Grade, Subject/Course: Manufacturing Technology (10-12)	
Unit: Introduction To Manufacturing	**__X__ Essential _____ Important _____ Compact**
Big Idea: Manufacturing involves converting raw materials into finished products using tools, machines, processes, and systems.	
STEELS/Tech and Engineering Strand:	**Pacing:** 1 week
Essential Questions: UEQ: How does manufacturing convert raw materials into finished products? LEQ: What is manufacturing? LEQ: What are the various types of manufacturing systems? LEQ: How does the manufacturing process transform raw materials into finished products? LEQ: How has lean manufacturing changed the future of the manufacturing process?	**Understandings:** Students will know that… ● A manufacturing system is a collection of machines, tools, and processes used to produce goods or services. ● Manufacturing transforms raw materials into finished products through a variety of processes. ● Lean manufacturing focuses on minimizing waste within manufacturing systems while simultaneously maximizing productivity.
Knowledge: History of Manufacturing Manufacturing Systems Materials & Processes Lean Manufacturing	**Do/Skills:** Students will be able to… ● Disassemble and identify the parts and materials needed in the manufacturing process of a finished product. ● Analyze and compare how products are produced by select manufacturing systems. ● Assemble a product using a manufacturing system.
Vocabulary: Raw Materials, Standard Stock (Industrial Materials). Products, Primary Processing, Secondary Processing, Casting, Molding, Separating, Conditioning, Forming, Assembling, Finishing, Research & Development, Mass Production, Just-In-Time Manufacturing, Kaizen, Industry 4.0, G-Code, Augmented Reality	**Core Resources:** Schoology LMS What's Up In Factories | PBS Learning Media Creators Wanted

Common Assessment(s):	**Supplemental Resources:**
1. Classroom Activities	Manufacturing: Your Future? Skilled Trades: Manufacturing Careers How Are Pens Made? How To Make Shoes | Custom Sneakers From The Sole Up How To Be A Sneaker Designer For Nike and Jordan Brand | Jobs Unlisted Toyota Production & Manufacturing Explained Lean Manufacturing @ Atlas Copco

Grade, Subject/Course: Manufacturing Technology (10-12)	
Unit: The Manufacturing System	**__X__ Essential _____ Important _____ Compact**
Big Idea: The manufacturing system involves identifying inputs, processes, and outputs within a manufacturing company.	
STEELS/Tech and Engineering Strand: 3.5.9-12.A Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems. 3.5.9-12.B Critically assess and evaluate a technology that minimizes resource use and resulting waste to achieve a goal.	**Pacing:** 2 weeks
Essential Questions: UEQ: How are inputs, processes, and outputs within a manufacturing system identified to produce a final product? LEQ: What are the different management departments and jobs in a manufacturing company? LEQ: What are the components of a project plan? LEQ: What is included on a bill of materials and how is product cost calculated?	**Understandings:** Students will know that… ● The management structure of a corporate organization chart is divided into particular managerial departments. ● A job application contains one's education or training, work/job history, and personal information. ● Detailed plans are needed to produce parts that outline the steps to construct and assemble a product.
Knowledge: Manufacturing Management Organizational Structure Job Application and Skills Examination Product Research & Development	**Do/Skills:** Students will be able to… ● Complete a job application and demonstrate their ability to do common calculations and read drawings commonly used in the production area of a manufacturing company. ● Apply research skills in searching for a particular job position in the company. ● Apply effective speaking skills used in presenting information about a particular job position. ● Determine and calculate a bill of materials and cost of a selected manufacturing product.
Vocabulary: Production, Finance, Marketing, Research & Development, Human Resources, Job Application, Skills Examination, Bill of Materials, Board Feet	**Core Resources:** Schoology LMS

Common Assessment(s):	**Supplemental Resources:**
1. Manufacturing Management Position Presentation 2. Manufacturing Product Bill of Materials and Cost	Corp 101: The Basics of Corporate Structure How To Fill Out A Job Application How To Prepare For An Interview

Grade, Subject/Course: Manufacturing Technology (10-12)	
Unit: Safety	**__X__ Essential _____ Important _____ Compact**
Big Idea: Safety is an inherent part of the manufacturing process.	
STEELS/Tech and Engineering Strand: 3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process. 3.5.9-12.L Interpret laws, regulations, policies, and other factors that impact the development and use of technology.	**Pacing:** 1 week
Essential Questions: UEQ: Why is safety an attitude not a set of rules? LEQ: What PPE is needed to safely operate tools and machines in manufacturing products? LEQ: Why is safety so important in the production lab? LEQ: What are the machine safety rules and operations used in manufacturing processes? LEQ: Why is it important to understand force when operating hand or power tools? LEQ: Why are cleanliness and organization important in the production lab?	**Understandings:** Students will know that… ● General safety rules for the lab need to be followed based on the PDE safety guide. ● Each machine has specific safety rules and operational processes. ● Rules about the production environment are regulated by the Occupational Safety & Health Association (OSHA). ● Safety Data Sheets (SDS) contain information about hazardous chemicals in the workplace. ● There are codes for fire prevention and safety. ● Lock Out Tag Out procedures are in place to prevent accidents when using machines. ● General lab maintenance and clean-up procedures are necessary to maintain a safe work environment.
Knowledge: General Lab Safety Personal Protective Equipment (PPE) Machine Specific Safety Lab Maintenance	**Do/Skills:** Students will be able to… ● Appropriately use personal protective equipment in the production lab. ● Safely operate all power tools and equipment with 100% accuracy. ● Correctly use SDS sheets to gather information on chemicals and products used in the production lab. ● Recognize possible fire situations, correctly select the appropriate fire extinguisher, and use it efficiently to extinguish a fire. ● Properly maintain established clear standards for student work areas.
Vocabulary: OSHA, SDS, LOTO, Danger Zone, Exposure, Personal Protective Equipment	**Core Resources:** Schoology LMS

Common Assessment(s):	**Supplemental Resources:**
1. Machine Safety Presentation 2. General Safety Quiz	PDE Safety Guide ITEEA Safety Resources

Grade, Subject/Course: Manufacturing Technology (10-12)	
Unit: Materials & Processes: Wood	**__X__ Essential _____ Important _____ Compact**
Big Idea: Wood is a material used to create products for various applications using wood manufacturing processes.	
STEELS/Tech and Engineering Strand: 3.5.9-12.M Develop a device or system for the marketplace. 3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems. 3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality. 3.5.9-12.P Apply a broad range of design skills to a design thinking process. 3.5.9-12.V Apply principles of human-centered design. 3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process. 3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work. 3.5.9-12.QQ Implement quality control as a planned process to ensure that a product, service, or system meets established criteria.	**Pacing:** 5 weeks
Essential Questions: UEQ: How are wood products developed and created using wood manufacturing tools, machines, processes, and systems for various applications? LEQ: How are detailed drawings utilized to construct and assemble a product? LEQ: How are operations selected and sequenced to increase the efficiency of the manufacturing system? LEQ: What is the purpose and function of a prototype? LEQ: What are the major engineering tasks in organizing a manufacturing system? LEQ: What essentials must be considered when planning a plant layout? LEQ: What are the factors to consider when designing tooling? LEQ: What tasks are involved in setting up a manufacturing system?	**Understandings:** Students will know that… ● Detailed plans are needed to produce parts that outline the steps to construct and assemble a product. ● Selecting and sequencing operations should be arranged to increase the efficiency of the manufacturing system. ● Creating a prototype enables one to test and refine the functionality of the product design. ● Plant layout involves placing machines or processes to fit specific manufacturing product needs. ● Tool design involves designing and developing the tools, methods, and techniques necessary to improve manufacturing efficiency and productivity. ● Production is a controlled activity that uses people and machines to convert resources into products. ● Quality control is to show that products meet stated standards with the fewest rejects as possible.

LEQ: How are products manufactured, assembled, and finished during the operation of a manufacturing system? LEQ: How can the quality of products be controlled in a manufacturing system? LEQ: What are the functions of good packaging design?	● Packaging design creates a package for product protection, visual appearance, and functionality.
Knowledge: Selecting and Sequencing Operations Constructing A Prototype Factory Layout and Planning Tool Design Woodworking Materials and Processes Manufacturing Production Package Design	**Do/Skills:** Students will be able to… ● Analyze product designs and drawings. ● Select and sequence wood manufacturing operations. ● Engineer manufacturing facilities by process or product plant layout. ● Design, fabricate, and test wood manufacturing tooling. ● Develop production and quality control systems. ● Design and fabricate a package to protect a product.
Vocabulary: Squaring A Board, Flow Process Chart, Operations, Inspections, Transportations, Delays, Storages, Prototype, Process Layout, Product Layout, Tooling, Pattern, Template, Fixture, Jig, Chip Relief, Clamping, Production, CNC Manufacturing, Surface Area, Volume, Girth, Scoring	**Core Resources:** Schoology LMS Autodesk AutoCAD MultiCam CNC Router
Common Assessment(s): 1. Selecting and Sequencing Operations 2. Constructing A Prototype 3. Factory Layout and Planning 4. Tool Design 5. Tooling Project 6. Manufacturing Product Project 7. Package Design Project	**Supplemental Resources:** Basic Woodworking Machinery | Woodworking Plant Layout, Objectives of Plant Layout, Types of Plant Layout How To Finish Your Wood - WOOD magazine

Grade, Subject/Course: Manufacturing Technology (10-12)	
Unit: Materials & Processes: Sheet Metal	**__X__ Essential _____ Important _____ Compact**
Big Idea: Sheet metal is a material used to develop and create products for various applications using metal manufacturing processes.	
STEELS/Tech and Engineering Strand: 3.5.9-12.M Develop a device or system for the marketplace. 3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems. 3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality. 3.5.9-12.P Apply a broad range of design skills to a design thinking process. 3.5.9-12.V Apply principles of human-centered design. 3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process. 3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work. 3.5.9-12.QQ Implement quality control as a planned process to ensure that a product, service, or system meets established criteria.	**Pacing:** 4 weeks
Essential Questions: UEQ: How are sheet metal products developed and created using metal manufacturing tools, machines, processes, and systems for a variety of applications? LEQ: What are the different pattern developments and how are they used to make different shapes? LEQ: What are the different sheet metal hand tools and machines used to transfer patterns, make layouts, and cut metal and how do you use them properly? LEQ: What is the proper sequencing of steps (folds) used to create a 3-dimensional sheet metal product? LEQ: What is the proper method and technique for joining sheet metal using resistance spot welding? LEQ: What is a blind (pop) rivet and how are they used to join two or more pieces of metal together?	**Understandings:** Students will know that… ● Patterns or stretchouts are developed using parallel line, radial, or triangulation layout development. ● Sheet metal hand tools and machines are used to transfer patterns, make layouts, and cut metal. ● Bending or folding of sheet metal involves the proper sequencing of steps (folds) to effectively create a 3-dimensional product. ● It is important to choose the proper method and technique for joining sheet metal using resistance spot welding. ● Blind (pop) riveting is an option used to join two or more pieces of metal together and have the opportunity to take them apart. ● Proper surface preparation and application of a finish can enhance the overall aesthetics of a product in addition to providing surface protection to sheet metal.

LEQ: What are the procedures for preparing for a coated metal finish? LEQ: How are coated metal finishes selected and applied to improve the appearance, functionality, and durability of a sheet metal product?	
Knowledge: Pattern Development Transferring Patterns and Creating Layouts Cutting and Bending Sheet Metal Tools and Processes Joining Sheet Metal Methods and Processes Preparation and Finishing of Sheet Metal	**Do/Skills:** Students will be able to… ● Use parallel line development to develop a pattern to make a simple layout for a sheet metal product. ● Transfer a simple layout of a product pattern to a flat piece of sheet metal. ● Use the proper sheet metal cutting hand tools and machines to produce a stretch-out for a sheet metal product. ● Use sheet metal bending tools and machines to make the proper sequence of bends to create a sheet metal product. ● Calculate weld time, weld current, and electrode force values when resistance spot welding a sheet metal product. ● Set up and safely operate a resistance spot welder to produce a sheet metal product. ● Use blind (pop) rivets as mechanical fasteners to make a sheet metal product. ● Prepare for a coated metal finish by properly removing rust and dirt. ● Apply a primer to improve paint adhesion and prevent corrosion to the sheet metal. ● Select and apply a coated metal finish to improve the appearance, functionality, and durability of the sheet metal.
Vocabulary: Aviation Snips, Bend Allowance, Lap Seam, Notcher, Parallel Line Development, Pattern, Radial Line Development, Scratch Awl, Setting Hammer, Sheet Metal & Wire Gage, Hem, Squaring Shear, Stretch Out, Template, Tin Snips, Triangulation, Bar Folder, Beading, Box & Pan Brake, Cornice Brake, Crimping, Dies, Slip-Roll Forming Machine, Wiring Machine, Resistance, Resistance Spot Welding (RSW), Squeeze Time, Weld Time, Hold Time, Off Time, Expulsion Weld, Spot Weld, Transformer, Electrode, Blind (Pop) Rivet, Burnishing, Enamel, Electroplating, Flat Lacquer, Lacquer, Lacquer Thinner, Mineral Spirits, Primer, Powder Coating, Solvent	**Core Resources:** Schoology LMS Autodesk AutoCAD

Common Assessment(s):	**Supplemental Resources:**
1. Sheet Metal Tools and Machines Quiz 2. Sheet Metal Toolbox Pattern 3. Sheet Metal Toolbox Project	

Grade, Subject/Course: Manufacturing Technology (10-12)	
Unit: Materials & Processes: Plastics & Polymers	**__X__ Essential _____ Important _____ Compact**
Big Idea: Polymers are materials used to create products for various applications using plastics manufacturing processes.	
STEELS/Tech and Engineering Strand: 3.5.9-12.M Develop a device or system for the marketplace. 3.5.9-12.N Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems. 3.5.9-12.O Apply appropriate design thinking processes to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality. 3.5.9-12.P Apply a broad range of design skills to a design thinking process. 3.5.9-12.V Apply principles of human-centered design. 3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process. 3.5.9-12.OO Use project management tools, strategies, and processes in planning, organizing, and controlling work. 3.5.9-12.QQ Implement quality control as a planned process to ensure that a product, service, or system meets established criteria.	**Pacing:** 5 weeks
Essential Questions: UEQ: How are polymer materials used to create products for various applications using plastic manufacturing tools, machines, processes, and systems for a variety of applications? LEQ: What are polymers? LEQ: How are plastic and polymer materials made? LEQ: What are the economic impacts that the plastics industry has on global, national, and statewide markets? LEQ: What are the differences between thermoplastics, thermosets, and elastomers? LEQ: How does society use plastic resources more efficiently to lessen the impacts on the environment? LEQ: What are the plastic resin identification codes? LEQ: What is injection molding and the processes involved in manufacturing solid thermoplastic parts using a mold?	**Understandings:** Students will know that… ● Plastics are polymers composed of hydrocarbons and bonded together through a polymerization process. ● The plastics industry has an enormous economic impact on global, national, and statewide markets. ● Plastics are categorized into thermoplastics, thermosets, and elastomers. ● Reducing, reusing, recycling, or recovering plastic resources more efficiently will lessen the impacts on the environment. ● Thermoplastics are divided into seven recycling resin codes based on the type of plastic resin. ● Injection molding is a plastics manufacturing process used to produce solid parts using a mold. ● Blow molding is a plastics manufacturing process used to produce thin-walled hollow thermoplastic parts.

LEQ: What is blow molding and the processes involved in manufacturing thin-wall hollow thermoplastic parts? LEQ: What is thermoforming and the processes involved in vacuum-forming plastic sheet products? LEQ: What is casting and the processes involved in casting thermoset resins? LEQ: How are plastic parts cut, shaped, and fastened using fabrication methods?	• Thermoforming is a plastics manufacturing process used to produce plastic sheet products through vacuum-forming. • Casting is a plastics manufacturing process used to produce parts by casting thermoset resin. • Fabrication of plastic products involves cutting, shaping, sanding, buffing, and joining of parts.
Knowledge: Introduction To Plastics Industry Basic Chemistry of Polymers Plastic Materials & Processes Thermoplastic Recycling Codes Plastic Manufacturing Methods Working With Acrylics	**Do/Skills:** Students will be able to… • Identify and differentiate between thermoplastic, thermoset, and elastomer plastic materials. • Cut, shape, and fasten plastic parts using fabrication methods. • Set up and operate an injection molder to produce a plastic product. • Set up and operate a blow molder to produce a hollow plastic product. • Set up and operate a vacuum thermoformer to produce a three-dimensional product from a plastic sheet. • Cast a product using a thermoset resin. • Design and fabricate a desk organizer from acrylic sheets, tubes, and cast parts.
Vocabulary: Plastics, Polymers, Hydrocarbons, Polymerization, Cracking, Thermoplastics, Thermosets, Elastomers, Polyethylene (PET), High-Density Polyethylene (HDPE), Polyvinyl Chloride (PVC), Low-Density Polyethylene (LDPE), Polypropylene (PP), Polystyrene (PS), Polylactic Acid (PLA), Acrylic, Biodegradable, Photodegradable, Injection Molding, Extrusion, Blow Molding, Thermoforming, Rotational Molding, Compression Molding, Casting, Coating, Fabrication	**Core Resources:** Schoology LMS Autodesk AutoCAD
Common Assessment(s): 1. Plathletic Excellence WebQuest 2. Thermoplastic Recycling Codes Scavenger Hunt 3. IKEA Acrylic Desk Organizer Project 4. Plastic Manufacturing Station Rotation Labs	**Supplemental Resources:**