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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Date:
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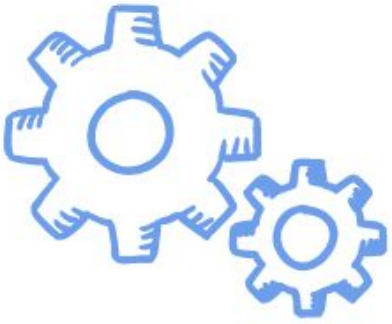
DESIGN & TECH II

HIGH SCHOOL NAME

2020-2021 Course Syllabus



TEACHER

E-MAIL

PHONE #

REMIND CODE

CLASSROOM CODE

COMMON TIME AVAILABILITY

_ and _ days in _-___.

I am not available any other day, but can meet after school, if you schedule it with me in advance.

COURSE DESCRIPTION

10-12 Graders - MUST HAVE PASSED INN. ENG.
5 Credits

Design & Tech 2 is the second level Technology Education course available to those who have passed Innovative Engineering. This class is recommended for students who are considering Engineering as a career. In this class, you will build on skills and concepts learned in Innovative Engineering and continue to use cutting edge computer aided drafting and solid modeling programs to develop your design solutions before you build them.

UNITS COVERED

- The Manufacturing Process
- AutoCAD Basics and House Floor Plans
- Package Design
- Soldering Safety and Electrical Circuits
- Advanced 3D Modeling Using Onshape
- CO2 Car Design
- Simple Machines
- Mousetrap Challenge
- Solid Fuel Rockets
- Structural Design

MATERIALS NEEDED

- Pencil (bring everyday)
- Two-Pocket Folder (keep in the classroom)

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

- Any classwork submitted late will be docked -15% points off of the total grade.
- You can earn some or all of these points back ONLY if you complete missed or late work during Common Time, but NOT during class time.

ABSENCES

- If you are absent, it is your responsibility to e-mail me and check Google Classroom.
- You will get extensions on assignments equal to the number of days you were out
- If you know you're going to be out, notify me ahead of time so I can help you with the classwork

TOP 10 WAYS TO EARN FULL PARTICIPATION POINTS

1. Keep phone and headphones away for the entire class period
2. Keep quiet and pay attention during lectures, lessons and demonstrations
3. 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 (but don't do nothing)
4. Each class we will have daily/weekly checkpoints. Make sure you know what they are and work to meet those checkpoints
5. When prompted to get to work, you should get to work within just a couple minutes. Any longer and you will lose participation points
6. 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
7. Use school appropriate language and be mindful of your classmates
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.

UNIT OUTLINE

Design & Technology II

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

Course Content

1. **Manufacturing Project (1 month)**: Students start by reviewing machine and lab safety and are introduced to newer, more advanced machines like the laser engraver, which offers an infinite amount of customization. Students use jigs and fixtures to process their rough materials into a final, fully customized project.

2. **AutoCAD Basics (3-4 weeks):** While knowing how to model in 3D is important, 2D design using AutoCAD is still an industry staple and is essential for all drafters and engineers to be familiar with.

3. **Package Design (1 month):** Students apply their knowledge of AutoCAD to create a package for a product to safely transport it without causing damage. On top of that, students must assess things like cost, size and shape, material, time, space, and other factors that students often don't consider.

4. **Basic Electronics and Soldering (2-3 weeks):** In this unit, students will be given a soldering kit, with various components from resistors to LEDs, which all must be put together correctly (and safely) in order for the kit to work.

5. **Engineering Design Process and BHPRSD Tech Challenge (1-2 months):** The BHPRSD Tech Challenge takes students through the Engineering Design Process where students begin by defining a problem, work in small groups to research and develop the best solution to that problem, and compete against the other two high schools in the district to see whose design worked the best.

6. **Reverse Engineer and 3D Model using Onshape (2-3 weeks):** Even though the Tech Challenge is over, the Engineering Design Process isn't. For this next step, students model their Tech Challenge device in Onshape, learning new tools and commands, with specific attention to assemblies and design documentation.

7. **CO2 Dragster Design (1 month)**: Using Onshape, students model a CO2 dragster using advanced tools and keystrokes. Once modeled in 3D, students assess weight, mass, and volume, make adjustments, and then build and race their CO2 powered cars and compete against others in the class to see who has the fastest car.

8. **Simple Machines (3-4 weeks)**: Students research and identify the six simple machines, learn to calculate mechanical advantage to make work easier, and apply this knowledge to solve an Engineering Design Challenge.

9. **MouseTrap Vehicle Design (Boat or Car) (3-4 weeks)**: Depending on the resources available in the classroom, students make either a mousetrap car or a mousetrap boat. Students first race their mousetrap powered vehicles to see whose is fastest, but then redesign them to see whose vehicle can last the longest.

10. **Solid Fuel Rockets (1-2 weeks)**: Students research, design, solid model using Onshape, and then construct a solid fuel rocket and all its components to achieve successful launch, flight, and safe landing.

Course Expectations and Skills:

1. Keep and maintain an Engineering notebook.
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. 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.

Black Horse Pike Regional School District Curriculum

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

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course: Design and Technology II **Unit Title:** Manufacturing Project **Grade Level(s):** 10-12	**Unit Summary:** ● Students will learn about the manufacturing engineering field as it pertains to our lives and the various career opportunities associated with manufacturing industries. Students will understand the importance of the systems approach and what it takes to develop a functional and effective product. Students will recognize how important safety is in a manufacturing environment, how it pertains to the classroom, and will be able to demonstrate the safe and effective use of tools and machinery. Using an assembly line approach with jigs and fixtures, students will work together to interpret a set of drawings of a product and work together to turn those drawings into a tangible, usable product.
Essential Questions: ● What is technology and how does it relate to manufacturing? ● What is a systems approach, as it relates to manufacturing? ● How has the history of manufacturing affected the future trends of manufacturing? ● What are the various career opportunities in the field of manufacturing? ● Why is the development of the Occupational Safety and Health Administration (OSHA) so important? ● What is the importance of using tooling in a manufacturing setting?	**Enduring Understanding:** ● Technology is anything humans use to extend their capabilities. Manufacturing encompasses all aspects of technology and engineering. ● The systems approach is the relation between the input of information, the process of reaching a goal, the output of work, and the feedback and impacts to help make the process better. ● Humans have been making items to meet their needs since the beginning of time. Those needs are ever changing but always end up using a similar process to reach the end goal. ● There are many career opportunities in the field of manufacturing, some of which include: Management, engineering, production, tooling, marketing, finances and human resources, to name a few. ● Workers have the right to a safe workplace. OSHA makes sure that companies comply with the development, implementation, and following of such regulations. ● Jigs and fixtures greatly improve the accuracy, safety, and speed up manufacturing times as materials are processed.

• What is the importance of creative problem solving? • What is the importance of quality control?	• Creative problem solving skills can be learned and are the most sought after skill employers look for. This can save companies time and in manufacturing, time is money. • Quality control ensures the final product matches the design in the final working drawings. Inspection stations should be set up throughout the manufacturing process.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable.

Learning Target:	**NJCCCS or CCS:**
1. Describe and discuss the impacts of technology and how they have affected people, the environment, and further developments or uses of technology.	**1. TEC.9-12.8.1 ELL.9-12.L.A.3**
2. Explain the systems model and apply the model to something used in daily life.	**2. TEC.9-12.8.2.12 B.4 ELL.9-12.S.B.3**
3. Compare and contrast the manufacturing materials, processes, purpose, and evolution of a product that we use today.	**3. TEC.9-12.8.12.E.1**
4. Describe and discuss the advantages and disadvantages of the various types of manufacturing systems.	**4. MANU.9-12.9.4.12.M.29**
5. Identify safety awareness and explain the improvements that have been made to the workplace because of OSHA.	**5. MANU.9-12.9.4.12.M.33 12.9.3.MN-PRO.2**
6. Compose and organize sketches for a proposed product idea.	**6. TECH.8.2.12.C.5**
7. Demonstrate the inspection of parts and creation of quality control gauges during the manufacturing process.	**7. MANU.9-12.9.4.12.M.30**

Interdisciplinary Connections:

STEAM, English

Students will engage with the following text:

Technology Education: Learning by Design
Pearson Prentice Hall
ISBN 0133639894

Periodicals may include, but are not limited to, newspapers, magazine articles and web pages.

Students will write:

Students will keep an Engineering notebook, which will include daily and weekly journal entries, notes, research information, design briefs and other information regarding the Engineering Design challenges throughout the course, sketches, brainstorming activities, etc.. In this unit, students will take notes on the manufacturing process and must read and interpret a variety of engineering drawings needed for the manufacturing process of this product.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE

How will students uncover content and build skills?.

- Students will research the developments of a certain technology and explain in essay form how this technology has developed over the years.
- Students will bring in an object from home and verbally explain how the systems model relates to the construction and functionality of that object or product.
- Students will be assigned positions. Each person will have a job to keep the team running and ensure checkpoints and deadlines are met.
- Students will ensure that every process in their manufacturing sequence is safe.
- Students will research different materials that can be recycled and also develop a project out of repurposed material.
- Students will safely use existing templates, jigs, and fixtures for the manufacturing project.
- Throughout the design and manufacturing process students will use creative problem solving skills to develop their project.
- Students will read and interpret Engineering drawings from Onshape of the product that will be built.
- Students will develop quality control checkpoints and go no go gages for their manufacturing process.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF THE CONTENT AND THEIR ABILITY TO APPLY SKILLS.
IDENTIFY BLOOM'S LEVELS

Formative Assessments:

- Warm-Up Activities
- Daily activities will be based on either student exploration of the content area or a reflection of a prior lesson, to help reinforce concepts already taught

- Checkpoints of understanding:
- Knowledge of machines
- Sketching models
- Exporting parts
- 3-View Orthographic projection of sketched models
- Engineering Design Process
- Measure and create a part from looking at a real world object

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Summative Assessments:

- Manufacturing Notes and Research
- Working Drawings
- Flow process charts and Operation sheets
- Proper tooling design and function
- Quality control gages and systems

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Performance Assessments:

- Completion of a fully finished manufactured product using jigs and fixtures

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Students with physical needs will be accommodated by use of custom and specialized jigs, guards and fixtures.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Black Horse Pike Regional School District Curriculum

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

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course: Design and Technology II **Unit Title:** AutoCAD Basics **Grade Level(s):** 10-12	**Unit Summary:** • Students will learn the fundamentals of how to use industry standard Computer Aided Drafting software to create a variety of technical drawings. The ability to utilize CAD software to create drawings and building plans will allow students to convey their solutions to design challenges they are presented with in the Design & Technology program.
Essential Questions: • What is technology and how does it relate to communication? • What are the advantages of using a CAD system? • How has the history of drafting and design affected future trends of Computer Aided Drafting and Design? • What are the various career opportunities in the field of CAD/CAM? • Why is file management and organization so important in the role of a CAD operator? • What is the importance of accurate annotation and detailing?	**Enduring Understanding:** • Technology is anything humans use to extend their capabilities. Communication is an essential part of the design process • CAD systems are extremely accurate and precise but also allow for revisions to be made easily. • Humans have been designing items to meet their needs since the beginning of time. While hand drawings and sketches are still useful and necessary, CAD software continues to advance and evolve to empower the designer and meet the needs of a high tech society. • There are many career opportunities in the field of Computer Aided Drafting, some of which include: CAD Operator, 3D modeler, Architectural Drafter and CNC operator/programmer. • A CAD operator must have file management skills to organize and catalog drawing files associated with complex design projects and the revisions made. • Technical drawings must be as accurate as possible to prevent costly manufacturing errors or product defects.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable.

Learning Target:	**NJCCCS or CCS:**
1. Describe and discuss the impacts of technology and how	**1. TEC.9-12.8.1**

they have affected people, the environment, and further developments or uses of technology.	**ELL.9-12.L.A.3**
2. Demonstrate the ability to accurately convey and revise a drawing file.	**2. 8.2.12.ED.2**
3. Compare and contrast the methods used and evolution of the technical drawing & design industry.	**3. 8.2.12.ED.6**
4. Describe and discuss the advantages and disadvantages of the various types of design communication.	**4. 8.2.12.ED.5**
5. Organize and maintain a file system for class related drawing projects and assignments.	**5. 8.1.12.CS.3**
6. Evaluate the accuracy of technical drawings as they pertain to the final product of a design challenge.	**6. 8.2.12.ED.2**

Interdisciplinary Connections:

STEAM, English

Students will engage with the following text:

Technology Education: Learning by Design
Pearson Prentice Hall
ISBN 0133639894

Periodicals may include, but are not limited to, newspapers, magazine articles and web pages.

Students will write:

Students will keep an Engineering notebook, which will include daily and weekly journal entries, notes, research information, design briefs and other information regarding the Engineering Design challenges throughout the course, sketches, brainstorming activities, etc.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE

How will students uncover content and build skills?.

- Students will research the developments of a certain technology and explain in essay form how this technology has developed over the years.
- Students will partake in teacher-lead demonstrations as well as instructional videos to learn new skills within the CAD software platform.
- Students will actively collaborate with classmates while working in the CAD lab environment.

- Students will complete applicable drawing exercises to reinforce newly introduced skills/methods..
- Students will apply CAD skills learned in this unit of study to complete D&T2 design projects.
- Students will be assisted by the instructor in a “one on one” fashion during class lab time.
- Throughout the design process students will use creative problem solving skills to develop solutions for design challenges.
- Students will become proficient at reading and interpreting Engineering drawings with industry-standard annotations.
- Students will learn to revise and edit technical drawings as a part of the design process.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF THE CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM’S LEVELS

Formative Assessments:

- Warm-Up Activities
- Daily activities will be based on either student exploration of the content area or a reflection of a prior lesson, to help reinforce concepts already taught
- Knowledge of CAD software platform
- Daily file management
- Basic technical drawing visualization
- Drawing format & setup
- Annotations and detailing
- Proficiency with fractional and decimal measurement

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Students with physical needs will be accommodated by use of custom and specialized computer hardware or workstations.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Summative Assessments:

- Daily Activity Log
- Drawing Assignments
- Design Projects
- Proper formatting and annotation

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Performance Assessments:

- Completion of assigned CAD drawing assignments

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Students with physical needs will be accommodated by use of custom and specialized computer hardware or workstations
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Black Horse Pike Regional School District Curriculum

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

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course: Design and Technology II **Unit Title:** Package Design **Grade Level(s):** 10-12	**Unit Summary:** ● Students will apply their knowledge of AutoCAD from the previous unit to create a package for a product to safely transport it without causing damage. On top of that, students must assess things like cost, size and shape, material, time, space, and other factors that manufacturers must consider when designing, producing and marketing a product for mass consumption.
Essential Questions: ● What is the difference between raster and vector graphics? ● What is the purpose of packaging? ● What are the three types of packaging? ● What is the significance of dielines in package design? ● What is the importance of creative problem solving? ● What trade-offs do companies have to consider when packaging a product?	**Enduring Understanding:** ● Raster graphics are made up of pixels and create the artwork on a package. Vector graphics are created using mathematical equations, which allows them to be scaled up or down without sacrificing quality. Vectors are used in AutoCAD as well as in dieline creation for package design. ● There are four main purposes of packaging: protection, convenience, image and sustainability. Each influence package design and the products they house. ● Primary packaging is the packaging that touches a product (bottle of Coca-Cola). Secondary packaging does not touch the product (6-pk. Holder for Coca-Cola). Tertiary packaging holds both primary and secondary together (the case that holds all the 6-pk.'s together). ● Dielines are the template for the packaging and determine which areas must be cut, scored, or folded so that the package can be assembled correctly to fit the product. ● Problems and unseen circumstances pop up all the time in the manufacturing industry. Creative problem solving skills can be learned and is the most sought after skill employers look for. This can save companies time and in manufacturing, time is money. ● The list can go on and on, but a company's goal is to make profit by keeping production costs low. For example, a company might use less material, thinner material, or cheaper material to package a product, but this comes at a cost as all of these options generally offer less protection.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.
After each target, identify the NJCCCS or Common Core Standards that are applicable.

Learning Target:	**NJCCCS or CCS:**
1. Define and then compare and contrast the difference between raster and vector graphics while providing examples of each type as they relate to package design.	**1. TECH.8.1.12.A.1 TECH.8.1.12.C.CS1**
2. Identify the four purposes of packaging and the impacts each have on any given product.	**2. TECH.8.2.12.B.1 TECH.8.2.12.D.4 ELL.9-12.L.A.3**
3. Differentiate between the three types of packaging (primary, secondary, and tertiary) and how each are influenced by the four purposes of packaging.	**3. TECH.8.2.12.A.3 ELL.9-12.S.B.3**
4. Explain what dielines are and apply this understanding to create dielines for a product.	**4. TECH.8.1.12.A.CS2**
5. Describe how important it is for manufacturing engineers and workers to be creative problem solvers.	**5. TECH.8.1.12.C.C S3 12.9.2.MN-PRO.1**
6. Identify various trade-offs companies have to consider when packaging a product, by addressing protection, convenience, image, sustainability, and cost.	**6. TECH.8.2.12.C.7 TECH.8.2.12.D.1**

Interdisciplinary Connections:

STEAM, English

Students will engage with the following text:

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Pearson Prentice Hall
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Periodicals may include, but are not limited to, newspapers, magazine articles and web pages.

Students will write:

Students will keep an Engineering notebook, which will include daily and weekly journal entries, notes, research information, design briefs and other information regarding the Engineering Design challenges throughout the course, sketches, brainstorming activities, etc. In this unit, students will take notes on the manufacturing and packaging processes and must read and interpret engineering drawings and dieline prints.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE
How will students uncover content and build skills?.

- Students will research raster and vector graphics and will create a simple box using

Illustrator that uses both kinds of graphics (raster for the art and vector for the dieline).

- Students will choose a package and identify the four purposes of that package in essay (or some other digital) form and share these findings with the rest of the class.
- Using the same product from above, students will identify the three types of packaging (primary, secondary and tertiary) and share these findings with the rest of the class.
- Students will disassemble, reverse engineer, and recreate a dieline for a package of their choice.
- Throughout the design and manufacturing process, students will work in pairs and use creative problem solving skills to develop a package for a fragile product.
- After building and testing the packaging, students will assess their package solution's effectiveness in essay form and consider various trade-offs made during the design process.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF THE CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM'S LEVELS

Formative Assessments:

- Warm-Up Activities
- Daily activities will be based on either student exploration of the content area or a reflection of a prior lesson, to help reinforce concepts already taught
- Checkpoints of understanding:
  - Basic hand tool safety
  - Raster vs. Vector graphics
  - Exporting dielines
  - Engineering Design Process
  - Measure and create a dieline from an existing package design

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Summative Assessments:

- Packaging Notes and Research
- Rough sketch package ideas
- Dieline iterations
- Group presentations on packaging and design considerations

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.
- Students may give the oral presentations one on one with the teacher.

Performance Assessments:

- Design a custom package to ship a fragile product (like a Pringle's chip) so that the product stays intact through the mail delivery system.

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Students with physical needs will be accommodated by use of custom and specialized jigs, guards and fixtures.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

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

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course: Design and Technology II **Unit Title:** Basic Electronics and Soldering **Grade Level(s):** 10-12	**Unit Summary:** ● Students will learn the fundamentals of electric circuits and how basic electronic components function. Students will complete a series of electronic circuit lab experiments while learning how to read and create schematic diagrams. Students will learn and practice proper soldering methods and utilize electronic diagnostic tools & equipment.
Essential Questions: ● How does electricity impact the way in which we live our lives? ● How do technological systems work together to accomplish goals and extend human capabilities? ● What precautions can be taken to ensure that electricity can be harnessed safely? ● What are the various career opportunities in the field of Electronics?	**Enduring Understanding:** ● Technological systems are designed to solve problems and extend human capabilities. Like any other energy source, electricity has both positive and negative effects on our society. ● Most mechanical systems in our modern day society rely upon the successful utilization of electrical circuits and systems to operate properly and consistently. ● While Electricity is a tremendous resource, it is also an extremely dangerous source of power that requires proper safety procedures, equipment and practices to harness it safely. ● There are many career opportunities in the field of Electronics, some of which include: Electrician, Electrical Engineer, Computer Repair or HVAC Technician.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable.

Learning Target:	NJCCCS or CCS:
1. Distinguish between a series and parallel circuit.	**1. TEC.9-12.8.1**
2. Calculate current, voltage, and resistance in a circuit.	**2. TEC.9-12.8.2**
3. Identify various electronic components based on their appearance and symbolic representation.	**3. TEC.9-12.8.2.12.E.1**
4. Discuss the advantages of using electromagnets in	**4. ELL.9-12.L.A.3**

mechanical systems. **5. Design, construct & troubleshoot electronic circuits for a specific goal/outcome.** **6. Safely use a soldering iron to solder components to a circuit board.**	**5. ELL.9-12.S.B.3** **6. SCI.9-12.5.7** **7. MA.9-12.4.2.12 D.2** **8. MA.9-12.4.5** **9. MA.9-12.4.5.12 B.2** **10. MA.9-12.4.5.12 E**

Interdisciplinary Connections:

STEAM, English

Students will engage with the following text:

Technology Education: Learning by Design
Pearson Prentice Hall
ISBN 0133639894

Periodicals may include, but are not limited to, newspapers, magazine articles and web pages.

Students will write:

Students will keep an Engineering notebook, which will include daily and weekly journal entries, notes, research information, design briefs and other information regarding the Engineering Design challenges throughout the course, sketches, brainstorming activities, etc.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE

How will students uncover content and build skills?.

- Students will learn the importance and significance of electricity in the modern world by analyzing the frequency in which the average person uses electricity and products made with electricity.
- Students will learn about series and parallel circuits, voltage, amperage, resistance, and ohm's law in electric circuits through interactive slide presentations.
- Students will build series and parallel circuits on a breadboard.
- Students will apply their knowledge of electromagnets and DC circuitry by building an electric motor.
- Students will troubleshoot their circuit experiments and fix any problems in the circuitry.

- Students will write a reflection essay explaining how electricity is created, converted, transmitted, controlled and used in the modern world citing examples and analysis of their electric motor.

- Students will learn about electronic circuitry and components through presentations and examples.

- Students will learn to identify different electronics components physically and by their schematic diagram symbol.

- Students will learn safe soldering techniques through demonstration, and practice soldering on electronics toy soldering kits.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF THE CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM'S LEVELS

Formative Assessments:

- Warm-Up Activities
- Daily activities will be based on either student exploration of the content area or a reflection of a prior lesson, to help reinforce concepts already taught
- Knowledge of circuit components, tools and diagnostic equipment
- Checkpoints of understanding:
    - Group collaboration
    - Active troubleshooting methods
    - Lab exercise progress
    - Engineering Design Process

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Summative Assessments:

- Daily Activity Log
- Unit assignments, worksheets and/or study questions
- Schematic Scavenger Hunt

- Schematic Symbol Chart
- Circuit Simulation problems
- Safety Quiz

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Performance Assessments:

- Breadboarding circuit experiments
- Final Soldering project

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Students with physical needs will be accommodated by use of custom and specialized tools, equipment and/or workspace.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Black Horse Pike Regional School District Curriculum

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

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course: Design and Technology II **Unit Title:** Engineering Design Process and BHPRSD Tech Challenge **Grade Level(s):** 10-12	**Unit Summary:** ● Students will work in teams and implement the design process to solve an open-ended design challenge. During this process, they will learn to safely use tools and machines to extend human capabilities for the purpose of solving a problem. Design & Technology students from Triton, Highland and Timber Creek will compete in a district-wide competition with a goal of finding the most successful solution to the problem presented.
Essential Questions: ● How can technological problems be solved in an organized and systematic fashion? ● How is technology used to extend human capabilities? ● Why are proper safety precautions necessary in the workplace? ● What are the benefits and concerns involved with working on a team?	**Enduring Understanding:** ● The major emphasis of this unit is centered on applying the design process to solve a design challenge. This process will be implemented to help students systematically solve challenges throughout all Design and Technology courses. Students will gain understanding as to why the design process is meant to be cyclical in nature. They will learn to solve open ended problems by designing, building and testing their own solutions and projects. The Tech Challenge unit will help increase student confidence in using tools and machines to process multiple types of materials while working cooperatively with team members in a friendly competition environment.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable.

Learning Target:	NJCCCS or CCS:
1. **Explain and apply the technological design process to a real design challenge** 2. **Design and create a working set of technical drawings** 3. **Safely and responsibly operate tools and machines to process a variety of different materials** 4. **Write a creative fictional story that applies to the designated challenge**	1. **TEC.9-12.8.1** 2. **TEC.9-12.8.2.12 B.3** 3. **TEC.9-12.8.2.12.E.1** 4. **TEC.9-12.8.1.12 B.9** 5. **ELL.9-12.S.B.3** 6. **ELL.9-12.R.E.6**

5. **Solve project - related geometric, algebraic, and statistical math problems** 6. **Display professionalism, sportsmanship and team-based accountability throughout a competition** 7. **Constructively reflect upon the technological design process, challenge and teamwork**	7. **MA.9-12.4.2.12 D.2** 8. **MA.9-12.4.5** 9. **MA.9-12.4.5.12 E**

Interdisciplinary Connections:

STEAM, English

Students will engage with the following text:

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Pearson Prentice Hall
ISBN 0133639894

Periodicals may include, but are not limited to, newspapers, magazine articles and web pages.

Students will write:

Students will keep an Engineering notebook, which will include daily and weekly journal entries, notes, research information, design briefs and other information regarding the Engineering Design challenges throughout the course, sketches, brainstorming activities, etc.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE

How will students uncover content and build skills?.

- Students will read and follow a Technological Design Challenge design packet. This documentation will include all of the information related to the challenge including the rules, constraints, materials, design journal components, timeline, and project rubric.

- Students will maintain a digital journal as they document the process in which they solve the problem presented by the challenge. Students will write a design brief statement showing
- comprehension and understanding of the challenge and project at hand.

- Students will design and sketch a team logo and cover page.

- Students will write a creative fictional story related to the design challenge.

- Students will brainstorm and sketch multiple solutions to the challenge using only the approved and allotted materials.
- Students will list positive and negative aspects of each design and choose the best solution to create a detailed rough sketch.

- Students will develop their best solution into a working mechanical drawing with an included bill of materials.
- Students will complete a challenge related engineering math worksheet.
- Students will maintain a daily activity log detailing their accomplishments during class time.
- Students will safely utilize classroom tools and equipment to construct their designs and test them when their prototypes are completed.
- Students will write a reflection essay that focuses on the evaluation of their design and performance of their team overall.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF THE CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM'S LEVELS

Formative Assessments:

- Students will read and understand the timeline, direction and constraints of the project as per the information provided in the design brief.
- Students will display proper safety procedures and practices during the construction phase of the project.
- Student teams will store their materials in an organized manner.
- Students will collaborate with their teammates in a positive, productive and respectful manner.

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Summative Assessments:

- Daily Activity Log
- Team Logo Design
- Journal Cover Design
- Problem Statement
- Fictional Story
- Research Topics
- Thumbnail Sketches
- Detailed Sketches
- Working Technical Drawing
- Materials/Parts List
- Reflection Essay

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Performance Assessments:

- Final Tech Challenge device

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Students with physical needs will be accommodated by use of custom and specialized tools, equipment and/or workspace.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Black Horse Pike Regional School District Curriculum

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

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course: Design and Technology II **Unit Title:** Reverse Engineer and 3D Model using Onshape **Grade Level(s):** 10-12	**Unit Summary:** ● Students will reverse engineer their design solution to the Tech Challenge using Onshape. Students will continue to build their skills in Onshape and grow more accustomed to Onshape's workflow. Students will learn new tools and commands to create an assembly of their design solution.
Essential Questions: ● What is reverse engineering? ● How do engineers use geometry to calculate and dimension objects? ● How do advanced 3D modeling tools work in Onshape? ● How are assembly drawings created?	**Enduring Understanding:** ● Demonstrate the ability to reverse engineer an object using working and assembly drawings. ● Interpret the dimensions of an orthographic projection and apply problem solving skills to determine the missing dimensions. ● Explain and determine when to use the different advanced modeling techniques such as sweep, extrude, revolve and loft, as well as modify tools like fillets, shells, etc. ● Create an assembly drawing of the student's Tech Challenge design solution using Onshape.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable.

Learning Target:	NJCCCS or CCS:
1. **Use math to determine lengths and angles of an object.**	1. **TEC.9-12.8.2.12 B.6 MA.9-12.4.2.12 A.2 MA.9-12.4.2.12 A.1**
2. **Create work planes where sketches can be drawn on to increase the complexity of a part.**	2. **TEC.9-12.8.1.12.B.1 TEC.9-12.8.2.12.F.3**
3. **Construct parts using parametric constraints including, parallel, horizontal, perpendicular, vertical, tangent, coincident, and equal constraints and troubleshoot over-constrained sketches.**	3. **TEC.9-12.8.1.12.B.10 TEC.9-12.8.1.12.B.11**
4. **Apply advanced 3D modeling and finishing modified tools by creating fillets, shelling, splitting, and or joining an object.**	4. **TEC.9-12.8.2.12 B.3 TEC.9-12.8.2.12.F.3**

	MA.9-12.4.2.12 A.1
5. Create working and assembly drawings that describe all parts of an object.	**5. TECH.8.1.12.A.2**
6. Demonstrate a working ability to use constraints to position parts within an assembly drawing.	**6. TECH.8.1.12.F.CS4 12.9.3.ST-SM.2**

Interdisciplinary Connections:

STEAM, English

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Students will write:

Students will keep an Engineering notebook, which will include daily and weekly journal entries, notes, research information, design briefs and other information regarding the Engineering Design challenges throughout the course, sketches, brainstorming activities, etc.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE

How will students uncover content and build skills?.

- Students will use the revolve tool to create round objects.
- Students will use the sweep tool to create a profile that will be extruded and a path that will follow to create parts.
- Students will use the loft tool to create complex parts that include tapers.
- Students will use modifying tools like fillet, chamfer, shell, split and join to refine their part designs and achieve greater accuracy as they reverse engineer their designs.
- Students will use their Tech Challenge design solution and take measurements to create a solid model of each part.
- Students will assemble all the parts drawn to make an assembly using Onshape.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF THE CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM'S LEVELS

Formative Assessments:

- Observation of student progress and skill development, checkpoints of understanding at:
  - Logging in and getting set up with layers and workspace settings
  - Sketching of parts
  - Revolving
  - Sweeping
  - Lofting
  - Assemblies
    - Mates
    - Revolutions
    - Exploded Views
- Do-now's and checkpoint quizzes will be given during and at the conclusion of these topics

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.
- Video tutorials for each new tool
- Printed instructions and tutorials, as needed

Summative Assessments:

- Completed drawing files for each part
- Design journal
- Test after each mini-unit listed in Part III

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Performance Assessments:

- Create the Tech Challenge design solution using Onshape. Each part must be drawn and a full assembly of the entire design solution must be present with effective documentation for each part and the assembly as a whole.

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.
- Video tutorials for each new tool
- Printed instructions and tutorials, as needed
- Work in Tech Challenge groups (small groups)
- Modified rubrics

Black Horse Pike Regional School District Curriculum

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

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course: Design and Technology II **Unit Title:** CO2 Dragster Design **Grade Level(s):** 10-12	**Unit Summary:** ● Students will utilize the technological design process as it pertains to the field of Transportation Technology to design, construct and test a CO2 powered vehicle that will reach the end of a test track in the least amount of time.
Essential Questions: ● How is the design process used to solve a problem? ● How is technology used to extend human capabilities? ● Why are proper safety precautions necessary in the workplace? ● What factors affect the speed and efficiency of a land powered vehicle? ● How can design elements be prioritized to achieve the best results?	**Enduring Understanding:** ● The design process is a systematic approach to solving a technological design challenge. It is an ongoing process that requires the designer to repeatedly test and refine the devised solution to the problem to achieve the best results. ● A designer or engineer must be able to utilize modern tools, equipment and computer software to create a prototype design. ● Following proper safety protocol in the field of manufacturing not only ensures personal safety, but the safety of others sharing the same workplace. ● Physics and aerodynamics play important roles in the design process when the problem to be solved is associated with transportation technology. ● A designer must carefully weigh the positives and negatives of design attributes to determine the best possible outcome.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable.

Learning Target:	NJCCCS or CCS:
1. **Explain and apply the technological design process to a real design challenge** 2. **Use CAD applications to create a working set of technical drawings for a design** 3. **Safely and responsibly operate tools and machines to**	1. **TEC.9-12.8.1** 2. **TEC.9-12.8.2.12 B.3** 3. **TEC.9-12.8.2.12. E.1**

process project materials. **4. Apply physical science concepts to the design elements of a prototype.** **5. Utilize 3D modeling applications and techniques during the design process.** **6. Display professionalism, sportsmanship and courtesy throughout a competition** **7. Constructively reflect upon the results of testing a prototype design**	**4. TEC.9-12.8.1.12 B.9** **5. ELL.9-12.S.B.3** **6. ELL.9-12.R.E.6** **7. MA.9-12.4.2.12 D.2** **8. MA.9-12.4.5** **9. MA.9-12.4.5.12 E**

Interdisciplinary Connections:

STEAM, English

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Students will write:

Students will keep an Engineering notebook, which will include daily and weekly journal entries, notes, research information, design briefs and other information regarding the Engineering Design challenges throughout the course, sketches, brainstorming activities, etc.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE

How will students uncover content and build skills?.

- Students will complete a series of activities/assignments in an interactive Google Slide presentation
- Students will define relevant project-related terminology
- Students will sketch ideas for a design and choose the best solution
- Students will watch project-related videos and list key takeaways
- Students will research different vehicle designs and create a list of positive and negative design elements to consider for their own design

- Students will use Onshape to create a solid model assembly of their vehicle prototype
- Students will utilize class tools and equipment to build a physical prototype of their design and test it

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF THE CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM'S LEVELS

Formative Assessments:

- Students will read and understand the timeline, direction and constraints of the project as per the information provided in the design brief.
- Students will display proper safety procedures and practices during the construction phase of the project.
- Students will demonstrate the basic skills necessary to implement CAD/Solid modeling software in the project's design process.
- Students will store their materials in an organized manner.
- Students will collaborate with their classmates in a positive, productive and respectful manner.

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.
- Video tutorials for each new tool
- Printed instructions and tutorials, as needed

Summative Assessments:

- Daily Activity Log
- Daily Participation Points
- Assignments/tasks contained within the project design journal
- Sketches, Final drawings and/or solid model assemblies
- Project reflection essay/evaluation

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Students with physical needs will be accommodated by use of custom and specialized tools, equipment and/or workspace.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Performance Assessments:

- Final dragster prototype

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Students with physical needs will be accommodated by use of custom and specialized tools, equipment and/or workspace.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.
- Modified Rubrics

Black Horse Pike Regional School District Curriculum

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

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course: Design and Technology II **Unit Title:** Simple Machines **Grade Level(s):** 10-12	**Unit Summary:** • The simple machines unit is designed to facilitate critical thinking and problem solving associated with the six core simple machines. Students will learn to identify, utilize, calculate mechanical advantage, and analyze efficiency of simple machine systems. Students will apply their knowledge of simple machines to a group design project.
Essential Questions: • How is the design process used to solve a problem? • How is technology used to extend human capabilities? • Why are proper safety precautions necessary in the workplace? • How are simple machines used in everyday life to increase human efficiency?	**Enduring Understanding:** • The design process is a systematic approach to solving a technological design challenge. It is an ongoing process that requires the designer to repeatedly test and refine the devised solution to the problem to achieve the best results. • Following proper safety protocol in the field of manufacturing not only ensures personal safety, but the safety of others sharing the same workplace. • Simple machines have been used for thousands of years and are still an active part of today's highly technological society. In their simplest form they are present in the most advanced mechanical devices. • Engineers and designers must utilize available resources to solve a problem in a given situation

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable.

Learning Target:	NJCCCS or CCS:
1. **Identify the six simple machines and point out examples found in everyday life.** 2. **Calculate and discuss mechanical advantages of using the different types of simple machines.** 3. **Apply knowledge of simple machines and use them to generate mechanical advantage.** 4. **Design and construct a mechanism using simple machines that successfully accomplishes a task.**	1. **TEC.9-12.8.1** 2. **TEC.9-12.8.2.12 B.3** 3. **TEC.9-12.8.2.12.E.1** 4. **ELL.9-12.L.A.3** 5. **ELL.9-12.S.B.3** 6. **ELL.9-12.R.E.6**

5. **Understand and apply the technological design process to a real design challenge.** 6. **Safely and responsibly operate tools and machines to process project materials.** 7. **Apply physical science concepts to the design elements of a prototype.** 8. **Learn to work productively and cooperatively with a team.** 9. **Constructively reflect upon the results of testing a prototype design**	7. **TEC.9-12.8.2.12 B.6** 8. **MA.9-12.4.5** 9. **MA.9-12.4.5.12 B.2** 10. **MA.9-12.4.5.12 E**

Interdisciplinary Connections:

STEAM, English

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PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE

How will students uncover content and build skills?.

- Students will complete a series of activities/assignments in an interactive Google Slide presentation
- Students will create a biographical slide presentation on the life of designer Rube Goldberg
- Students will define relevant project-related terminology
- Students will sketch ideas for a design with their team and choose the best solution
- Students will watch project-related videos and list key takeaways
- Students will research different simple machine contraptions from various online resources

- Students will create a Rube Goldberg - style cartoon drawing that describes the simple machine device their group will build and test.

- Students will utilize class tools and equipment to build a physical prototype of their design and test it

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF THE CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM'S LEVELS

Formative Assessments:

- Students will read and understand the timeline, direction and constraints of the project as per the information provided in the design brief.

- Students will actively engage in the design & construction process by brainstorming ideas with their teammates.

- Students will display proper safety procedures and practices during the construction phase of the project.

- Students will actively partake in supplying materials and gadgets for their team's device and store them in an organized manner.

- Students will collaborate with their classmates in a positive, productive and respectful manner.

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.
- Assistance provided for students who are not able to contribute materials to the group's project.
- Printed instructions and tutorials, as needed

Summative Assessments:

- Daily Activity Log
- Daily Participation Points
- “Who the Heck is Rube Goldberg?” biographical slide presentation
- Assignments/tasks contained within the project design journal
- Preliminary sketches of device ideas and construction
- Project reflection essay/evaluation

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Students with physical needs will be accommodated by use of custom and specialized tools, equipment and/or workspace.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Performance Assessments:

- Final simple machines contraption/prototype

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Students with physical needs will be accommodated by use of custom and specialized tools, equipment and/or workspace.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.
- Modified Rubrics

Black Horse Pike Regional School District Curriculum

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

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

<table>
<tr>
<td>Course:
Design and Technology II

Unit Title:
Mousetrap Vehicle Design

Grade Level(s):
10-12</td>
<td>Unit Summary:
● Students will design a mousetrap vehicle using limited materials and must adhere to strict constraints and criteria for this design challenge. Constraints include students having a virtual budget that they use to buy approved parts for their vehicle, the vehicle having specified maximum dimensions and weight, and a travel distance requirement. Students will have to consider trade offs, design a solution, test their design, make changes in their design, and then make a final decision about their solution based on data and performance. Students will first race their mousetrap powered vehicles to see whose is fastest, but then redesign them to see whose vehicle can last the longest.</td>
</tr>
<tr>
<td>Essential Questions:
● What is kinetic and potential energy?

● What relationships exist among force, mass, torque, speed, and acceleration?

● What are some forces that work against motion?

● When designing for distance, what are some important factors to consider?

● When designing for speed, what are some important factors to consider?

● The design process is iterative. What does this mean?</td>
<td>Enduring Understanding:
● Potential energy is the available, stored energy, like a ball at the top of a hill. Kinetic energy is the energy in motion, when the ball is rolling down the hill.

● Force, mass, speed and acceleration all impact the vehicle in different ways. Engineers take these forces into account when designing moving objects such as car tires, roller coasters, and rockets.

● Many factors influence an object’s motion, but friction and loss of torque will work against motion and slow down moving objects, like a mousetrap vehicle.

● When designing for distance, some factors include: reduced friction bearings, longer length lever arm, large diameter drive wheels, small diameter axles, slow moving vehicles, and light-weight components.

● When designing for speed, some factors include: high torque gearing, shorter length lever arm, smaller diameter drive wheels, wheels with good traction, reduced friction bearings, and light-weight components.

● In Engineering, we use the Engineering Design Process, which is an ongoing process that requires students to constantly reevaluate and redesign.</td>
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PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable.

Learning Target:	**NJCCCS or CCS:**
1. Differentiate between potential and kinetic energy and explain how each influence and affect a mousetrap vehicle.	**1. SCI.MS-PS3-1 SCI.MS-PS3-2**
2. Define the following physics terms and explain how they affect a mousetrap vehicle: force, friction, torque, speed, acceleration and power.	**2. TECH.8.1.12.A.CS1**
3. Compare and contrast how a mousetrap vehicle designed for speed is both similar and different than a mousetrap vehicle designed for distance.	**3. TECH.8.2.12.C.6 SCI.HS-PS3-3 9-12.HS-ETS1-2.6.1**
4. Document and describe the progression through the Engineering Design Process, from brainstorming to sketching, through prototyping and redesign/self-assessment.	**4. TECH.8.1.12.B.CS1 TECH.8.2.12.C.CS2 TECH.8.2.12.D.1**

Interdisciplinary Connections:

STEAM, English

Students will engage with the following text:

Technology Education: Learning by Design
Pearson Prentice Hall
ISBN 0133639894

Periodicals may include, but are not limited to, newspapers, magazine articles and web pages.

Students will write:

Students will keep an Engineering notebook, which will include daily and weekly journal entries, notes, research information, design briefs and other information regarding the Engineering Design challenges throughout the course, sketches, brainstorming activities, etc.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE

How will students uncover content and build skills?.

- Students will complete lab experiments using a ball or a Hot Wheels car and inclined plane to model the difference between kinetic and potential energy.
- Students will complete readings and additional research activities online to investigate how the following physics terms affect a mousetrap vehicle: force, friction, torque, speed, acceleration and power.

- Students will watch a video on mousetrap vehicles and then write, in essay form, describing how the mousetrap powers the vehicle and include terms such as: wheel, axle, lever arm, bearing, mousetrap, etc. Students will label a 3D model and submit this with their essay.

- Students will research, design, build and test a mousetrap vehicle for maximum speed and compete against others in the class.

- After students compete for speed, they will change their designs and focus not on speed, but distance, and compete against others in the class.

- After testing, students will reflect on the design process, how vehicles designed for speed are both similar and different than those designed for distance, and how the forces affect each.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF THE CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM'S LEVELS

Formative Assessments:

- Warm-Up Activities
- Daily activities will be based on either student exploration of the content area or a reflection of a prior lesson, to help reinforce concepts already taught
- Checkpoints of understanding:
  - Kinetic vs. potential energy
  - Newton's Laws on Mousetrap vehicles
  - Speed vs. Acceleration
  - Power, inertia, and torque
  - Designing for speed
  - Designing for power

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Summative Assessments:

- Physics Notes and Research
- Rough sketch vehicle designs

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.
- Students may work in partners for these assignments.

Performance Assessments:

- With limited materials, students will design a mousetrap vehicle for speed, while adhering to strict design criteria and constraints.
- After brainstorming, designing, building and testing for speed, students will redesign the same vehicle this time for distance, not speed.

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Students with physical needs will be accommodated by use of custom and specialized jigs, guards and fixtures.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Black Horse Pike Regional School District Curriculum

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

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course: Design and Technology II **Unit Title:** Solid Fuel Rockets **Grade Level(s):** 10-12	**Unit Summary:** ● Students will use the Engineering design process to research, design and solid model an aerodynamically sound rocket using Onshape. Students will use these plans to construct a solid fuel rocket and all its components to achieve a successful launch, flight and safe landing, based on their understanding of flight related concepts and aeronautics.
Essential Questions: ● How can we strategically solve problems? ● Why is safety important and what precautions can we take to ensure safety? ● How are rockets propelled into space? ● What physical forces act upon an object in flight?	**Enduring Understanding:** ● Engineers follow the Engineering design process with each and every design challenge to ensure that the best design solution is pursued and that it adheres to all the design criteria on the design brief. ● Tools and machines must be used safely so that no one gets injured, but also, these solid fuel rockets can be very dangerous, if used improperly. ● Rockets and engines behave according to Newton's third law. When a rocket shoots fuel out one end, it propels the rocket in the opposite direction. ● Lift, thrust, drag and weight affect all objects in flight differently and engineers must design machines capable of flight to withstand and work with these forces.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

After each target, identify the NJCCCS or Common Core Standards that are applicable.

Learning Target:	NJCCCS or CCS:
1. **Apply the Engineering design process to solve problems and design challenges.**	1. **TEC.9-12.8.1**
2. **Understand and identify the different parts of an aircraft and their function.**	2. **TEC.9-12.8.2.12 B.4**
3. **Integrate basic aerodynamics pertaining to aeronautical engineering.**	3. **TEC.9-12.8.2.12.E.1**
4. **Understand math concepts that pertain to rocket flight.**	4. **MA.9-12.4.2.12 D.2** **MA.9-12.4.5**

5. Design a solid model rocket using Onshape.	**5. TECH.8.2.12.C.5**
6. Construct a model rocket by safely using tools and machines.	**6. TECH.8.2.12.C.7**
7. Launch a rocket following a strict rocket launching safety protocol.	**7. ELL. 9-12.L.A.3 ELL.9-12.R.E.6**
8. Calculate the altitude of the rocket in flight.	**8. MA.9-12.4.5.12 B.2 MA.9-12.4.5.12 E**

Interdisciplinary Connections:

STEAM, English.

Students will engage with the following text:

Technology Education: Learning by Design
Pearson Prentice Hall
ISBN 0133639894

Periodicals may include, but are not limited to, newspapers, magazine articles and web pages.

Students will write:

Students will keep an Engineering notebook, which will include daily and weekly journal entries, notes, research information, design briefs and other information regarding the Engineering Design challenges throughout the course, sketches, brainstorming activities, etc.. In this unit, students will take notes on aeronautical engineering and must read, interpret, and sign off on the solid fuel rocket safety protocol guidelines.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE

How will students uncover content and build skills?.

- Students will learn the basic aeronautical engineering principles through presentations, videos and demonstrations. Students will take notes during these presentations. Labs and mini lessons will help reinforce this content.
- Students will complete guided research on the different components of a model rocket.
- Students will document their progress through this design challenge in their design journals, documenting research, brainstorming, design sketches, and mechanical drawings, which will be designed and documented using Onshape.
- Students will safely construct their rockets using tools, machines, and efficient building techniques and procedures.
- Students will research rocket launch protocol and develop a list of safety precautions and

steps needed to successfully and safely launch a solid fuel rocket.

- Students will launch their rockets and use trigonometry to calculate the altitude of the rocket.
- After the launch, students will reflect on their understanding of aeronautical concepts taught during the unit, aeronautic engineering as a career, and how the Engineering design process can be used to design, build and safely launch a rocket.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF THE CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM'S LEVELS

Formative Assessments:

- Warm-Up Activities
- Daily activities will be based on either student exploration of the content area or a reflection of a prior lesson, to help reinforce concepts already taught
- Checkpoints of understanding:
- Notes on presentations
- Research on rocket components
- Solid modeling parts completion checkpoints (Onshape)

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Students with physical needs will be accommodated by use of custom and specialized jigs, guards and fixtures.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.

Summative Assessments:

- Aeronautical engineering test
- Aeronautical engineering reflection paper

Accommodations and Modifications:

- Students may be given extra time to complete the assessments.
- Students may need extra guidance from the teacher or an aide.
- Students may need modified tests, quizzes and other summative writing prompts.

Performance Assessments:

- Solid model a rocket on Onshape
- Construct a solid fuel model rocket based on the plans designed in Onshape

Accommodations and Modifications:

- Students will be accommodated on a case by case basis.
- Students with physical needs will be accommodated by use of custom and specialized jigs, guards and fixtures.
- Alternative assignments, additional time for assignments, preferential seating arrangements, one on one interaction, after school help, and assistance for organization may be required.
- Video tutorials and printed notes for Onshape 3D modeling.
- Check frequently for student understanding.
- Allow students to get their work checked frequently.
- Extra help is available for students who need more time or more clarification.