Black Horse Pike Regional School District
580 Erial Road, Blackwood, NJ 08012

Design and Technology II

COURSE OF STUDY

Technology Department

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DESIGN & TECHNOLOGY II

2026-2027 School Calendar

1. Intro Design Challenge
2. Orthographic and Isometric Drafting + Measurement Refresher
3. Machine, Tool, and Lab Safety + Hands-On Build Project Utilizing the Laser Engraver
4. Intro to the Calipers + Digital Design Challenge (suggested AutoCAD and/or Onshape/Fusion)
5. Simple Machines
6. BHPRSD District Tech Challenge
7. Advanced 3D Modeling: 3D Model Tech Challenge Device - Assemblies and DWG's
8. CO2 Cars: Design (3D Model), Build and Test
9. Basic Electronics and Introduction to Soldering
10. LED Signs
11. Solid Fuel Rockets

September '26

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October '26

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November '26

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December '26

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January '27

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March '27

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April '27

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June '27

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DESIGN & TECH II

BLACK HORSE PIKE REGIONAL SCHOOL DISTRICT

2026-2027 Course Syllabus

COURSE DESCRIPTION

10-12 Graders - Must have passed D&T I
5 Credits

Design & Tech 2 is the second level Technology Education course offered to students who have successfully completed Design & Tech 1. In this course, students continue to refine their understanding of the Engineering Design Process as they plan, design, build, and test prototypes through a variety of engaging, hands-on design challenges. The course emphasizes a balance between designing and fabrication, with students spending equal time developing ideas through research, sketching, and digital modeling, as well as constructing and testing their solutions in the lab. Students expand their technical skills by learning to operate more advanced tools, equipment, and manufacturing technologies that allow them to create innovative solutions in new and exciting ways.

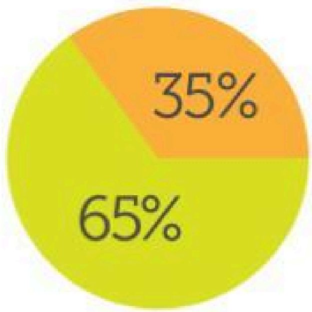
UNITS COVERED

- The Manufacturing Process
- Advanced 3D Modeling and Digital Design
- Orthographic and Isometric Hand Drafting
- AutoCAD Basics
- Introduction to Architecture and Residential House Floor Plans
- Caliper Measurement
- Package Design
- Simple Machines
- CO2 Car Design
- Soldering Safety and Electrical Circuits
- Solid Fuel Rockets

MATERIALS NEEDED

- Pencil
- Two-Pocket Folder
- Safety glasses (supplied)

GRADING



CLASSWORK (65%): Anything you make or produce falls under this category including written assignments, quizzes, sketches and brainstorming activities, any computer-based work, and anything you build from your prototypes to your final designs.

PARTICIPATION (35%): You are expected to actively participate each and every day. Over a third of your grade is participation! Below are some pointers to help you succeed in class and earn full participation points every week.

LATE WORK

- Late work is -10% each day each day it is late, up to -50% (5 days late). Work can still be turned in after that, but will be -50%.
- Work more than two weeks late will not be accepted
- Up to teacher discretion.

ATTENDANCE

- If you are absent, or plan on being absent, it is your responsibility to see me during common time or email me and check Google Classroom.
- You will get extensions on assignments equal to the number of days you were out.
- You must arrive to class BEFORE the bell rings to be marked present. If you arrive after the bell, you are late to class.

TOP 10 WAYS TO EARN FULL PARTICIPATION POINTS

1. Keep quiet and pay attention during lectures, lessons and demonstrations
2. Ask questions if you're not sure what to do. If I am busy with someone else, try and look up the answer on your own or ask a classmate or partner (try to figure it out)
3. Each class we will have daily/weekly checkpoints. Make sure you know what they are and work to meet those checkpoints
4. When prompted to get to work, you should get to work within just a couple minutes. Any longer and you will lose participation points
5. Be productive and try your best. You should be working on your projects for this class for the majority of the period. Breaks are ok, but should be short and limited
6. Use school appropriate language and be mindful of your classmates
7. Follow BHPRSD cell phone and electronics policy
8. Arrive to class on time, prepared with all necessary materials and sit in your seat
9. Use tools, machinery, and classroom equipment correctly and safely
10. Have fun!

DESIGN & TECHNOLOGY DEPARTMENT
PERFORMANCE CHART

	ADVANCED	PROFICIENT	BELOW AVERAGE
GRADING GUIDE	A	B-C	D-F
EFFORT AND USE OF CLASS TIME **(Group or Individual)**	Extra effort during and after class time is put into project. Student(s) modeled exceptional behavior, were always on task, followed all safety rules, and helped others.	Consistent effort is put into the project during class time. Student(s) modeled good behavior, but was not always on task and misused equipment.	Inconsistent effort during class time. Student(s) did not use class time wisely, misused tools and machinery, and, as a result, missed checkpoints, deadlines and due dates.
ACCURACY AND NEATNESS	Project is prepared neatly and carefully. All measurements are accurate. Project is aesthetically pleasing and well built.	Project is fairly neat. Measuring is mostly accurate. Project is good. There is room for improvement.	Project is prepared with little care and lacks neatness. Project looks rushed and doesn't work as intended. Lots of room for improvement.
CREATIVITY	Project is original and imaginative. Design is unique, innovative and well thought out.	Project has some original elements. Design is somewhat clever but not entirely unique.	Project lacks creativity and thought. Design is not original and is more or less a copy of an existing one.
FOLLOWING INSTRUCTIONS, SPECIFICATIONS AND CONSTRAINTS	All project instructions have been followed. Every requirement has been met and exceeded.	Some project instructions and requirements met, but not all.	The majority of project instructions and requirements were not followed, have not been met, and project is incomplete.
DEMONSTRATES UNDERSTANDING	Student is extremely knowledgeable of project concepts and is able to help others.	Student displays knowledge of most concepts, methods and/or practices involved in the project.	Student lacks knowledge about project concepts, methods and practices.

9.3 – Career & Technical Education (CTE)
Content Area: 21st Century Life and Careers

CONTENT AREA:	*STANDARD 9.3 CAREER AND TECHNICAL EDUCATION*
ARCHITECTURE & CONSTRUCTION CAREER CLUSTER®	
Number	**Standard statement**
By the end of Grade 12, Career and Technical Education Program completers will be able to:	
CAREER CLUSTER®:	*ARCHITECTURE & CONSTRUCTION (AC)*
9.3.12.AC.1	**Use vocabulary, symbols and formulas common to architecture and construction.**
9.3.12.AC.2	**Use architecture and construction skills to create and manage a project.**
9.3.12.AC.3	**Comply with regulations and applicable codes to establish and manage a legal and safe workplace.**
9.3.12.AC.4	**Evaluate the nature and scope of the Architecture & Construction Career Cluster and the role of architecture and construction in society and the economy.**
9.3.12.AC.5	**Describe the roles, responsibilities, and relationships found in the architecture and construction trades and professions, including labor/management relationships.**
9.3.12.AC.6	**Read, interpret and use technical drawings, documents and specifications to plan a project.**
9.3.12.AC.7	**Describe career opportunities and means to achieve those opportunities in each of the Architecture & Construction Career Pathways.**
PATHWAY:	*CONSTRUCTION (AC-CST)*
9.3.12.AC-CST.1	**Describe contractual relationships between all parties involved in the building process.**
9.3.12.AC-CST.2	**Describe the approval procedures required for successful completion of a construction project.**
9.3.12.AC-CST.3	**Implement testing and inspection procedures to ensure successful completion of a construction project.**
9.3.12.AC-CST.4	**Apply scheduling practices to ensure the successful completion of a construction project.**
9.3.12.AC-CST.5	**Apply practices and procedures required to maintain jobsite safety.**
9.3.12.AC-CST.6	**Manage relationships with internal and external parties to successfully complete construction projects.**
9.3.12.AC-CST.7	**Compare and contrast the building systems and components required for a construction project.**
9.3.12.AC-CST.8	**Demonstrate the construction crafts required for each phase of a construction project.**
9.3.12.AC-CST.9	**Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals.**

9.3 – Career & Technical Education (CTE)
Content Area: 21st Century Life and Careers

CONTENT AREA:	*STANDARD 9.3 CAREER AND TECHNICAL EDUCATION*
ARCHITECTURE & CONSTRUCTION CAREER CLUSTER®	
Number	**Standard statement**
PATHWAY:	*DESIGN/PRE-CONSTRUCTION (AC-DES)*
9.3.12.AC-DES.1	Justify design solutions through the use of research documentation and analysis of data.
9.3.12.AC-DES.2	Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.
9.3.12.AC-DES.3	Describe the requirements of the integral systems that impact the design of buildings.
9.3.12.AC-DES.4	Apply building codes, laws and rules in the project design.
9.3.12.AC-DES.5	Identify the diversity of needs, values and social patterns in project design, including accessibility standards.
9.3.12.AC-DES.6	Apply the techniques and skills of modern drafting, design, engineering and construction to projects.
9.3.12.AC-DES.7	Employ appropriate representational media to communicate concepts and project design.
9.3.12.AC-DES.8	Apply standards, applications and restrictions pertaining to the selection and use of construction materials, components and assemblies in the project design.
PATHWAY:	*MAINTENANCE/OPERATIONS (AC-MO)*
9.3.12.AC-MO.1	Recognize and employ universal construction signs and symbols to function safely in the workplace.
9.3.12.AC-MO.2	Use troubleshooting procedures when solving a maintenance problem in buildings.
9.3.12.AC-MO.3	Apply construction skills when repairing, restoring or renovating existing buildings.
9.3.12.AC-MO.4	Determine work required to repair or renovate an existing building.
9.3.12.AC-MO.5	Plan and practice preventative maintenance activities to service existing buildings.
9.3.12.AC-MO.6	Maintain and inspect building systems to achieve safe and efficient operation of buildings.

UNIT OUTLINE

Design & Technology II

5 Credits
GRADES: 10-12
Prerequisite: Must have passed Design and Tech I

Course Introduction

Design & Tech 2 is the second level Technology Education course offered to students who have successfully completed Design & Tech 1. In this course, students continue to refine their understanding of the Engineering Design Process as they plan, design, build, and test prototypes through a variety of engaging, hands-on design challenges. The course emphasizes a balance between designing and fabrication, with students spending equal time developing ideas through research, sketching, and digital modeling, as well as constructing and testing their solutions in the lab. Students expand their technical skills by learning to operate more advanced tools, equipment, and manufacturing technologies

Course Content

1. Intro Design Challenge: A quick 2-3 open-ended design challenge where students team up with a partner and work together to solve a mini design challenge.

2. **Orthographic and Isometric Drafting + Measurement Refresher**: This unit introduces students to the fundamentals of measurement, technical drawing, and design communication. Students will work in both two-dimensional and three-dimensional spaces, beginning with hand sketches and technical drawings before transitioning to computer-generated models. Through this process, students will develop an understanding of how engineers visualize, document, and communicate part designs using both traditional and digital design methods.

3. **Machine, Tool and Lab Safety + Hands-On Build Project Utilizing the Laser Engraver**: This unit serves as a refresher of the machine and tool safety skills introduced in Design & Tech I while continuing to strengthen students' technology and engineering literacy. Through hands-on activities focused on laboratory, tool, and machine safety, students apply safe work practices while using the Engineering Design Process to complete engaging design challenges. These experiences reinforce problem-solving, critical thinking, and foundational skills in mathematics, science, communication, and technical design.

4. **Intro to the Calipers + Digital Design Challenge (AutoCAD and/or Onshape/Fusion)**:In this unit, students develop their measurement skills by learning to use dial calipers, a precision measuring tool that provides greater accuracy than a standard ruler. While 3D modeling is an important skill in modern design, 2D drafting using AutoCAD remains an essential industry practice used by engineers and designers to communicate technical information. Students apply their AutoCAD skills to design a product package that safely transports an item while preventing damage during handling and shipping. Throughout the design process, students consider real-world factors such as cost, size and shape, material selection, manufacturing time, available space, and other constraints that influence successful product design.

5. **Simple Machines:** Simple machines are the foundation of many modern tools, machines, and technological systems used in everyday life. In this unit, students explore the six types of simple machines to develop a deeper understanding of how engineers and designers apply basic mechanical principles to make work easier, safer, and more efficient. Students apply their knowledge of simple machines, along with their skills in precision measurement using dial calipers, laser engraving, 3D printing, and the Engineering Design Process, to design, plan, and build a Rube Goldberg machine.

6. **BHPRSD Tech Challenge**: The BHPRSD Tech Challenge is designed to guide students through the Engineering Design Process as they work in teams to solve an open-ended design challenge. Students begin by defining a problem, then collaborate to research, brainstorm, develop, test, and refine the most effective design solution. The unit culminates in a district-wide competition in which Design & Technology students from Highland, Triton, and Timber Creek compete to determine which team developed the most successful solution.

7. **Advanced 3D Modeling: 3D Model Tech Challenge Device - Assemblies and DWG's**: This unit provides students with the opportunity to continue expanding their skills in digital design, 3D printing, and the Engineering Design Process developed throughout this course and in Design & Tech I. Students explore advanced tools and features within digital design software, including TinkerCAD, Onshape, and Fusion, with an emphasis on creating multi-part assemblies, exploded views, section views, and technical drawings to accurately document their designs. Through a series of hands-on design challenges, students strengthen their understanding of digital modeling workflows, tools, and commands while applying the Engineering Design Process to create, test, evaluate, and refine original 3D models.

8. **CO2 Cars: Design (3D Model), Build and Test**: In this unit, students research, design, plan, and build a CO_2 dragster while balancing design constraints, performance goals, and manufacturing limitations. Using digital design software such as Onshape or Fusion, students create detailed 3D models of their dragsters while developing proficiency with advanced modeling tools and techniques. After completing their digital designs, students analyze factors such as weight, mass, volume, and aerodynamics, make necessary refinements, and manufacture their prototypes. Students then test and race their CO2 powered vehicles, using performance data to evaluate their designs and compete against one another to create the fastest and most efficient dragster.

9. **Basic Electronics and Introduction to Soldering**: This unit introduces students to the fundamentals of electricity, electronics, and basic electrical engineering. Students explore what electricity is, how it is generated, transmitted, and controlled to create simple direct current (DC) circuits in both series and parallel configurations. Through hands-on activities, students apply Ohm's Law and work with electronic components such as batteries, switches, LEDs, and motors to understand how electrical systems function. Students learn to read, interpret, and create electrical schematics while applying their knowledge through a series of design challenges and projects. These experiences allow students to build and troubleshoot simple DC circuits, develop problem-solving skills, and gain practical experience with electrical systems. Students also practice soldering using easy-to-follow step-by-step kits.

10. **LED Signs**: In this unit, students apply their knowledge of basic electronics, soldering, and the Engineering Design Process to design and fabricate a custom LED sign. Through this hands-on project, students strengthen their electrical engineering, manufacturing, and problem-solving skills while gaining experience designing, assembling, testing, and troubleshooting a functional electronic product.

11. **Solid Fuel Rockets**: For the final unit of the year, students will participate in a hands-on and engaging design challenge focused on solid-fuel rocket design, fabrication, and flight analysis. While students previously researched, designed, and built rockets in Design & Tech I, this unit introduces solid-fuel rockets capable of significantly greater acceleration and altitude. Students will apply their understanding of aerodynamics, physics of flight, and engineering design principles to optimize their designs. Using 3D modeling software, students will digitally develop and refine their rockets before fabricating, testing, and analyzing flight performance, making adjustments to improve their designs and maximize success.

Course Expectations and Skills:

1. Keep and maintain an Engineering notebook, binder, or folder.
2. Apply and document the Engineering process while solving challenges.
3. Practice proper attitude and safe discipline.
4. Develop an acceptable degree of craftsmanship in each activity.
5. Participate and contribute equally to group generated solutions.
6. Apply and analyze science and math related concepts to the challenge.
7. Think creatively while solving real-world problems.
8. Learn from mistakes and view failures as opportunities to improve.
9. Base design decisions on evidence, testing, and data.
10. Balance creativity with functionality, safety, and efficiency.
11. Consider ethical, environmental, and economic impacts when developing solutions.
12. Prepare students to be successful in high school and higher level technology courses.

Resources:

"Technology Education: Learning by Design" by Michael Hacker & David Burghardt, 2008.

Unit Title:	Orthographic and Isometric Drafting + Measurement Refresher
Course:	Design & Technology II
Grade Levels:	10-12
Last Revision:	Summer 2026

Unit Overview
This unit introduces students to the fundamentals of measurement, technical drawing, and design communication. Students will work in both two-dimensional and three-dimensional spaces, beginning with hand sketches and technical drawings before transitioning to computer-generated models. Through this process, students will develop an understanding of how engineers visualize, document, and communicate part designs using both traditional and digital design methods.

Essential Questions	**Enduring Understandings**
How can two-dimensional drawings accurately represent three-dimensional objects?	Two-dimensional drawings accurately represent three-dimensional objects by using multiple standardized views, dimensions, and drawing conventions to clearly communicate an object's size, shape, and features.
How do engineers use orthographic sketches to communicate design ideas accurately?	Engineers use orthographic sketches to communicate design ideas accurately by representing an object with multiple standard views (front, top, and right side) that clearly define its size, shape, dimensions, and features.
How do standardized drawing practices improve collaboration among engineers, designers, and manufacturers?	Engineering drawings follow standardized drafting conventions and this provides a universal language that allows engineers, manufacturers, and technicians to interpret, manufacture, and assemble parts consistently and accurately.
How do technical drawings support brainstorming, prototyping, testing, and manufacturing?	Technical drawings clearly communicate design ideas, dimensions, and specifications, allowing engineers to visualize concepts, build accurate prototypes, evaluate performance, and manufacture parts consistently and precisely.

Learning Targets/Goals/Outcomes	Standards (NJSLS)
Visualize objects from multiple perspectives and translate them into orthographic views (front, top and side views).	8.2.8.ED.1 CTE - 9.3.MN.3
Identify missing views and determine the information needed to completely define a part.	8.2.8.NT.2
Use sketches to communicate ideas during the brainstorming and design phases of the Engineering Design Process.	8.2.8.ED.3 8.2.8.NT.2 CTE - 9.3.MN.3

Interdisciplinary Connections
English (RST.9-10.2 / RST.11-12.2), Math (HSG-MG.A.1), Science (HS-ETS1-2, HS-ETS1-3), History (6.3.12.CivicsPI.1), Career Readiness, Life Literacies & Key Skills (9.4.12.CI.1)

21st Century Skills
In this unit, students develop critical thinking skills, creativity, collaboration, communication, and problem-solving. Using the Engineering Design Process, students learn to analyze challenges, develop innovative solutions, create prototypes, and refine designs based on testing and feedback. Students build digital literacy, adaptability, and technical communication skills by using CAD software, operating emerging technologies, and presenting their design decisions.

Writing Assignments
● Sketching Assignments ● Reflection Assignments ● Individual and/or group Presentations

Vocabulary - List Tier 2 (Academic Essentials)	Vocabulary - Tier 3 (Content-Specific)
● Criteria ● Constraint ● Design ● Create ● Improve/Iterate ● Prototype ● Parallel ● Perpendicular	● Orthographic ● Projection Lines ● Hidden Lines ● Form ● Function ● Sketch ● Plane ● Origin ● Pan, Orbit, and Revolve ● Extrude ● Feature ● Face ● Fillet and Chamfer ● Shell

Activities, Instructional Strategies, and Assignments
● “I Do, You Do, We Do” - Teacher guided instruction on a new skill, followed by students experimenting with the new skill(s) taught, and summed up as a whole class where students practice the skill again ● “Go Slow to Go Fast” - early on in the unit, basic skills are taught, re-taught, and practiced often ● Project based and self-exploration activities ● Real life digital design challenges, assessments, and projects ● Teacher guided instruction ● Multiple Visual Examples ● Question and Answer ● Whole class reviews, check-ins, and student-led presentations ● Independent, self-paced learning ● Collaborative group (partner) design challenges ● Do-nows ● Exit Tickets

Accommodations and Modifications (BHPRSD Accommodations and Modifications)
● Provide a variety of concrete examples from familiar contexts ● Build background knowledge of content and vocabulary from familiar contexts prior to readings ● Use mental models to build understanding through familiar contexts ● Provide oral & written instructions ● Incorporate multimedia/audio visual representation (YouTube, Discovery Education, TV Show parodies, etc.) to build understanding ● Use graphic organizers to guide notes, brainstorming, pre-writing, project planning, and test preparation ● Model through processes during assignments and elicit student-generated thoughts to determine gaps in understanding ● Highlight, bold, or underline main ideas in readings and in directions for writing assignments in the curricular areas ● Provide guiding questions to complete during the activity ● Provide chunking of instructional notes and activities to allow for formative assessment (checks for understanding) before moving on to the next stage ● Choose cooperative learning groups to ensure effective work, productivity and support socialization ● Use multiple intelligences or the student's learning style to facilitate effective learning when a student is having difficulty grasping concepts ● Provide demonstrations, utilize pictures, or graphic to assist visual learners to support written text information ● Include oral discussions, oral presentations, group collaboration, or other oral delivery methods to support auditory learners ● Provide chunking of assignments into manageable steps, including checklists that clarify directions for assignments ● Provide a clear, concise version of a scoring rubric prior to the assignment or assessment ● Highlight distinctive features/key concepts ● Provide choice of projects depending on the student’s interests or strengths. ● Review, repeat, and clarify directions ● Chunk sections of assessment ● Allow for partial credit, when appropriate

Formative Assessments
Students are expected to keep an organized Engineering Design Notebook, folder, or binder. Designs and projects that are done on the computer will be submitted to Google Classroom and are still considered to be part of the student's Engineering Design Notebook. Orthographic Sketching Packet. Checkpoints at: ● Basic Orthographic Projection - Front, Top and Side Views ● Finding the Missing Views ● Advanced Orthographic Projection Do-now's and checkpoint quizzes will be given during and at the conclusion of these topics Daily Digital Design skill exercises (sketching, dimensioning, constraints, extrude, fillet, assemblies) Daily Design sketches and brainstorming activities Vocabulary checks and quizzes on 3D printing terminology and on Digital Design tools Exit tickets reflecting on challenges and solutions

Summative Assessments
Final Orthographic Sketch Packet Final 3D Model Project

Black Horse Pike Regional School District Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit Title:	Machine, Tool and Lab Safety + Hands-On Build Project Utilizing the Laser Engraver
Course:	Design & Technology II
Grade Levels:	10-12
Last Revision:	Summer 2026

Unit Overview
This unit serves as a refresher of the machine and tool safety skills introduced in Design & Tech I while continuing to strengthen students' technology and engineering literacy. Through hands-on activities focused on laboratory, tool, and machine safety, students apply safe work practices while using the Engineering Design Process to complete engaging design challenges using the laser engraver. These experiences reinforce problem-solving, critical thinking, and foundational skills in mathematics, science, communication, and technical design.

Essential Questions	**Enduring Understandings**
Why is safety an essential part of working in a technology education laboratory?	Technology labs often involve tools, machines, materials, and processes that can create potential hazards if they are not used properly. Following safety procedures helps students identify risks, make responsible decisions, and prevent injuries
How can understanding how machines work help us operate them safely and effectively?	Equipment shall be used only as intended and within the specifications set forth by the manufacturer. If equipment is used improperly, this creates a dangerous working environment for the user and others nearby.
What role does personal protective equipment (PPE) play in preventing injuries?	Personal protective equipment (PPE) plays a critical role in preventing injuries by reducing exposure to hazards in the technology education laboratory. PPE acts as a protective barrier between students and potential dangers such as flying debris, sharp materials, excessive noise, heat, chemicals, and moving machine parts. While PPE does not replace safe operating procedures, proper use of equipment such as safety glasses, hearing protection, gloves, and protective clothing helps minimize the risk of injury and promotes a safe working environment.
How does machine safety connect to problem-solving and the engineering design process?	Throughout the design process, engineers identify potential hazards, establish safety criteria and constraints, select appropriate tools and procedures, and test solutions to ensure they work safely and effectively.

Learning Targets/Goals/Outcomes	Standards (NJSLS)
Safely use all tools and machines, as outlined in this unit.	8.2.12.ED.1 8.2.2.ITH.4 CTE - 9.3.12.AC.2
Understand the intended use and limitations of each machine and identify which machine is ideal for the task at hand.	8.2.12.ED.1 8.2.12.ED.5 8.2.2.ITH.4 CTE - 9.3.12.AC-CST.9
Apply knowledge of machine and tool safety, their intended use, and consider how parts can be designed more effectively using the Engineering Design Process.	8.2.12.ED.5 8.2.2.ITH.4

Interdisciplinary Connections
Science (ETS1.A), Career Readiness, Life Literacies & Key Skills (9.2.12.CAP.6)

21st Century Skills
In this unit, students continue to develop critical thinking skills, creativity, collaboration, communication, and problem-solving. Using the Engineering Design Process, students learn to use their knowledge of machine and tool safety to better analyze challenges, develop innovative solutions, and create prototypes. Ultimately, the focus of this unit is on safe decision making, workplace behavior, and effective communication.

Writing Assignments

- Sketching Assignments
- Reflection Assignments

Vocabulary - List Tier 2 (Academic Essentials)	Vocabulary - Tier 3 (Content-Specific)
• Blade • Drill • Table • Stock/Workpiece • PPE	• Drill Press ○ Chuck and Chuck Key ○ RPM's and Feed Rate ○ Table Height Adjustment Knob ○ Vise and clamp ○ Forstner and Twist Bit ○ Thru-hole • Band Saw ○ Blade Guard ○ Blade Guard Lock ○ Backing out of a cut ○ Waste-side of a cut • Sander ○ Oscillating Belt and Disc ○ Sandpaper Grit ○ Chamfer ○ Fillet

Activities, Instructional Strategies, and Assignments
“Go Slow to Go Fast” - early on in the unit, basic skills are taught, re-taught, and practiced often   - Hands-on Projects   - Reinforces measurement and layout   - Reinforces terms learned in the Digital Design Unit, like face, top, front, and side views, etc.   - Students practice using the machines safely using scrap wood before working on their projects   - Projects are designed to give students experience on the drill press, band saw, and sander   - Whole-class, teacher-guided safety demonstrations   - POV Edpuzzle Safety videos   - Safety quizzes   - Question and Answer   - Whole class reviews and check-ins   - Do-nows   - Exit Tickets

Accommodations and Modifications (BHPRSD Accommodations and Modifications)
- Build background knowledge of content and vocabulary from familiar contexts prior to readings   - Provide oral & written instructions   - Incorporate multimedia/audio visual representation (YouTube, Discovery Education, TV Show parodies, etc.) to build understanding   - Use graphic organizers to guide notes, brainstorming, pre-writing, project planning, and test preparation   - Model through processes during assignments and elicit student-generated thoughts to determine gaps in understanding   - Highlight, bold, or underline main ideas in readings and in directions for writing assignments in the curricular areas   - Provide guiding questions to complete during the activity   - Provide chunking of instructional notes and activities to allow for formative assessment (checks for understanding) before moving on to the next stage   - Choose cooperative learning groups to ensure effective work, maximize productivity and support socialization   - Use multiple intelligences or the student's learning style to facilitate effective learning when a student is having difficulty grasping concepts   - Provide demonstrations, utilize pictures, or graphic to assist visual learners to support written text information   - Provide chunking of assignments into manageable steps, including checklists that clarify directions for assignments   - Provide a clear, concise version of a scoring rubric prior to the assignment or assessment   - Highlight distinctive features/key concepts   - Provide choice of projects depending on the student’s interests or strengths.   - Review, repeat, and clarify directions   - Chunk sections of assessment   - Allow for partial credit, when appropriate

Formative Assessments
Students are expected to keep an organized Engineering Design Notebook, folder, or binder. Prior to getting materials, students practice measurement and layout on paper before repeating that process on their workpiece. All handouts and work done with pencil and paper should be stored in the Engineering Design Notebook. 1. Edpuzzle Safety Videos 2. Measurement and Layout Practice (done on paper prior to receiving material) 3. Measurement and Layout Practice on the actual workpiece 4. Hands-on practice using each machine (with scrap wood) 5. Adobe Illustrator Vector Graphics and Image Trace Assignment 6. Exporting to the Laser Engraver Do-now's and checkpoint quizzes will be given during and at the conclusion of these topics

Summative Assessments
• Final Project Prototype Evaluations, including measurement, layout, safety, and accuracy of machining • Final Design Journal checks • Safety Quiz assessments

Black Horse Pike Regional School District Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit Title:	Intro to the Calipers + Digital Design Challenge (AutoCAD and/or Onshape/Fusion)
Course:	Design & Technology II
Grade Levels:	10-12
Last Revision:	Summer 2026

Unit Overview
In this unit, students develop their measurement skills by learning to use dial calipers, a precision measuring tool that provides greater accuracy than a standard ruler. While 3D modeling is an important skill in modern design, 2D drafting using AutoCAD remains an essential industry practice used by engineers and designers to communicate technical information. Students apply their AutoCAD skills to design a product package that safely transports an item while preventing damage during handling and shipping. Throughout the design process, students consider real-world factors such as cost, size and shape, material selection, manufacturing time, available space, and other constraints that influence successful product design.

Essential Questions	**Enduring Understandings**
How are dial calipers used to accurately measure parts?	Dial calipers are used to accurately measure the dimensions of parts by using a sliding jaw system and a precision dial that provides measurements more precise than a standard ruler. They allow engineers, designers, and machinists to measure features such as outside dimensions, inside dimensions, depths, and step distances.
How do engineers and designers use their understanding of the entire manufacturing process to design effective product packages and containers?	Engineers and designers use their understanding of the entire manufacturing process to create packages and containers that are functional, efficient, cost-effective, and easy to produce. They must consider every stage of a product's life cycle, from material selection and manufacturing methods to transportation, storage, and end-user needs.

Learning Targets/Goals/Outcomes	**Standards (NJSLS)**
Use the dial calipers to accurately measure, mark, and layout measurements on a package, in preparation for reverse engineering the product.	8.2.12.ED.2 CTE - 9.3.12.AC.1 CTE - 9.3.12.AC.6

Interdisciplinary Connections
Math (HSG-MG.A.3), Science (HS-ETS1-3)

21st Century Skills
In this unit, students continue to develop critical thinking skills, creativity, collaboration, communication, and problem-solving. Even with a skill as basic as measurement, students are still using the Engineering Design Process to analyze challenges, develop innovative solutions, create prototypes, and refine designs based on testing and feedback, as students learn first hand to measure twice, cut once.

Writing Assignments
● Sketching Assignments ● Measurement Practice

Vocabulary - List Tier 2 (Academic Essentials)	Vocabulary - Tier 3 (Content-Specific)
● Inch ● Graduation ● Tenths ● Hundredths ● Thousandths	● Dial Caliper ● Feature ● Face ● Technical Drawing ● Orthographic (Front, Top, Side, etc.) ● Tolerance ● Center Line ● Cut Line ● Fold Line ● Primary, Secondary and Tertiary Packaging ● Ergonomics

Activities, Instructional Strategies, and Assignments
● "I Do, You Do, We Do" - Teacher guided instruction on a new skill, followed by students experimenting with the new skill(s) taught, and summed up as a whole class where students practice the skill again ● Real life digital design challenges, assessments, and projects ● Teacher guided instruction ● Lectures ● Multiple Visual Examples ● Video Tutorials posted to Google Classroom ● Question and Answer ● Whole class reviews, check-ins, and student-led presentations ● Independent, self-paced learning ● Do-nows ● Exit Tickets

Accommodations and Modifications (BHPRSD Accommodations and Modifications)
● Provide a variety of concrete examples from familiar contexts ● Build background knowledge of content and vocabulary from familiar contexts prior to readings ● Use mental models to build understanding through familiar contexts ● Provide oral & written instructions ● Incorporate multimedia/audio visual representation (YouTube, Discovery Education, TV Show parodies, etc.) to build understanding ● Provide guiding questions to complete during the activity ● Provide chunking of instructional notes and activities to allow for formative assessment (checks for understanding) before moving on to the next stage ● Choose cooperative learning groups to ensure effective work, maximize productivity and support socialization ● Provide chunking of assignments into manageable steps, including checklists that clarify directions for assignments ● Provide a clear, concise version of a scoring rubric prior to the assignment or assessment ● Provide choice of projects depending on the student's interests or strengths ● Review, repeat, and clarify directions

Formative Assessments

Students are expected to keep an organized Engineering Design Notebook, folder, or binder.
 	
1. Dial Caliper Measurement Pre-Assessment
2. Dial Caliper Hands-On Measurement Activity
3. Reverse Engineer Package Project - Sketching and Gathering Dimensions
    a. Dimensions
    b. Fold vs. Cut Lines
4. Reverse Engineer Package Project - AutoCAD
 	
Do-now's and checkpoint quizzes will be given during and at the conclusion of these topics

Summative Assessments

● Final Caliper Measurement Reading Assessment
    ○ Written Section
    ○ Hands-On Section
● Final Reverse Engineer Package Design
    ○ AutoCAD File
    ○ Final printed and folded package

Black Horse Pike Regional School District Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit Title:	Simple Machines
Course:	Design & Technology II
Grade Levels:	10-12
Last Revision:	Summer 2026

Unit Overview
Simple machines are the foundation of many modern tools, machines, and technological systems used in everyday life. In this unit, students explore the six types of simple machines to develop a deeper understanding of how engineers and designers apply basic mechanical principles to make work easier, safer, and more efficient. Students apply their knowledge of simple machines, along with their skills in precision measurement using dial calipers, laser engraving, 3D printing, and the Engineering Design Process, to design, plan, and build a Rube Goldberg machine.

Essential Questions	**Enduring Understandings**
What are the steps of the Engineering Design Process and how can this process be applied to solve a technological problem?	The Engineering Design Process can be used to solve a technological problem by following a structured series of steps that lead to an effective solution: 1. Identify the problem – Define the need or challenge and understand the criteria and constraints. 2. Research and gather information – Learn about the problem, existing solutions, and relevant technologies. 3. Brainstorm possible solutions – Generate multiple ideas without judging them initially. 4. Select the best solution – Evaluate ideas based on effectiveness, safety, cost, materials, and feasibility. 5. Develop a design – Create sketches, plans, or models that communicate the chosen solution. 6. Build a prototype – Construct a working model or first version of the design. 7. Test and evaluate – Determine whether the prototype meets the design criteria and identify areas for improvement. 8. Improve and redesign – Modify the design based on test results and feedback, repeating the process as needed.
What are the six simple machines and how are they used in everyday products?	The six simple machines (lever, inclined plane, wedge, screw, wheel and axle, and pulley) are used in everyday products to make tasks easier by changing the amount, direction, or application of force, such as using scissors to cut, ramps to move objects, screws to fasten materials, and gears to transfer motion.

Why is it important for all parts of a system to work together effectively?	It is important for all parts of a system to work together effectively because each component contributes to the overall function, and a failure or change in one part can impact the performance of the entire system. Engineers design systems by considering how individual parts interact, ensuring they work together efficiently, safely, and reliably to achieve the desired outcome.
How does the Engineering Design Process help us design, make and build products to solve problems?	The Engineering Design Process helps us design, make, and build products by providing a structured approach to solving problems. Engineers use this process to identify a need, research information, define requirements and constraints, brainstorm possible solutions, create and test prototypes, evaluate results, and improve their designs.
How can testing and iteration improve a design?	In typical manufacturing, a product is planned, tested and prototyped, which takes time, money and effort. With Digital Design, 3D prints can be produced quicker, iterated on faster, and reprinted to meet criteria, constraints and desired specifications.

Learning Targets/Goals/Outcomes	**Standards (NJSLS)**
Define the need or challenge and understand the criteria and constraints, as outlined on the Design Brief.	8.2.12.ED.1 8.2.5.ED.5
Research and gather information to learn about the problem, existing solutions, and relevant technologies.	8.2.12.ED.1 8.2.2.NT.2 8.2.5.ED.2 CTE - 9.3.12.AC-DES.1
Brainstorm and generate multiple ideas using the information gathered while researching the Design Challenge.	8.2.12.ED.1 8.2.2.NT.2 8.2.5.ED.2
Evaluate brainstormed ideas based on their effectiveness, safety, cost, materials, and feasibility, as well as how they relate to the criteria and constraints outlined on the Design Brief.	8.2.12.ED.1 8.2.2.NT.2 8.2.5.ED.2
Create sketches, plans, or models that communicate the chosen solution.	8.2.12.ED.2 8.2.5.ED.2 CTE - 9.3.12.AC.6
Use tools and machines safely and appropriately to construct a working model or first version of the design.	8.2.12.ED.4 8.2.2.ED.3 CTE - 9.3.12.AC-CST.9
Test and evaluate the prototype and make necessary adjustments and modifications to the prototype to better adhere to the criteria and constraints.	8.2.12.ED.5 8.2.12.ED.6 8.2.5.ITH.2 CTE - 9.3.12.AC-CST.3

Recognize that the Design Process is iterative in nature and this process is never truly completed, as designs can always be improved through innovation.	8.2.5.ED.6 8.2.12.ED.1 8.2.12.ED.2 8.2.12.ED.3 8.2.12.ED.4 8.2.12.ED.5 8.2.12.ED.6
Work collaboratively with others, sharing ideas and the workload evenly.	8.2.5.ED.2

Interdisciplinary Connections
English (RST.9-10.2 / RST.11-12.2), Math (HSG-MG.A.1), Science (MS-ETS1-1-4), Career Readiness, Life Literacies & Key Skills (NJSLS-CLKS 9.4)

21st Century Skills
In this unit, students develop critical thinking skills, creativity, collaboration, communication, and problem-solving. Using the Engineering Design Process, students learn to analyze challenges, develop innovative solutions, create prototypes, and refine designs based on testing and feedback.

Writing Assignments
● Sketching Assignments ● Design Matrix Assignments ● Reflection Assignments ● Individual and/or group Presentations

Vocabulary - List Tier 2 (Academic Essentials)	**Vocabulary - Tier 3 (Content-Specific)**
● Mass ● Input ● Output ● System ● Gravity	● Rube Goldberg Machine ● Simple machine ● Lever ● Inclined plane ● Wedge ● Screw ● Wheel and axle ● Pulley ● Compound machine ● Mechanical advantage ● Effort force ● Resistance force ● Fulcrum ● Load ● Gear ● Cam ● Axle

Activities, Instructional Strategies, and Assignments

- "Go Slow to Go Fast" - early on in the unit, basic skills are taught, re-taught, and practiced often
  - Each step of the Design Process will be covered in detail, multiple times, and at a slow pace
- Project based and self-exploration activities
- Real life digital design challenges, assessments, and projects
- Teacher guided instruction
- Lectures
- Multiple Visual Examples
- Question and Answer
- Whole class reviews, check-ins, and student-led presentations
- Independent, self-paced learning
- Collaborative group (partner) design challenges
- Do-nows
- Exit Tickets

Accommodations and Modifications (BHPRSD Accommodations and Modifications)

- Provide a variety of concrete examples from familiar contexts
- Build background knowledge of content and vocabulary from familiar contexts prior to readings
- Use mental models to build understanding through familiar contexts
- Provide oral & written instructions
- Incorporate multimedia/audio visual representation
- Use graphic organizers to guide notes, brainstorming, pre-writing, project planning, and test preparation
- Model through processes during assignments and elicit student-generated thoughts to determine gaps in understanding
- Highlight, bold, or underline main ideas in readings and in directions for writing assignments in the curricular areas
- Provide guiding questions to complete during the activity
- Provide chunking of instructional notes and activities to allow for formative assessment (checks for understanding) before moving on to the next stage
- Choose cooperative learning groups to ensure effective work, maximize productivity and support socialization
- Use multiple intelligences or the student's learning style to facilitate effective learning when a student is having difficulty grasping concepts
- Provide demonstrations, utilize pictures, or graphic to assist visual learners to support written text information
- Include oral discussions, oral presentations, group collaboration, or other oral delivery methods to support auditory learners
- Provide chunking of assignments into manageable steps, including checklists that clarify directions for assignments
- Provide a clear, concise version of a scoring rubric prior to the assignment or assessment
- Highlight distinctive features/key concepts
- Provide choice of projects depending on the student's interests or strengths.
- Review, repeat, and clarify directions
- Chunk sections of assessment
- Allow for partial credit, when appropriate

Formative Assessments

Students are expected to keep an organized Engineering Design Notebook, folder, or binder. Designs and projects that are done on the computer will be submitted to Google Classroom and are still considered to be part of the student's Engineering Design Notebook.
 	
1. Identifying the Problem
    a. "Who the Heck is Rube Goldberg?" biographical slide presentation
2. Research and Brainstorming
    a. Simple Machines fill-in-the-blank class notes
    b. Simple Machines Research Assignment
3. Materials Consideration Design Matrix
4. Thumbnail Sketch Design Matrix
5. Final Sketch of Desired Prototype
6. (Optional) 3D printed and/or laser engraved part
7. Build checkpoints
8. Testing and Modification Rationale
 	
Do-now's and checkpoint quizzes will be given during and at the conclusion of these topics

Summative Assessments
Final Design Prototype Evaluations End of Unit checks on Design Journals, documenting: ● Problem statement ● Criteria and constraints ● Design process ● Digital Design Development ● Testing, Modification, and Improvements made Final presentation or design review (partners/small group) Written reflection explaining design decisions (individual)

Black Horse Pike Regional School District Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit Title:	BHPRSD Tech Challenge
Course:	Design & Technology II
Grade Levels:	10-12
Last Revision:	Summer 2026

Unit Overview
The BHPRSD Tech Challenge is designed to guide students through the Engineering Design Process as they work in teams to solve an open-ended design challenge. Students begin by defining a problem, then collaborate to research, brainstorm, develop, test, and refine the most effective design solution. The unit culminates in a district-wide competition in which Design & Technology students from Highland, Triton, and Timber Creek compete to determine which team developed the most successful solution.

Essential Questions	**Enduring Understandings**
What are the steps of the Engineering Design Process and how can this process be applied to solve a technological problem?	The Engineering Design Process can be used to solve a technological problem by following a structured series of steps that lead to an effective solution: 1. Identify the problem – Define the need or challenge and understand the criteria and constraints. 2. Research and gather information – Learn about the problem, existing solutions, and relevant technologies. 3. Brainstorm possible solutions – Generate multiple ideas without judging them initially. 4. Select the best solution – Evaluate ideas based on effectiveness, safety, cost, materials, and feasibility. 5. Develop a design – Create sketches, plans, or models that communicate the chosen solution. 6. Build a prototype – Construct a working model or first version of the design. 7. Test and evaluate – Determine whether the prototype meets the design criteria and identify areas for improvement. 8. Improve and redesign – Modify the design based on test results and feedback, repeating the process as needed.
What are the benefits and concerns involved with working on a team?	Working on a team promotes more diverse ideas, a shared workload, and collaboration, which leads to improved problem-solving. But working on a team can lead to conflict due to issues with communication.

How does the Engineering Design Process help us design, make and build products to solve problems?	The Engineering Design Process helps us design, make, and build products by providing a structured approach to solving problems. Engineers use this process to identify a need, research information, define requirements and constraints, brainstorm possible solutions, create and test prototypes, evaluate results, and improve their designs.
How can testing and iteration improve a design?	In typical manufacturing, a product is planned, tested and prototyped, which takes time, money and effort. With Digital Design, 3D prints can be produced quicker, iterated on faster, and reprinted to meet criteria, constraints and desired specifications.

Learning Targets/Goals/Outcomes	**Standards (NJSLS)**
Define the need or challenge and understand the criteria and constraints, as outlined on the Design Brief.	8.2.12.ED.1 8.2.5.ED.5
Research and gather information to learn about the problem, existing solutions, and relevant technologies.	8.2.12.ED.1 8.2.2.NT.2 8.2.5.ED.2 CTE - 9.3.12.AC-DES.1
Brainstorm and generate multiple ideas using the information gathered while researching the Design Challenge.	8.2.12.ED.1 8.2.2.NT.2 8.2.5.ED.2
Evaluate brainstormed ideas based on their effectiveness, safety, cost, materials, and feasibility, as well as how they relate to the criteria and constraints outlined on the Design Brief.	8.2.12.ED.1 8.2.2.NT.2 8.2.5.ED.2
Create sketches, plans, or models that communicate the chosen solution.	8.2.12.ED.2 8.2.5.ED.2 CTE - 9.3.12.AC.6
Use tools and machines safely and appropriately to construct a working model or first version of the design.	8.2.12.ED.4 8.2.2.ED.3 CTE - 9.3.12.AC-CST.9
Test and evaluate the prototype and make necessary adjustments and modifications to the prototype to better adhere to the criteria and constraints.	8.2.12.ED.5 8.2.12.ED.6 8.2.5.ITH.2 CTE - 9.3.12.AC-CST.3
Recognize that the Design Process is iterative in nature and this process is never truly completed, as designs can always be improved through innovation.	8.2.5.ED.6 8.2.12.ED.1 8.2.12.ED.2 8.2.12.ED.3 8.2.12.ED.4 8.2.12.ED.5 8.2.12.ED.6
Work collaboratively with others, sharing ideas and the workload evenly.	8.2.5.ED.2

Interdisciplinary Connections
English (RST.9-10.2 / RST.11-12.2), Math (HSG-MG.A.1), Science (MS-ETS1-1-4), Career Readiness, Life Literacies & Key Skills (NJSLS-CLKS 9.4)

21st Century Skills
In this unit, students continue to develop critical thinking skills, creativity, collaboration, communication, and problem-solving. Using the Engineering Design Process, students learn to analyze challenges, develop innovative solutions, create prototypes, and refine designs based on testing and feedback.

Writing Assignments
● Sketching Assignments ● Design Matrix Assignments ● Reflection Assignments ● Individual and/or group Presentations

Activities, Instructional Strategies, and Assignments
● Project based and self-exploration activities ● Real life digital design challenges, assessments, and projects ● Teacher guided instruction ● Lectures ● Multiple Visual Examples ● Question and Answer ● Whole class reviews, check-ins, and student-led presentations ● Collaborative group (partner) design challenges ● Do-nows ● Exit Tickets

Accommodations and Modifications (BHPRSD Accommodations and Modifications)
● Provide a variety of concrete examples from familiar contexts ● Build background knowledge of content and vocabulary from familiar contexts prior to readings ● Use mental models to build understanding through familiar contexts ● Provide oral & written instructions ● Incorporate multimedia/audio visual representation (YouTube, Discovery Education, TV Show parodies, etc.) to build understanding ● Use graphic organizers to guide notes, brainstorming, pre-writing, project planning, and test preparation ● Model through processes during assignments and elicit student-generated thoughts to determine gaps in understanding ● Highlight, bold, or underline main ideas in readings and in directions for writing assignments in the curricular areas ● Provide guiding questions to complete during the activity ● Choose cooperative learning groups to ensure effective work, productivity and support socialization

- Use multiple intelligences or the student's learning style to facilitate effective learning when a student is having difficulty grasping concepts
- Provide demonstrations, utilize pictures, or graphic to assist visual learners to support written text information
- Include oral discussions, oral presentations, group collaboration, or other oral delivery methods to support auditory learners
- Provide chunking of assignments into manageable steps, including checklists that clarify directions for assignments
- Provide a clear, concise version of a scoring rubric prior to the assignment or assessment
- Highlight distinctive features/key concepts
- Provide choice of projects depending on the student's interests or strengths.
- Review, repeat, and clarify directions
- Chunk sections of assessment
- Allow for partial credit, when appropriate

Formative Assessments

Students are expected to keep an organized Engineering Design Notebook, folder, or binder. Designs and projects that are done on the computer will be submitted to Google Classroom and are still considered to be part of the student's Engineering Design Notebook.

1. Daily Activity Log
2. Identifying the Problem
3. Research and Brainstorming
4. Materials Consideration Design Matrix
5. Thumbnail Sketch Design Matrix
6. Final Sketch of Desired Prototype
7. Build checkpoints
8. Team Name and Logo Sketches
9. Final Team Name and Logo
10. Testing and Modification Rationale

Do-now's and checkpoint quizzes will be given during and at the conclusion of these topics

Summative Assessments

Final Design Prototype Evaluations
End of Unit checks on Design Journals, documenting:

- Problem statement
- Criteria and constraints
- Design process
- Digital Design Development
- Testing, Modification, and Improvements made

Final presentation or design review (partners/small group)
Written reflection explaining design decisions (individual)

Black Horse Pike Regional School District Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit Title:	Advanced 3D Modeling: 3D Model Tech Challenge Device - Assemblies and DWG's
Course:	Design & Technology II
Grade Levels:	10-12
Last Revision:	Summer 2026

Unit Overview
This unit provides students with the opportunity to continue expanding their skills in digital design, 3D printing, and the Engineering Design Process developed throughout this course and in Design & Tech I. Students explore advanced tools and features within digital design software, including TinkerCAD, Onshape, and Fusion, with an emphasis on creating multi-part assemblies, exploded views, section views, and technical drawings to accurately document their designs. Through a series of hands-on design challenges, students strengthen their understanding of digital modeling workflows, tools, and commands while applying the Engineering Design Process to create, test, evaluate, and refine original 3D models.

Essential Questions	**Enduring Understandings**
How are 3D parts designed using a Digital Design software, like TinkerCAD, Onshape, or Fusion?	The goal is to "move well to make well." Designs start as sketches, which are then extruded, and then modified (fillet, chamfer, etc.) and, depending on the complexity of the shape, this process could be repeated again and again.
With regards to editing existing parts, what are some of the benefits of using digital design as opposed to traditional manufacturing?	Unlike traditional manufacturing, digital design allows users to literally go back in time and edit features and geometries previously made. Once those edits are made, the part can be reprinted, tested, and iterated on. With traditional manufacturing, parts cannot be as easily edited once they are made and typically need to be remade from scratch, which takes more time and costs more money and effort.
What is the significance of standardization and proper dimensioning with regards to creating parts and Engineering Drawings?	Standardization and proper dimensioning are essential when creating parts and engineering drawings because they ensure accuracy, consistency, and clear communication between designers, engineers, and manufacturers. By following industry standards, designers can create parts that are compatible, repeatable, and able to be produced correctly regardless of who manufactures them.
How are section views used to detail parts and assemblies?	Section views show the internal features of a part or assembly by cutting away a portion of the object to reveal hidden details to show things like holes, pockets, and thicknesses.
How are exploded views used to detail parts and assemblies?	Exploded views separate the components of an assembly and display them in an organized arrangement to show how individual parts fit together to communicate assembly order and part relationships.

When using a digital design software, how do designers choose which tool is most effective/best for that part?	The great thing about digital design is that there are many ways to create a part or geometry and there's not one "right" answer. Some tools allow designers to make the part quicker, with greater accuracy, or, allow for easier edits and future changes to the part.
How does the Engineering Design Process help us design, make and build products to solve problems?	The Engineering Design Process helps us design, make, and build products by providing a structured approach to solving problems. Engineers use this process to identify a need, research information, define requirements and constraints, brainstorm possible solutions, create and test prototypes and evaluate and improve their designs.
How can testing and iteration improve a design?	In typical manufacturing, a product is planned, tested and prototyped, which takes time, money and effort. With Digital Design, 3D prints can be produced quicker, iterated on faster, and reprinted to meet criteria, constraints and desired specifications.

Learning Targets/Goals/Outcomes	**Standards (NJSLS)**
Use tools within a digital design software, like shell and hole to create more advanced design solutions to real-world problems.	8.2.12.ED.2
Use assembly tools within a digital design software, like mate features in Onshape to create advanced, multi-part assemblies.	8.2.12.ED.2
Use drawing and dimensioning tools within a digital design software, like the exploded view and section view tools in Onshape to create industry-standard, fully dimensioned drawings.	8.2.12.ED.2 CTE - 9.3.12.AC.6
Create a functional 3D printed part by first modeling the part, then exporting to a slicing software.	8.2.12.ED.1
Apply the Engineering Design Process to refine and iterate a design to better solve the real-world design challenge.	8.2.8.ED.2 8.2.12.ED.1 8.2.12.ED.4 8.2.12.ED.5 8.2.5.ITH.2
In digital design software, time and form are not linear. When problems arise, develop a plan to find a solution and experiment with tools and help features within the program, using appropriate vocabulary while doing so.	8.1.2.CS.3 8.1.2.AP.4

Interdisciplinary Connections
English (RST.9-10.2 / RST.11-12.2), Math (HSG-MG.A.1), Science (HS-ETS1-2, HS-ETS1-3), History (6.3.12.CivicsPI.1), Career Readiness, Life Literacies & Key Skills (9.4.12.CI.1)

21st Century Skills
In this unit, students continue to develop critical thinking skills, creativity, collaboration, communication, and problem-solving. Using the Engineering Design Process, students learn to analyze challenges, develop innovative solutions, create prototypes, and refine designs based on testing and feedback. Students build digital literacy, adaptability, and technical communication skills by using CAD software, operating emerging technologies, and presenting their design decisions.

Writing Assignments
• Sketching Assignments • Reflection Assignments • Individual and/or group Presentations

Vocabulary - List Tier 2 (Academic Essentials)	Vocabulary - Tier 3 (Content-Specific)
• Criteria • Constraint • Design • Create • Improve/Iterate • Prototype	• Sketch • Plane • Origin • Pan, Orbit, and Revolve • Extrude • Feature • Face • Fillet and Chamfer • Shell • Additive and Subtractive Manufacturing • Hole • Assemblies • Mate Features • Drawings (DWG's) • Dimension line • Section Views • Exploded Views • Annotations

Activities, Instructional Strategies, and Assignments
• "I Do, You Do, We Do" - Teacher guided instruction on a new skill, followed by students experimenting with the new skill(s) taught, and summed up as a whole class where students practice the skill again • "Go Slow to Go Fast" - early on in the unit, basic skills are taught, re-taught, and practiced often • Project based and self-exploration activities • Real life digital design challenges, assessments, and projects • Teacher guided instruction and lectures, including Q&A • Multiple Visual Examples • Whole class reviews, check-ins, and student-led presentations • Independent, self-paced learning • Collaborative group (partner) design challenges • Do-nows and Exit Tickets

Accommodations and Modifications (BHPRSD Accommodations and Modifications)
- Provide a variety of concrete examples from familiar contexts   - Build background knowledge of content and vocabulary from familiar contexts prior to readings   - Use mental models to build understanding through familiar contexts   - Provide oral & written instructions   - Incorporate multimedia/audio visual representation (YouTube, Discovery Education, TV Show parodies, etc.) to build understanding   - Use graphic organizers to guide notes, brainstorming, pre-writing, project planning, and test preparation   - Model through processes during assignments and elicit student-generated thoughts to determine gaps in understanding   - Highlight, bold, or underline main ideas in readings and in directions for writing assignments in the curricular areas   - Provide guiding questions to complete during the activity   - Provide chunking of instructional notes and activities to allow for formative assessment (checks for understanding) before moving on to the next stage   - Choose cooperative learning groups to ensure effective work, maximize productivity and support socialization   - Use multiple intelligences or the student's learning style to facilitate effective learning when a student is having difficulty grasping concepts   - Provide demonstrations, utilize pictures, or graphic to assist visual learners to support written text information   - Include oral discussions, oral presentations, group collaboration, or other oral delivery methods to support auditory learners   - Provide chunking of assignments into manageable steps, including checklists that clarify directions for assignments   - Provide a clear, concise version of a scoring rubric prior to the assignment or assessment   - Highlight distinctive features/key concepts   - Provide choice of projects depending on the student’s interests or strengths.   - Review, repeat, and clarify directions   - Chunk sections of assessment   - Allow for partial credit, when appropriate

Formative Assessments

Students are expected to keep an organized Engineering Design Notebook, folder, or binder. Designs and projects that are done on the computer will be submitted to Google Classroom and are still considered to be part of the student's Engineering Design Notebook.
 	
1. Creating multi-part assemblies - Submit links to project(s) to Google Classroom
2. Editing previously made multi-part assemblies - Submit links to project(s) to Google Classroom
3. Documenting Designs through DWG's - Submit links and exported PDF's of project(s) to Google Classroom
    a. Exploded views
    b. Section views
4. Reading Dimensions from Blueprints - handout
5. Creating advanced geometries, *like reverse engineering the Tech Challenge Devices* - Submit links to project(s) to Google Classroom
 	
Do-now's and checkpoint quizzes will be given during and at the conclusion of these topics
 	
Digital Design skill exercises (sketching, dimensioning, constraints, assemblies, and DWG's)
Design sketches and brainstorming activities
Vocabulary checks and quizzes on 3D printing terminology and on Digital Design tools
Exit tickets reflecting on challenges and solutions
Peer design critiques

Summative Assessments
Final Design Prototype Evaluations End of Unit checks on Design Journals, documenting: ● Problem statement ● Criteria and constraints ● Design process ● Digital Design Development ● Testing, Modification, and Improvements made Final presentation or design review (partners/small group) Written reflection explaining design decisions (individual)

Black Horse Pike Regional School District Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit Title:	CO2 Cars: Design (3D Model), Build and Test
Course:	Design & Technology II
Grade Levels:	10-12
Last Revision:	Summer 2026

Unit Overview
In this unit, students research, design, plan, and build a CO_2 dragster while balancing design constraints, performance goals, and manufacturing limitations. Using digital design software such as Onshape or Fusion, students create detailed 3D models of their dragsters while developing proficiency with advanced modeling tools and techniques. After completing their digital designs, students analyze factors such as weight, mass, volume, and aerodynamics, make necessary refinements, and manufacture their prototypes. Students then test and race their CO2 powered vehicles, using performance data to evaluate their designs and compete against one another to create the fastest and most efficient dragster.

Essential Questions	**Enduring Understandings**
What are the steps of the Engineering Design Process and how can this process be applied to solve a technological problem?	The Engineering Design Process can be used to solve a technological problem by following a structured series of steps that lead to an effective solution: 1. Identify the problem – Define the need or challenge and understand the criteria and constraints. 2. Research and gather information – Learn about the problem, existing solutions, and relevant technologies. 3. Brainstorm possible solutions – Generate multiple ideas without judging them initially. 4. Select the best solution – Evaluate ideas based on effectiveness, safety, cost, materials, and feasibility. 5. Develop a design – Create sketches, plans, or models that communicate the chosen solution. 6. Build a prototype – Construct a working model or first version of the design. 7. Test and evaluate – Determine whether the prototype meets the design criteria and identify areas for improvement. 8. Improve and redesign – Modify the design based on test results and feedback, repeating the process as needed.
What is the importance of many technological systems working together as a whole?	The body design, aerodynamics, wheels and axles, propulsion system, materials, and manufacturing methods must all function together to create a fast, efficient, and reliable vehicle. Engineers must understand how changes to one system can impact the performance of the entire design, such as how weight, friction, or air resistance can affect speed and stability.

How do engineers balance design constraints, available resources, and desired outcomes when developing a product?	Engineers balance constraints, resources, and goals by making design choices that create the best possible solution. In the CO2 car unit, students must consider factors like weight, shape, materials, and manufacturing limits while testing and improving their designs to create the fastest and most efficient vehicle.
How does the Engineering Design Process help us design, make and build products to solve problems?	The Engineering Design Process helps us design, make, and build products by providing a structured approach to solving problems. Engineers use this process to identify a need, research information, define requirements and constraints, brainstorm possible solutions, create and test prototypes, evaluate results, and improve their designs.
How can testing and iteration improve a design?	In typical manufacturing, a product is planned, tested and prototyped, which takes time, money and effort. With Digital Design, 3D prints can be produced quicker, iterated on faster, and reprinted to meet criteria, constraints and desired specifications.

Learning Targets/Goals/Outcomes	**Standards (NJSLS)**
Define the need or challenge and understand the criteria and constraints, as outlined on the Design Brief.	8.2.12.ED.1 8.2.5.ED.5
Research and gather information to learn about the problem, existing solutions, and relevant technologies.	8.2.12.ED.1 8.2.2.NT.2 8.2.5.ED.2 CTE - 9.3.12.AC-DES.1
Brainstorm and generate multiple ideas using the information gathered while researching the Design Challenge.	8.2.12.ED.1 8.2.2.NT.2
Evaluate brainstormed ideas based on their effectiveness, safety, cost, materials, and feasibility, as well as how they relate to the criteria and constraints outlined on the Design Brief.	8.2.12.ED.1 8.2.2.NT.2 8.2.5.ED.2
Create sketches, plans, or models that communicate the chosen solution.	8.2.12.ED.2 8.2.5.ED.2 CTE - 9.3.12.AC.6
Use tools and machines safely and appropriately to construct a working model or first version of the design.	8.2.12.ED.4 8.2.2.ED.3
Test and evaluate the prototype and make necessary adjustments and modifications to the prototype to better adhere to the criteria and constraints.	8.2.12.ED.5 8.2.12.ED.6 8.2.5.ITH.2
Recognize that the Design Process is iterative in nature and this process is never truly completed, as designs can always be improved through innovation.	8.2.12.ED.1 8.2.12.ED.2 8.2.12.ED.3 8.2.12.ED.4 8.2.12.ED.5 8.2.12.ED.6

Consider the effectiveness of each part individually, but also the effectiveness those parts have on the greater whole of the CO2 Car. Redesign and modify the design as needed.	8.2.8.NT.3 CTE - 9.3.12.AC-CST.3

Interdisciplinary Connections
English (RST.9-10.2 / RST.11-12.2), Math (NJSLS-M G-MG), Science (HS-PS2-1-2), Career Readiness, Life Literacies & Key Skills (NJSLS-CLKS 9.4)

21st Century Skills
In this unit, students continue to develop critical thinking skills, creativity, collaboration, communication, and problem-solving. Using the Engineering Design Process, students learn to analyze challenges, develop innovative solutions, create prototypes, and refine designs based on testing and feedback.

Writing Assignments
• Sketching Assignments • Design Matrix Assignments • Reflection Assignments • Individual and/or group Presentations

Vocabulary - List Tier 2 (Academic Essentials)	**Vocabulary - Tier 3 (Content-Specific)**
• Precision • Accuracy • Specifications • Criteria • Constraints	• Chassis • Frame • Suspension • Axle • Force • Motion • Acceleration • Velocity • Speed • Momentum • Inertia • Impulse • Energy • Kinetic energy • Potential energy • Energy transfer • Newton's Laws of Motion • Acceleration and Deceleration • Aerodynamics • Air resistance • Drag • Bearing • Center of Gravity

Activities, Instructional Strategies, and Assignments
● Project based and self-exploration activities ● Real life digital design challenges, assessments, and projects ● Teacher guided instruction ● Lectures ● Multiple Visual Examples ● Question and Answer ● Whole class reviews, check-ins, and student-led presentations ● Independent, self-paced learning ● Collaborative group (partner) design challenges ● Do-nows ● Exit Tickets

Accommodations and Modifications (BHPRSD Accommodations and Modifications)
● Provide a variety of concrete examples from familiar contexts ● Build background knowledge of content and vocabulary from familiar contexts prior to readings ● Use mental models to build understanding through familiar contexts ● Provide oral & written instructions ● Incorporate multimedia/audio visual representation (YouTube, Discovery Education, TV Show parodies, etc.) to build understanding ● Use graphic organizers to guide notes, brainstorming, pre-writing, project planning, and test preparation ● Model through processes during assignments and elicit student-generated thoughts to determine gaps in understanding ● Highlight, bold, or underline main ideas in readings and in directions for writing assignments in the curricular areas ● Provide guiding questions to complete during the activity ● Provide chunking of instructional notes and activities to allow for formative assessment (checks for understanding) before moving on to the next stage ● Choose cooperative learning groups to ensure effective work, maximize productivity and support socialization ● Use multiple intelligences or the student's learning style to facilitate effective learning when a student is having difficulty grasping concepts ● Provide demonstrations, utilize pictures, or graphic to assist visual learners to support written text information ● Include oral discussions, oral presentations, group collaboration, or other oral delivery methods to support auditory learners ● Provide chunking of assignments into manageable steps, including checklists that clarify directions for assignments ● Provide a clear, concise version of a scoring rubric prior to the assignment or assessment ● Highlight distinctive features/key concepts ● Provide choice of projects depending on the student’s interests or strengths. ● Review, repeat, and clarify directions ● Chunk sections of assessment ● Allow for partial credit, when appropriate

Formative Assessments

Students are expected to keep an organized Engineering Design Notebook, folder, or binder. Designs and projects that are done on the computer will be submitted to Google Classroom and are still considered to be part of the student's Engineering Design Notebook.

1. Identifying the Problem
2. Research and Brainstorming
    a. "Dragster Physics" - How it Works Google Classroom Assignment
    b. CO2 Dragster fill-in-the-blank class notes
3. Thumbnail Sketch Design Matrix
4. Final Sketch of Desired Prototype
5. 3D Model Prototype (required before building out of basswood)
6. Dragster build checkpoints
    a. Rough Shape
    b. Refined Shape
    c. Wheels and Axles
    d. Sanding and Finishing
7. Testing and Modification Rationale
    a. Pre-Testing Trial Runs

Do-now's and checkpoint quizzes will be given during and at the conclusion of these topics

Summative Assessments

Final Design Prototype Evaluations
End of Unit checks on Design Journals, documenting:

- Problem statement
- Criteria and constraints
- Design process
- Digital Design Development
- Testing, Modification, and Improvements made

Final presentation or design review (partners/small group)
Written reflection explaining design decisions (individual)

Black Horse Pike Regional School District Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit Title:	Basic Electronics and Introduction to Soldering
Course:	Design & Technology II
Grade Levels:	10-12
Last Revision:	Summer 2026

Unit Overview
This unit introduces students to the fundamentals of electricity, electronics, and basic electrical engineering. Students explore what electricity is, how it is generated, transmitted, and controlled to create simple direct current (DC) circuits in both series and parallel configurations. Through hands-on activities, students apply Ohm's Law and work with electronic components such as batteries, switches, LEDs, and motors to understand how electrical systems function. Students learn to read, interpret, and create electrical schematics while applying their knowledge through a series of design challenges and projects. These experiences allow students to build and troubleshoot simple DC circuits, develop problem-solving skills, and gain practical experience with electrical systems. Students also practice soldering using easy-to-follow step-by-step kits.

Essential Questions	**Enduring Understandings**
How do engineers design and build electrical systems that are safe, reliable, and efficient?	Engineers design electrical systems that are safe, reliable, and efficient by carefully selecting components, applying scientific principles, following safety standards, testing performance, and optimizing designs to ensure they function properly while minimizing risks and energy waste. DC circuits often have soldered components to create strong, reliable electrical connections that allow individual parts to work together as a functional electronic system.
How can Ohm's Law be used to predict and solve problems within a circuit?	Ohm's Law allows engineers to predict and solve circuit problems by calculating the relationship between voltage, current, and resistance to determine how electrical components will perform and ensure circuits operate safely and efficiently.
How can engineers troubleshoot and improve electrical systems when they do not function as expected?	Engineers troubleshoot and improve electrical systems by analyzing problems, testing components, identifying failures, and making design adjustments to ensure the system operates safely, efficiently, and reliably.
How do engineers use electrical schematics to communicate, design, and troubleshoot complex electrical systems?	Engineers use electrical schematics as a visual language to represent circuit designs, communicate how components connect, and troubleshoot electrical systems by identifying errors and improving functionality.

Learning Targets/Goals/Outcomes	Standards (NJSLS)
Read, interpret, and create electrical schematics using standard symbols.	8.2.12.ED.2 CTE - 9.3.12.AC.6
Use Ohm's Law to calculate and predict the behavior of electrical circuits.	8.2.5.ED.2 CTE - 9.3.12.AC.6
Design and build simple DC circuits using batteries, switches, LEDs, resistors, and motors.	8.2.12.ED.5 8.2.12.ED.6
Explain how individual components work together as part of a larger electrical system.	8.2.8.NT.3 CTE - 9.3.12.AC-CST.3
Demonstrate proper safety procedures when using soldering equipment and electronic tools.	8.2.12.ED.4 8.2.2.ED.3

Interdisciplinary Connections
English (NJSLSA.W4), Math (NJSLS-M HSA-CED.A.1 and NJSLS-M HSA-CED.A.4), Science (HS-PS3-1-2)

21st Century Skills
In this unit, students continue to develop critical thinking skills, creativity, collaboration, communication, and problem-solving. Using the Engineering Design Process, students learn to analyze challenges, develop innovative solutions, create prototypes, and refine designs based on testing and feedback.

Writing Assignments
• Sketching Assignments • Schematic Design Layouts • Reflection Assignments • Individual and/or group Presentations

Vocabulary - List Tier 2 (Academic Essentials)	Vocabulary - Tier 3 (Content-Specific)
• Component • System • Function • Process • Specifications • Input • Output • Connection	• Electron • Charge • Conductor • Insulator • Circuit • Current • Voltage • Resistance • Power • Direct current (DC) • Polarity • Electromotive force • Ground • Battery

	• Power source • Resistor • Capacitor • LED (Light Emitting Diode) • Diode • Motor • Switch • Series circuit • Parallel circuit • Open circuit • Closed circuit • Short circuit • Electrical schematic • Circuit diagram • Symbol • Node • Branch • Path • Load • Loop • Ohm's Law • Ampere (Amp) • Volt (V) • Ohm (Ω) • Watt (W) • Voltage drop • Current flow • Resistance value • Solder • Soldering iron • Solder joint • Flux • Solder wick • Tip • Heat transfer • Melting point • Conduction • Component lead • Through-hole component • Continuity • Fault • Failure • Diagnostic

Activities, Instructional Strategies, and Assignments
● Project based and self-exploration activities ● Real life digital design challenges, assessments, and projects ● Teacher guided instruction ● Lectures ● Multiple Visual Examples ● Question and Answer ● Whole class reviews, check-ins, and student-led presentations ● Independent, self-paced learning ● Collaborative group (partner) design challenges ● Do-nows ● Exit Tickets

Accommodations and Modifications (BHPRSD Accommodations and Modifications)
● Provide a variety of concrete examples from familiar contexts ● Build background knowledge of content and vocabulary from familiar contexts prior to readings ● Use mental models to build understanding through familiar contexts ● Provide oral & written instructions ● Incorporate multimedia/audio visual representation (YouTube, Discovery Education, TV Show parodies, etc.) to build understanding ● Use graphic organizers to guide notes, brainstorming, pre-writing, project planning, and test preparation ● Model through processes during assignments and elicit student-generated thoughts to determine gaps in understanding ● Highlight, bold, or underline main ideas in readings and in directions for writing assignments in the curricular areas ● Provide guiding questions to complete during the activity ● Provide chunking of instructional notes and activities to allow for formative assessment (checks for understanding) before moving on to the next stage ● Choose cooperative learning groups to ensure effective work, maximize productivity and support socialization ● Use multiple intelligences or the student's learning style to facilitate effective learning when a student is having difficulty grasping concepts ● Provide demonstrations, utilize pictures, or graphic to assist visual learners to support written text information ● Include oral discussions, oral presentations, group collaboration, or other oral delivery methods to support auditory learners ● Provide chunking of assignments into manageable steps, including checklists that clarify directions for assignments ● Provide a clear, concise version of a scoring rubric prior to the assignment or assessment ● Highlight distinctive features/key concepts ● Provide choice of projects depending on the student’s interests or strengths. ● Review, repeat, and clarify directions ● Chunk sections of assessment ● Allow for partial credit, when appropriate

Formative Assessments

Students are expected to keep an organized Engineering Design Notebook, folder, or binder. Designs and projects that are done on the computer will be submitted to Google Classroom and are still considered to be part of the student's Engineering Design Notebook.
 	
1. Identifying the Problem
2. Research and Brainstorming
    a. "Basic Electronic Components" - Individual Research Assignment
    b. "What is Electricity?" - Google Classroom Assignment
        i. Open vs. Closed
        ii. AC vs. DC
        iii. Series vs. Parallel and Open vs. Closed
    c. Schematic Designs Presentation w/ fill-in-the-blank notes
        i. "Create Your Own Schematic" - TinkerCAD
3. Basic DC Circuit Test and Analysis
    a. Resistance
    b. Voltage
    c. Current
    d. Ohm's Law
4. Soldering Safety Worksheet and Safety Quiz
 	
Do-now's and checkpoint quizzes will be given during and at the conclusion of these topics

Summative Assessments
Final Soldered Circuit Design Prototype Evaluations End of Unit checks on Design Journals, documenting: ● Problem statement ● Criteria and constraints ● Design process ● Digital Design Development ● Testing, Modification, and Improvements made Final presentation or design review (partners/small group) Written reflection explaining design decisions (individual)

Black Horse Pike Regional School District Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit Title:	LED Signs
Course:	Design & Technology II
Grade Levels:	10-12
Last Revision:	Summer 2026

Unit Overview
In this unit, students apply their knowledge of basic electronics, soldering, and the Engineering Design Process to design and fabricate a custom LED sign. Through this hands-on project, students strengthen their electrical engineering, manufacturing, and problem-solving skills while gaining experience designing, assembling, testing, and troubleshooting a functional electronic product.

Essential Questions	**Enduring Understandings**
How do engineers design and build electrical systems that are safe, reliable, and efficient?	Engineers design electrical systems that are safe, reliable, and efficient by carefully selecting components, applying scientific principles, following safety standards, testing performance, and optimizing designs to ensure they function properly while minimizing risks and energy waste. DC circuits often have soldered components to create strong, reliable electrical connections that allow individual parts to work together as a functional electronic system.
How can engineers troubleshoot and improve electrical systems when they do not function as expected?	Engineers troubleshoot and improve electrical systems by analyzing problems, testing components, identifying failures, and making design adjustments to ensure the system operates safely, efficiently, and reliably.
How do engineers use electrical schematics to communicate, design, and troubleshoot complex electrical systems?	Engineers use electrical schematics as a visual language to represent circuit designs, communicate how components connect, and troubleshoot electrical systems by identifying errors and improving functionality.
How do engineers minimize risks when using heat, tools, and electrical equipment?	Engineers do so by following safety procedures, using appropriate protective equipment, maintaining proper work environments, and applying careful planning and testing to prevent accidents and equipment damage.

Learning Targets/Goals/Outcomes	Standards (NJSLS)
Read, interpret, and create electrical schematics using standard symbols.	8.2.12.ED.2 CTE - 9.3.12.AC.6
Explain how individual components work together as part of a larger electrical system.	8.2.8.NT.3 CTE - 9.3.12.AC-CST.3
Demonstrate proper safety procedures when using soldering equipment and electronic tools.	8.2.12.ED.4 8.2.2.ED.3

Interdisciplinary Connections
English (NJSLSA.W4), Math (NJSLS-M HSA-CED.A.1 and NJSLS-M HSA-CED.A.4), Science (HS-PS3-1-2)

21st Century Skills
In this unit, students continue to develop critical thinking skills, creativity, collaboration, communication, and problem-solving. Using the Engineering Design Process, students learn to analyze challenges, develop innovative solutions, create prototypes, and refine designs based on testing and feedback.

Writing Assignments

- Sketching Assignments
- Schematic Design Layouts
- Reflection Assignments
- Individual and/or group Presentations

Vocabulary - List Tier 2 (Academic Essentials)	Vocabulary - Tier 3 (Content-Specific)
Vocab is the same as the previous unit, as this unit is an extension of content and skills previously learned	

Activities, Instructional Strategies, and Assignments

- Project based and self-exploration activities
- Real life digital design challenges, assessments, and projects
- Teacher guided instruction
- Lectures
- Multiple Visual Examples
- Question and Answer
- Whole class reviews, check-ins, and student-led presentations
- Independent, self-paced learning
- Collaborative group (partner) design challenges
- Do-nows
- Exit Tickets

Accommodations and Modifications (BHPRSD Accommodations and Modifications)
● Provide a variety of concrete examples from familiar contexts ● Build background knowledge of content and vocabulary from familiar contexts prior to readings ● Use mental models to build understanding through familiar contexts ● Provide oral & written instructions ● Incorporate multimedia/audio visual representation (YouTube, Discovery Education, TV Show parodies, etc.) to build understanding ● Use graphic organizers to guide notes, brainstorming, pre-writing, project planning, and test preparation ● Model through processes during assignments and elicit student-generated thoughts to determine gaps in understanding ● Highlight, bold, or underline main ideas in readings and in directions for writing assignments in the curricular areas ● Provide guiding questions to complete during the activity ● Provide chunking of instructional notes and activities to allow for formative assessment (checks for understanding) before moving on to the next stage ● Choose cooperative learning groups to ensure effective work, maximize productivity and support socialization ● Use multiple intelligences or the student's learning style to facilitate effective learning when a student is having difficulty grasping concepts ● Provide demonstrations, utilize pictures, or graphic to assist visual learners to support written text information ● Include oral discussions, oral presentations, group collaboration, or other oral delivery methods to support auditory learners ● Provide chunking of assignments into manageable steps, including checklists that clarify directions for assignments ● Provide a clear, concise version of a scoring rubric prior to the assignment or assessment ● Highlight distinctive features/key concepts ● Provide choice of projects depending on the student’s interests or strengths. ● Review, repeat, and clarify directions ● Chunk sections of assessment ● Allow for partial credit, when appropriate

Formative Assessments

Students are expected to keep an organized Engineering Design Notebook, folder, or binder. Designs and projects that are done on the computer will be submitted to Google Classroom and are still considered to be part of the student’s Engineering Design Notebook.
 	
1. Identifying the Problem
2. Research and Brainstorming
    a. “Raster to Vector” - Individual Research Assignment
    b. Schematic Designs Presentation w/ fill-in-the-blank notes
        i. “Create Your Own Schematic” - TinkerCAD
3. REVIEW: Soldering Safety Worksheet and Safety Quiz
4. Exporting Vectors and Laser Engraving
    a. Laser Engraving on Acrylic
 	
Do-now’s and checkpoint quizzes will be given during and at the conclusion of these topics

Summative Assessments
Final Soldered LED Circuit Design Prototype Evaluations End of Unit checks on Design Journals, documenting: ● Problem statement ● Criteria and constraints ● Design process ● Digital Design Development ● Testing, Modification, and Improvements made Final presentation or design review (partners/small group) Written reflection explaining design decisions (individual)

Black Horse Pike Regional School District Curriculum

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Unit Title:	Solid Fuel Rockets
Course:	Design & Technology II
Grade Levels:	10-12
Last Revision:	Summer 2026

Unit Overview
For the final unit of the year, students will participate in a hands-on and engaging design challenge focused on solid-fuel rocket design, fabrication, and flight analysis. While students previously researched, designed, and built rockets in Design & Tech I, this unit introduces solid-fuel rockets capable of significantly greater acceleration and altitude. Students will apply their understanding of aerodynamics, physics of flight, and engineering design principles to optimize their designs. Using 3D modeling software, students will digitally develop and refine their rockets before fabricating, testing, and analyzing flight performance, making adjustments to improve their designs and maximize success.

Essential Questions	**Enduring Understandings**
How can we study real-world rockets, planes, and principles of flight to help in this challenge?	Students can study real-world rockets, aircraft, and the principles of flight to understand how engineers use aerodynamics, stability, propulsion, and material selection to design vehicles that fly safely and efficiently. By analyzing existing aerospace technologies, students can identify design strategies that can be applied to improve the performance of their own model rockets.
What are some advantages of using computer software and models to test designs throughout the design process?	Using computer software and digital models throughout the Engineering Design Process allows engineers to explore ideas, test performance, and improve designs before investing time and resources in building physical prototypes.
What is the importance of many technological systems working together as a whole?	The success of the design depends on how multiple systems interact to safely absorb and distribute the forces of a collision, as no single part of the vehicle can protect the egg on its own.

Learning Targets/Goals/Outcomes	**Standards (NJSLS)**
Research existing, real-world rockets and aircrafts and apply similar geometric shapes, particularly to the fins, to designs for this challenge.	8.2.12.NT.1 8.2.8.ED.3 CTE - 9.3.12.AC-DES.1
Research existing, real-world rockets and aircrafts and consider how physics can impact the rockets in this Design Challenge.	8.2.12.NT.1 8.2.8.ED.3 CTE - 9.3.12.AC-DES.1

Brainstorm and generate multiple ideas using the information gathered while researching the Design Challenge.	8.2.12.ED.1 8.2.2.NT.2
Using digital design software, like AutoCAD and/or Onshape, create a working design of the model rocket that can be used as a blueprint template.	8.2.8.ED.3 CTE - 9.3.12.AC.6
Construct a functional, fully assembled, working model of a rocket that can be launched and tested for things like: center of gravity, center of pressure, flight, and altitude.	8.2.5.ED.6 CTE - 9.3.12.AC-CST.3

Interdisciplinary Connections
Science (HS-PS2-1, HS-PS2-1, HS-PS3-1, HS-PS3-3), Math (G-MG.1)

21st Century Skills
In this unit, students continue to develop critical thinking skills, creativity, collaboration, communication, and problem-solving. Using the Engineering Design Process, students learn to analyze challenges, develop innovative solutions, create prototypes, and refine designs based on testing and feedback.

Writing Assignments
● Sketching Assignments ● Reflection Assignments ● Individual and/or group Presentations

Vocabulary - List Tier 2 (Academic Essentials)	**Vocabulary - Tier 3 (Content-Specific)**
●	● Airframe ● Body Tube ● Nose Cone ● Payload ● Fins ● Propellant ● Shock Cord ● Center of Gravity (CG) ● Center of Pressure (CP) ● Stability ● Aerodynamics ● Lift ● Drag ● Thrust ● Air Resistance ● Acceleration ● Velocity ● Trajectory ● Stability ● Equilibrium ● Turbulence

Activities, Instructional Strategies, and Assignments
● Project based and self-exploration activities ● Real life digital design challenges, assessments, and projects ● Teacher guided instruction ● Lectures ● Multiple Visual Examples ● Question and Answer ● Whole class reviews, check-ins, and student-led presentations ● Independent, self-paced learning ● Collaborative group (partner) design challenges ● Do-nows ● Exit Tickets

Accommodations and Modifications (BHPRSD Accommodations and Modifications)
● Provide a variety of concrete examples from familiar contexts ● Build background knowledge of content and vocabulary from familiar contexts prior to readings ● Use mental models to build understanding through familiar contexts ● Provide oral & written instructions ● Incorporate multimedia/audio visual representation (YouTube, Discovery Education, TV Show parodies, etc.) to build understanding ● Use graphic organizers to guide notes, brainstorming, pre-writing, project planning, and test preparation ● Model through processes during assignments and elicit student-generated thoughts to determine gaps in understanding ● Highlight, bold, or underline main ideas in readings and in directions for writing assignments in the curricular areas ● Provide guiding questions to complete during the activity ● Provide chunking of instructional notes and activities to allow for formative assessment (checks for understanding) before moving on to the next stage ● Choose cooperative learning groups to ensure effective work, maximize productivity and support socialization ● Use multiple intelligences or the student's learning style to facilitate effective learning when a student is having difficulty grasping concepts ● Provide demonstrations, utilize pictures, or graphic to assist visual learners to support written text information ● Include oral discussions, oral presentations, group collaboration, or other oral delivery methods to support auditory learners ● Provide chunking of assignments into manageable steps, including checklists that clarify directions for assignments ● Provide a clear, concise version of a scoring rubric prior to the assignment or assessment ● Highlight distinctive features/key concepts ● Provide choice of projects depending on the student’s interests or strengths. ● Review, repeat, and clarify directions ● Chunk sections of assessment ● Allow for partial credit, when appropriate

Formative Assessments

Students are expected to keep an organized Engineering Design Notebook, folder, or binder. Designs and projects that are done on the computer will be submitted to Google Classroom and are still considered to be part of the student's Engineering Design Notebook.
 	
1. Identifying the Problem
2. Research and Brainstorming
    a. Principles of Flight fill-in-the-blank class notes
    b. Fin and Nose Cone Sketches and Preliminary Designs
3. Preliminary Sketches - Design Matrix
4. Digital Design Model of Fins (Onshape, Fusion, and/or AutoCAD)
5. Build checkpoints
    a. Body Tube
    b. Nosecone
    c. Fins
6. Testing, Evaluation and Modification Rationale
 	
Do-now's and checkpoint quizzes will be given during and at the conclusion of these topics

Summative Assessments
Final Design Prototype Evaluations End of Unit checks on Design Journals, documenting: ● Problem statement ● Criteria and constraints ● Design process ● Digital Design Development ● Testing, Modification, and Improvements made Final presentation or design review (partners/small group) Written reflection explaining design decisions (individual)