build and apply levers/linkages in a system to increase or decrease mechanical advantage and to change motion. ● Calculate the mechanical advantage when using levers.

EVIDENCE OF LEARNING

Formative Assessments (Ongoing during the unit; link formative data tracking forms and/or samples of formative assessments)	Observation of "Do Now" mechanical advantage problems during and after lessons. Observation of hands on linkage project. Linkage problem solving assignment (hands on). Quiz on Mechanical Advantage in levers.

Summative Assessments (At the end of the unit; link samples of summative assessments)	Engineering log - Linkages.

RESOURCES

Teacher notes on levers and linkages.
Teacher notes on calculating mechanical advantage.
Mechanical advantage worksheets.
Foam core, cardboard, pins, fasteners and foam cutting tools.
Problem solving design brief: Design an end-effector utilizing linkages.

DIFFERENTIATED INSTRUCTIONAL STRATEGIES / RESOURCES / MATERIALS

Students may be provided with extra time and/or printed notes. The unit is structured to support students at various level of skill and knowledge of the topic.

Unit/Topic Title	Engineering Logs	**Approximate Pacing**	1 weeks

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Students will understand:

- How to create and share an Engineering Log in Google Slides
- How to properly document daily work.
- How to properly format an Engineering Log.

CONTENT AREA STANDARDS

NJSLS #	Standard Language
8.1.12.A.2	Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.

RELATED STANDARDS

(e.g., Technology Standard 8, 21st Century Life and Careers, Standard 9, NJSLS ELA Companion Standards are required for all 6-12 non-ELA courses, and/or others: ISTE, AASL, etc.)	
NJSLS #	**Standard Language**
CRP11	Use technology to enhance productivity.
NJSLSA.W1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
NJSLA.W4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
W.11-12.6	Use technology, including the Internet, to produce, share, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

STUDENT LEARNING TARGETS	
Declarative Knowledge	**Procedural Knowledge**
Students will know: ● How to use Google Slides in order to create and share a log. ● List the items that should be included in the daily log. ● State the proper formatting techniques.	***Students will be able to:*** ● Generate a shared Google Slide ● Properly format a daily log.

EVIDENCE OF LEARNING	
Formative Assessments (Ongoing during the unit; link formative data tracking forms and/or samples of formative assessments)	Observation of log setup/sharing of log with teacher. Mechanical Advantage in levers final project.
Summative Assessments (At the end of the unit; link samples of summative assessments)	Hydraulic Arm Final Log. Crane Final Log.

RESOURCES
Teacher notes on Engineering Logs. Former student log examples. Panasonic Challenge Engineering Log notes and examples.

DIFFERENTIATED INSTRUCTIONAL STRATEGIES / RESOURCES / MATERIALS
Students may be provided with extra time and/or printed notes. The unit is structured to support students at various level of skill and knowledge of the topic.

Unit/Topic Title	Fluid Power	Approximate Pacing	2 weeks

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Students will understand:

- How fluid power is used to increase power or speed in a technological system.
- How to calculate mechanical advantage for power and speed in fluid power systems.
- How to design and build a fluid power system.

CONTENT AREA STANDARDS

NJSLS #	Standard Language
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.

RELATED STANDARDS

(e.g., Technology Standard 8, 21st Century Life and Careers, Standard 9, NJSLS ELA Companion Standards are required for all 6-12 non-ELA courses, and/or others: ISTE, AASL, etc.)

NJSLS #	Standard Language
CRP2	Apply appropriate academic and technical skills.
CRP6	Demonstrate creativity and innovation
CRP11	Use technology to enhance productivity.
MP1	Make sense of problems and persevere in solving them.
MP3	Construct viable arguments and critique the reasoning of others.
MP4	Model with mathematics.

STUDENT LEARNING TARGETS

Declarative Knowledge	Procedural Knowledge
Students will know: ● Identify and recall uses of fluid power. ● State the differences between hydraulic and pneumatic power. ● Explain when and how to utilize different types of fluid power. ● State the formula for calculating mechanical advantage in fluid power.	***Students will be able to:*** ● Compare and contrast and determine when to use hydraulic vs. pneumatic fluid power. ● Demonstrate the ability to design, build and apply fluid power in a system to increase or decrease mechanical advantage in order to solve a problem. ● Calculate the mechanical advantage of fluid power systems.

EVIDENCE OF LEARNING

Formative Assessments (Ongoing during the unit; link formative data tracking forms and/or samples of formative assessments)	Observation of "Do Now" mechanical advantage problems during and after lessons. Observation of fluid power systems designed and built by students. Quiz on Mechanical Advantage in Fluid Power

Summative Assessments (At the end of the unit; link samples of summative assessments)	Fluid Power Design Project - Testing of Arm and Engineering Logbook Evaluation Questions on Unit Test following Fluid Power Arm Unit.

RESOURCES

Teacher notes on fluid power.
Teacher notes on calculating mechanical advantage.
Mechanical advantage worksheets.
Pumps and tubing.
Problem solving design brief: Fluid Power

DIFFERENTIATED INSTRUCTIONAL STRATEGIES / RESOURCES / MATERIALS

Students may be provided with extra time and/or printed notes. The unit is structured to support students at various level of skill and knowledge of the topic.

Unit/Topic Title	Design and build a technological product - Hydraulic Arm	**Approximate Pacing**	2 weeks

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Students will understand:

- How to apply new and previously learned unit knowledge in order to design and build a working fluid powered robotic arm.

CONTENT AREA STANDARDS

NJSLS #	Standard Language
8.1.12.A.2	Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.
8.2.12.C.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.

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.
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.

RELATED STANDARDS

(e.g., Technology Standard 8, 21st Century Life and Careers, Standard 9, NJSLS ELA Companion Standards are required for all 6-12 non-ELA courses, and/or others: ISTE, AASL, etc.)

NJSLS #	Standard Language
CRP2	Apply appropriate academic and technical skills.
CRP4	Communicate clearly and effectively and with reason.
CRP6	Demonstrate creativity and innovation.
CRP7	Employ valid and reliable research strategies.
CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11	Use technology to enhance productivity.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
MP1	Make sense of problems and persevere in solving them.
MP3	Construct viable arguments and critique the reasoning of others.
MP4	Model with mathematics.
NJSLSA.W1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
NJSLA.W4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
W.11-12.6	Use technology, including the Internet, to produce, share, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

STUDENT LEARNING TARGETS

Declarative Knowledge	Procedural Knowledge
Students will know: ● List engineering log requirements. ● List orthographic drawing requirements. ● Identify the rules associated with lab, eye and machine safety. ● Identify how to use safety equipment, hand tools and all machines. ● Identify errors when processing material. ● Describe proper technique for fluid power piston setup.. ● Identify different types of fluid power. ● Define the purpose of different types of fluid power. ● Explain when and how to utilize different types of fluid power.	***Students will be able to:*** ● Utilize a variety of methods to research possible solutions. ● Sketch, compare and contrast possible rover solutions. ● Select the best solution for the rover, and defend rationale for final chosen solution. ● Create and format an engineering log. ● Create and annotate an orthographic drawing. ● Select, rationalize and calculate mechanical advantage. ● Apply knowledge of linkages and levers to design a robotic arm that can solve a real world problem.

• State the formula for calculating mechanical advantage in fluid power.. • Identify linkages and levers.	• Properly utilize lab tools and equipment to build the following systems: a base, joints, arms and end effector. • Test the robotic arm and research methods to improve issues with: Power, friction, mechanical advantage, and others. • Research, propose and document what would happen if changes were made to the arm.

EVIDENCE OF LEARNING	
Formative Assessments (Ongoing during the unit; link formative data tracking forms and/or samples of formative assessments)	Weekly log check(s). Orthographic drawing check. Mechanical advantage in fluid power check. Structure/material processing check. Initial testing and evaluation.
Summative Assessments (At the end of the unit; link samples of summative assessments)	Final Testing of Robotic Arm/Final Grading of Engineering Log Unit Test

RESOURCES

Teacher Notes and lessons available in Google Classroom.
Engineering log template. Project planning template.
Robotic arm project rubric.

DIFFERENTIATED INSTRUCTIONAL STRATEGIES / RESOURCES / MATERIALS

Students may be provided with extra time and/or printed notes. The unit is structured to support students at various level of skill and knowledge of the topic.

Unit/Topic Title	Mechanical Advantage in Gears and Pulleys	**Approximate Pacing**	3 weeks

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Students will understand:

- How gears are used to increase power or speed in a technological system.
- How to calculate gear ratios for power and speed.
- How to design and build simple and complex (compound) gear systems.
- How pulleys are used to increase mechanical advantage, and the trade-offs.

CONTENT AREA STANDARDS

NJSLS #	Standard Language
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.

RELATED STANDARDS

(e.g., Technology Standard 8, 21st Century Life and Careers, Standard 9, NJSLS ELA Companion Standards are required for all 6-12 non-ELA courses, and/or others: ISTE, AASL, etc.)

NJSLS #	Standard Language
CRP2	Apply appropriate academic and technical skills.
CRP6	Demonstrate creativity and innovation
CRP11	Use technology to enhance productivity.
MP1	Make sense of problems and persevere in solving them.
MP3	Construct viable arguments and critique the reasoning of others.
.MP4	Model with mathematics.

STUDENT LEARNING TARGETS

Declarative Knowledge	Procedural Knowledge
Students will know: ● Identify different types of gears. ● Define the purpose of different types of gears. ● Explain when and how to utilize different types of gears. ● State the formula for calculating mechanical advantage. ● Explain the purpose of pulleys in a mechanical system.	***Students will be able to:*** ● Determine when to increase or decrease mechanical advantage in a system. ● Demonstrate the ability to design, build and apply gears in a system to increase or decrease mechanical advantage in order to solve a problem. ● Calculate the mechanical advantage of simple and complex (compound) gear systems and pulleys.

EVIDENCE OF LEARNING

Formative Assessments (Ongoing during the unit; link formative data tracking forms and/or samples of formative assessments)	Observation of "Do Now" mechanical advantage problems during and after lessons. Observation of drivetrains and pulley systems designed and built by students. Drawing of project drivetrain and how to calculate its MA. Quiz on Mechanical Advantage in gears and pulleys. Types of gears quiz.
Summative Assessments (At the end of the unit; link samples of summative assessments)	Design project and engineering log - design and build a drivetrain to solve a real world problem; calculate mechanical advantage and explain rationale. Include sketches, orthographic drawings, rationale, and how to improve. Questions on Unit Test following Rover Unit.

RESOURCES

Teacher notes on gears.
Teacher notes on calculating mechanical advantage.
Mechanical advantage worksheets.
Lego gears, axles and structural components.
Problem solving design brief: Compound drivetrain.

DIFFERENTIATED INSTRUCTIONAL STRATEGIES / RESOURCES / MATERIALS

Students may be provided with extra time and/or printed notes. The unit is structured to support students at various level of skill and knowledge of the topic.

Unit/Topic Title	Design and build a technological product - Crane	Approximate Pacing	3 weeks

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS
Students will understand: ● How to apply new and previously learned unit knowledge in order to design and build a working fluid powered robotic arm.

CONTENT AREA STANDARDS	
NJSLS #	**Standard Language**
8.1.12.A.2	Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.
8.2.12.C.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
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.
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.

RELATED STANDARDS **(e.g., Technology Standard 8, 21st Century Life and Careers, Standard 9, NJSLS ELA Companion Standards are required for all 6-12 non-ELA courses, and/or others: ISTE, AASL, etc.)**	
NJSLS #	**Standard Language**
CRP2	Apply appropriate academic and technical skills.
CRP4	Communicate clearly and effectively and with reason.
CRP6	Demonstrate creativity and innovation.
CRP7	Employ valid and reliable research strategies.
CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11	Use technology to enhance productivity.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
MP1	Make sense of problems and persevere in solving them.
MP3	Construct viable arguments and critique the reasoning of others.
MP4	Model with mathematics.
NJSLSA.W1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
NJSLA.W4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
W.11-12.6	Use technology, including the Internet, to produce, share, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

STUDENT LEARNING TARGETS	
Declarative Knowledge	**Procedural Knowledge**
Students will know: ● List engineering log requirements. ● List orthographic drawing requirements. ● Identify the rules associated with lab, eye and machine safety. ● Identify how to use safety equipment, hand tools and all machines. ● Identify errors when processing material. ● Describe how to properly set up a pulley system. ● Identify different types of gears. ● Define the purpose of different types of gears. ● Explain when and how to utilize different types of gears. ● State the formula for calculating mechanical advantage.	***Students will be able to:*** ● Utilize a variety of methods to research possible solutions. ● Sketch, compare and contrast possible rover solutions. ● Select the best solution for the rover, and defend rationale for final chosen solution. ● Create and format an engineering log. ● Create and annotate an orthographic drawing. ● Select, rationalize and calculate mechanical advantage in gears and pulleys.. ● Properly utilize lab tools and equipment to build the following systems: a structure, drivetrain, pulley system, cranking system, and storage container.. ● Test the device and research methods to improve issues with: Power, friction, mechanical advantage, etc. ● Research, propose and document what would happen if changes were applied to various systems within the project.

EVIDENCE OF LEARNING	
Formative Assessments (Ongoing during the unit; link formative data tracking forms and/or samples of formative assessments)	Weekly log check(s). Orthographic drawing check. Drivetrain check. Pulley system check. Mechanical advantage in gears check. Mechanical advantage in pulleys check. Structure/material processing check. Container check. Initial testing and evaluation.
Summative Assessments (At the end of the unit; link samples of summative assessments)	Final Testing of Crane Final Grading of Engineering Log Unit Test

RESOURCES
Teacher Notes and lessons available in Google Classroom Engineering log template. Project planning template. Crane project rubric.

DIFFERENTIATED INSTRUCTIONAL STRATEGIES / RESOURCES / MATERIALS
Students may be provided with extra time and/or printed notes. The unit is structured to support students at various level of skill and knowledge of the topic.