Grade, Subject/Course: Design & Fabrication / Honors (10-12)	
Unit: Intro to Graphics and Output Preparation	**__X___ Essential _____ Important _____ Compact**
Big Idea: Graphic design transforms ideas into visually engaging content, equipping students with essential skills to prepare and present high-quality designs across various media.	
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.P - Apply a broad range of design skills to a design thinking process. 3.5.9-12.Q - Implement and critique principles, elements, and factors of design. 3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.	**Pacing:** 3 weeks
Essential Questions: UEQ: How does graphic design transform ideas into visually engaging content for output across various media? LEQ:What are the differences between vector and raster graphics, and how does each type impact design quality and flexibility? LEQ:How are vector graphics created, and what tools and methods are commonly used in their design and editing? LEQ:What factors should be considered when preparing graphics for high-quality printing? LEQ:How do the requirements for laser fabrication influence the preparation of digital graphics? LEQ:What are the best practices for ensuring that a digital design is accurately translated into a physical acrylic product using laser fabrication? LEQ:How do file formats and resolution requirements differ for graphics intended for print versus laser cutting? LEQ:In what ways can vector graphics enhance the precision and scalability needed for creating intricate laser-cut designs? LEQ:How can color, line weight, and path organization affect the output quality of both printed and laser-fabricated graphics? LEQ:What safety considerations are essential when preparing and handling materials for laser cutting? LEQ:How do properties of materials, like acrylic, impact design choices and outcomes in laser fabrication projects?	**Understandings:** Students will know that… ● Vector and raster graphics differ in structure and scalability, impacting design quality and usage in various applications. ● Vector graphics are created using specific tools and methods that enable precise shapes and paths, ideal for scalable designs. ● Effective graphics preparation for print requires consideration of file resolution, color settings, and file format. ● Preparing graphics for laser fabrication involves setting paths, adjusting line weights, and ensuring accurate dimensions for cutting. ● The translation of digital designs into physical products through laser fabrication requires careful preparation to maintain design fidelity. ● File formats and resolutions must be selected appropriately based on whether the graphic output is intended for print or laser cutting. ● Vector graphics allow for high precision and scalability, essential for creating detailed designs that are cut accurately by lasers. ● Color, line weight, and path organization directly impact the quality of both printed materials and laser-cut designs. ● Safety protocols are crucial during the setup and execution of laser cutting to prevent hazards. ● Material properties, such as the type and thickness of acrylic, influence design choices and the final quality of laser-fabricated products.

Knowledge: Vector & Raster Graphics Adobe Illustrator Laser Engraving Techniques Laser Engraver Operation	**Do/Skills:** Students will be able to… ● Differentiate between vector and raster graphics, explaining their impact on design scalability and quality. ● Use vector graphics tools and methods to create scalable, precise designs. ● Prepare digital graphics for print by adjusting file resolution, color settings, and format. ● Modify graphics for laser fabrication by setting paths, line weights, and dimensions to meet design specifications. ● Translate digital designs into physical products through laser fabrication while maintaining design accuracy. ● Choose appropriate file formats and resolution based on whether the graphic is intended for print or laser cutting. ● Apply principles of vector design to enhance precision and detail for laser-cut graphics. ● Adjust color, line weight, and path organization to optimize the quality of printed and laser-fabricated outputs. ● Follow safety protocols to ensure safe preparation and handling of materials for laser cutting. ● Analyze material properties, such as acrylic thickness, and adapt designs to produce high-quality laser-fabricated products.
Vocabulary: Vector, raster, engraving, cutting path, acrylic, fill, stroke, focus, lens, mirror, carriage, speed, power, frequency, resolution, DPI, line weight, anchors, paths, handles	**Core Resources:** Schoology LMS Adobe Illustrator Laser cutting machine Wix
Common Assessment(s): 1. Vector Trace Project 2. Vector Trace Product	**Supplemental Resources:** Teacher created activities, tutorials and assignments

Grade, Subject/Course: Design & Fabrication / Honors (10-12)	
Unit: Creativity and Problem Solving	**__X___ Essential _____ Important _____ Compact**
Big Idea: Creativity and problem-solving transform challenges into opportunities for impactful solutions.	
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.P - Apply a broad range of design skills to a design thinking process. 3.5.9-12.Q - Implement and critique principles, elements, and factors of design. 3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.	**Pacing:** 2 weeks
Essential Questions: UEQ: How do creativity and problem-solving transform challenges into opportunities for impactful solutions? LEQ:What does it mean to have a creative mindset, and how can it be cultivated in different fields? LEQ:What is the role of innovation in design, and how can it be encouraged through iterative thinking? LEQ:How do convergent and divergent thinking contribute to problem-solving in the design process? LEQ:In what ways can divergent thinking inspire unique ideas, and how does convergent thinking refine those ideas into practical solutions? LEQ:How can technology tools be used to enhance creativity and adapt designs to meet user needs? LEQ:How does the engineering design process support both creative exploration and structured problem-solving? LEQ:How does a portfolio showcase an individual's adaptability, innovation, and creative thinking? LEQ:What role do visual and interactive elements play in enhancing the impact of a website portfolio?	**Understandings:** Students will know that… ● Creativity and problem-solving are essential skills that can turn challenges into meaningful opportunities for innovative solutions. ● A creative mindset involves open-mindedness, adaptability, and the willingness to explore new ideas, all of which can be developed across different fields. ● Innovation is a critical element in design, which can be fostered through iterative processes and experimentation to improve and refine ideas. ● Convergent and divergent thinking both play vital roles in problem-solving, with divergent thinking generating ideas and convergent thinking narrowing them into workable solutions. ● Divergent thinking encourages the exploration of unique ideas, while convergent thinking brings focus, helping transform creative ideas into practical designs. ● Technology tools can expand creative potential and allow designers to adjust and tailor solutions to better meet user needs. ● The engineering design process promotes creativity by structuring problem-solving steps, allowing for both creative exploration and systematic refinement of ideas. ● A portfolio effectively demonstrates an individual's adaptability, creativity, and innovation, showcasing their growth and problem-solving capabilities. ● Visual and interactive elements in a portfolio strengthen its impact, making it more engaging and reflective of the creator's skills and unique style

Knowledge: Creative Mindset Convergent Thinking Divergent Thinking Engineering Design Process	**Do/Skills:** Students will be able to… ● Define creativity and problem-solving, and explain how they enable individuals to convert challenges into valuable opportunities for innovative solutions. ● Describe a creative mindset, and identify strategies to cultivate it across different fields. ● Explain the importance of innovation in design, and practice iterative thinking to enhance and refine ideas. ● Distinguish between convergent and divergent thinking, and demonstrate how each contributes to effective problem-solving in the design process. ● Use divergent thinking techniques to generate unique ideas, and apply convergent thinking to refine those ideas into feasible solutions. ● Employ technology tools to expand creative capabilities and adjust designs to meet specific user needs. ● Apply the engineering design process to blend creative exploration with structured problem-solving in design projects. ● Develop a portfolio that showcases adaptability, creativity, and innovation through various design projects. ● Integrate visual and interactive elements in a portfolio to enhance its impact and effectively convey individual skills and style. ● Utilize the appropriate tools and resources necessary to design their own project portfolio.
Vocabulary: Creativity, Problem-Solving, Creative Mindset, Adaptability, Innovation, Iteration, Convergent Thinking, Divergent Thinking, Engineering Design Process, User-Centered Design, Portfolio, Visual Elements, Interactive Elements, Scalability, Prototype, Feedback, Ideation, Aesthetics, Functionality	**Core Resources:** Schoology LMS Wix
Common Assessment(s): 1. Student Project Portfolio Setup	**Supplemental Resources:** Teacher created activities, tutorials and assignments

Grade, Subject/Course: Design & Fabrication / Honors (10-12)	
Unit: Vinyl Sticker Design and Fabrication	**__X___ Essential _____ Important _____ Compact**
Big Idea: Vinyl stickers can be used as a medium for self-expression, creativity, and communication.	
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.Q Implement and critique principles, elements, and factors of design. 3.5.9-12.U Evaluate and define the purpose of a design. 3.5.9-12.W Optimize a design by addressing desired qualities within criteria and constraints while considering trade-offs. 3.5.9-12.X Implement the best possible solution to a design using an explicit process. 3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. 3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.	**Pacing:** 3 weeks

Essential Questions: UEQ: How can vinyl stickers be used as a medium for self-expression, creativity, and communication? LEQ: What makes vinyl an effective material for creating durable stickers? LEQ: How does the design process for vinyl stickers differ from other types of design projects? LEQ: What software tools and techniques are commonly used to create vinyl sticker designs? LEQ: How are vector graphics used in vinyl sticker production, and why are they preferred? LEQ: What steps are involved in preparing a design for cutting on a vinyl cutter? LEQ: How does the vinyl cutter work, and what settings are essential for precise cuts? LEQ: What is the purpose of transfer tape, and how is it used to apply vinyl stickers? LEQ: What are some effective methods for troubleshooting common issues in vinyl cutting and application? LEQ: How can color, shape, and style impact the appeal and functionality of vinyl stickers? LEQ: In what ways can vinyl stickers be used for personal expression, branding, or practical applications?	**Understandings:** Students will know that… ● Vinyl is a durable material suitable for stickers due to its weather resistance, flexibility, and adhesive qualities. ● The design process for vinyl stickers has unique considerations, such as durability, cut accuracy, and transferability, that may differ from other design projects. ● Specialized software tools and techniques, such as vector design programs, are commonly used to create vinyl sticker designs. ● Vector graphics are preferred in vinyl sticker production because they allow for scalable, precise, and smooth cuts. ● Preparing a design for vinyl cutting involves steps like setting paths, adjusting size, and confirming cut lines for accuracy. ● A vinyl cutter operates through precise blade movement, with settings like pressure and speed being essential for clean cuts. ● Transfer tape is used to transfer vinyl stickers from their backing to a surface, ensuring accurate placement and adhesion. ● Troubleshooting techniques, such as adjusting blade settings and checking material alignment, are effective in resolving common issues in vinyl cutting and application. ● Color, shape, and style significantly impact the visual appeal and functionality of vinyl stickers for different purposes. ● Vinyl stickers can serve as tools for personal expression, branding, and practical applications due to their versatility and durability.
Knowledge: Vinyl Design and Cutting Vinyl Post Processing	**Do/Skills:** Students will be able to… ● Explain why vinyl is an effective material for creating durable stickers. ● Describe the unique steps and considerations in the design process for vinyl stickers compared to other design projects. ● Identify software tools and techniques commonly used in creating vinyl sticker designs. ● Explain the importance of vector graphics in vinyl sticker production and why they are preferred. ● Outline the steps needed to prepare a design for cutting on a vinyl cutter. ● Describe how a vinyl cutter works and identify essential settings for achieving precise cuts. ● Explain the purpose of transfer tape and demonstrate its use in applying vinyl stickers accurately. ● Apply troubleshooting techniques to resolve common issues in vinyl cutting and sticker application. ● Analyze how color, shape, and style impact the appeal and functionality of vinyl stickers. ● Describe various applications for vinyl stickers, including personal expression, branding, and practical uses. ● Utilize the appropriate tools and resources necessary to design and fabricate their own vinyl sticker product.

Vocabulary: Vinyl, Cutter, Plotter, Adhesive Vinyl, Weeding, Transfer Tape, Cut Path, Vector Graphic, Raster Graphic, Contour Cut, Registration Marks, Blade Depth, Pressure Setting, Speed Setting, Overcut, Print and Cut, Masking, Alignment, Offset.	**Core Resources:** Schoology LMS Adobe Illustrator Vinyl Cutting machine Vinyl Print and Cut machine
Common Assessment(s): 1. Vinyl Sticker Project 2. Vinyl Print and Cut Project 3. Portfolio Page	**Supplemental Resources:** Teacher created activities, tutorials and assignments

Grade, Subject/Course: Design & Fabrication / Honors (10-12)	
Unit: Edge Lit Acrylic Design and Fabrication	**__X___ Essential _____ Important _____ Compact**
Big Idea: Integrating LED lighting, 3D printing, and laser engraving technology enables students to creatively design and engineer illuminated products.	
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.Q Implement and critique principles, elements, and factors of design. 3.5.9-12.S Conduct research to inform intentional inventions and innovations that address specific needs and wants. 3.5.9-12.U Evaluate and define the purpose of a design. 3.5.9-12.W Optimize a design by addressing desired qualities within criteria and constraints while considering trade-offs. 3.5.9-12.X Implement the best possible solution to a design using an explicit process. 3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. 3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process. 3.5.9-12.PP Demonstrate the use of conceptual, graphical, virtual, mathematical, and physical modeling to identify conflicting considerations before the entire system is developed and to aid in design decision making.	**Pacing:** 4 weeks

Essential Questions:	**Understandings:** Students will know that…
UEQ: How does integrating LED lighting, 3D printing, and laser engraving technology enable students to creatively design and engineer illuminated products? LEQ: What factors should be considered when selecting LED light strips and SMD types for different design projects? LEQ: How do controllers and power supply specifications impact the functionality and safety of LED light strip setups? LEQ: What are the differences between PLA, ABS, and PETG materials, and how do they affect the quality and durability of 3D-printed objects? LEQ: How does a 3D printer's slicer software influence print settings like filament type, diameter, nozzle size, and support material? LEQ: What are STL and GCODE files, and how are they utilized in preparing and executing 3D printing projects? LEQ: What principles of light refraction and hotspot avoidance are essential for designing edge-lit acrylic displays? LEQ: How does cast acrylic differ from other acrylic types for laser engraving, and what effects are achieved through reverse engraving techniques? LEQ: What safety precautions should be followed when working with laser engraving machines and 3D printers? LEQ: What are key considerations when creating 3D CAD models, especially with orthographic projection and part design basics? LEQ: How does tessellation and sketching contribute to developing detailed and precise 3D CAD designs? LEQ: What are the basic features and functions of parts in CAD software, and how are assemblies and drawing basics used to visualize product design? LEQ: How do Epilog dashboard settings impact the quality and precision of laser engraving on various materials? LEQ: What are the primary steps in preparing a design for an edge-lit acrylic project, from CAD modeling to laser engraving and assembly?	● Integrating LED lighting, 3D printing, and laser engraving allows for innovative design and the creation of functional, visually dynamic products by combining multiple technologies. ● Factors like LED strip type, SMD ratings, and color temperature must be considered to select the right LED components for specific design requirements and visual effects. ● Proper selection of controllers and power supplies ensures that LED light strips perform safely and efficiently, providing necessary power while maintaining system integrity. ● Different 3D printing materials (PLA, ABS, and PETG) have distinct properties that influence durability, flexibility, and suitability for various applications. ● The slicer software settings, including filament type, nozzle diameter, and support material, directly impact the accuracy and quality of the 3D print outcome. ● STL and GCODE files are essential for translating 3D models into machine-readable instructions that guide 3D printers and laser engravers in creating precise physical objects. ● Understanding light refraction and how to avoid hotspots is crucial for achieving uniform light distribution in edge-lit acrylic designs. ● Cast acrylic is ideal for laser engraving due to its clear, smooth surface, and reverse engraving techniques can produce unique, high-contrast designs. ● Laser engraving and 3D printing involve specific safety protocols, such as proper ventilation and protective equipment, to minimize risks. ● Key considerations in 3D CAD modeling, such as orthographic projection, help ensure accuracy in creating parts that fit together in an assembly. ● Tessellation and sketching in CAD software contribute to the development of intricate designs by breaking down complex shapes into manageable components. ● Basic part features in CAD software, such as extrusions and cuts, enable the creation of functional 3D models that can be used in assemblies and visualized in product design. ● The settings on the Epilog dashboard, such as speed, power, and resolution, determine the precision and quality of laser engravings on various materials, including acrylic. ● Preparing a design for edge-lit acrylic involves several steps, from initial CAD modeling and creating accurate engravings to final assembly, ensuring proper lighting effects and visual impact.

Knowledge: Technical Drawings CADD Laser Cutting and Engraving 3D Printing	**Do/Skills:** Students will be able to… ● Demonstrate the ability to integrate LED lighting, 3D printing, and laser engraving technologies to create functional and visually dynamic designs. ● Identify and evaluate key factors (LED strip type, SMD ratings, and color temperature) when selecting LED components for specific design projects. ● Select appropriate controllers and power supplies to ensure safe and efficient operation of LED light strips and systems. ● Compare and contrast the properties of different 3D printing materials (PLA, ABS, and PETG) and choose the best material for various design applications. ● Manipulate slicer software settings, including filament type, nozzle diameter, and support material, to optimize 3D print accuracy and quality. ● Explain the use of STL and GCODE files in preparing 3D models for 3D printing and laser engraving. ● Apply the principles of light refraction and hotspot avoidance to design edge-lit acrylic projects with uniform light distribution. ● Assess the suitability of cast acrylic for laser engraving and apply reverse engraving techniques to create high-contrast designs. ● Follow safety protocols, such as proper ventilation and the use of protective equipment, when working with 3D printers and laser engraving machines. ● Apply key considerations of 3D CAD modeling, including orthographic projection, to design parts that fit accurately in assemblies. ● Use tessellation and sketching techniques in CAD software to create detailed, precise designs for 3D printing and laser engraving. ● Demonstrate proficiency in creating functional 3D models using basic CAD features, including extrusions and cuts, for product design. ● Configure the Epilog dashboard settings (speed, power, resolution) to optimize laser engraving results on various materials, such as acrylic. ● Complete the steps involved in preparing a design for an edge-lit acrylic project, including CAD modeling, laser engraving, and assembly, to achieve optimal lighting effects. ● Utilize the appropriate tools and resources necessary to design and fabricate their own edge lit acrylic product.
Vocabulary: LED Light Strips, Surface-Mounted Device Types (SMD), Controllers, Power Supply, 3D Printing, STL Files (Stereolithography), GCODE, PLA (Polylactic Acid), ABS (Acrylonitrile Butadiene Styrene), PETG (Polyethylene Terephthalate Glycol), Slicer Options, Filament, Filament Diameter, Nozzle Diameter, Support Material, Brim, Shells, Infill, Edge Lit Acrylic, Light Refraction, Hot Spots, Hot Spot Avoidance, Laser Engraving, Cast Acrylic, Reverse Engraving, Epilog Dashboard Settings, Safety, 3D CAD (Computer-Aided Design), Orthographic Projection, Intro to Sketching, Tessellation, Intro to Part Design, Basic Part Features, Assembly Drawing Basics, Product Design.	**Core Resources:** Schoology LMS Adobe Illustrator CADD Software 3D Printer Laser Cutter and Engraver

Common Assessment(s): 1. Research Project 2. Edge Lit Acrylic Project 3. Portfolio Page	**Supplemental Resources:** Teacher created activities, tutorials and assignments Google Sites

Grade, Subject/Course: Design & Fabrication / Honors (10-12)	
Unit: Coaster Set Design and Fabrication	**__X___ Essential _____ Important _____ Compact**
Big Idea: Dye sublimation, laser-cutting techniques, and material choices can combine to create visually appealing, durable, and functional products.	
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.Q Implement and critique principles, elements, and factors of design. 3.5.9-12.S Conduct research to inform intentional inventions and innovations that address specific needs and wants. 3.5.9-12.U Evaluate and define the purpose of a design. 3.5.9-12.W Optimize a design by addressing desired qualities within criteria and constraints while considering trade-offs. 3.5.9-12.X Implement the best possible solution to a design using an explicit process. 3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. 3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.	**Pacing:** 3 weeks

Essential Questions:	**Understandings:** Students will know that…
UEQ: How can dye sublimation, laser-cutting techniques, and thoughtful material choices work together to create products that are visually appealing, durable, and functional? LEQ: How does the dye sublimation process transfer designs onto materials, and what makes it ideal for creating durable, vibrant coaster images? LEQ: What considerations are important when designing functional and aesthetically appealing products like drink coasters and holders? LEQ: How do laser-cutting settings and techniques affect the accuracy and finish of custom product designs? LEQ: How can material selection, such as wood or acrylic for the holder, impact the look, functionality, and durability of the finished product? LEQ: In what ways can a cohesive design style be achieved across both coasters and holders to create a unified product set? LEQ: What are the key steps in preparing digital files for both dye sublimation printing and laser cutting, and how do these processes differ? LEQ: How does the selection of different wood joinery techniques impact the strength, aesthetics, and functionality of laser-cut projects? LEQ: What are the safety considerations when working with dye sublimation printers and laser cutters, and how can they be effectively managed? LEQ: How can elements such as color, texture, and shape be used to create designs that are both visually appealing and practical for regular use? LEQ: In what ways can product design principles, such as ergonomics and functionality, be applied to ensure the coaster set is user-friendly and durable?	● Dye sublimation is a printing process that uses heat to transfer vibrant, durable images onto materials, making it well-suited for creating long-lasting, visually striking coaster designs. ● Effective product design considers both functionality and aesthetics to produce items like coasters and holders that are practical and visually appealing. ● Laser-cutting settings and techniques, such as speed and power adjustments, directly influence the precision, finish, and quality of custom product designs. ● Material choice, such as selecting wood or acrylic, impacts the appearance, durability, and functionality of a product, with each material offering distinct benefits for different design purposes. ● A cohesive design style, consistent across multiple elements like coasters and holders, enhances visual unity and creates a unified, professional product set. ● Preparing digital files for dye sublimation and laser cutting involves distinct processes, each with specific steps that ensure accurate and successful output in each method. ● The use of various wood joinery techniques in laser-cut designs can affect the structural integrity, aesthetics, and overall functionality of the final product. ● Safety protocols are essential when using dye sublimation printers and laser cutters, requiring proper handling and protective measures to minimize risks. ● Design elements, such as color, texture, and shape, contribute to creating products that are not only visually appealing but also functional for everyday use. ● Applying product design principles, including ergonomics and functionality, helps ensure that products like coaster sets are user-friendly, durable, and meet the needs of the end user effectively.

<table>
<tr>
<td><u>Knowledge:</u>
CADD
Wood Joinery
Laser Cutting and Engraving
Dye Sublimation</td>
<td><u>Do/Skills</u>: Students will be able to…
Explain the dye sublimation process and its advantages for creating vibrant, durable designs on coaster products.
Apply principles of effective product design by balancing functionality and aesthetics in creating practical, visually appealing coasters and holders.
Adjust laser-cutting settings, such as speed and power, to achieve precise cuts and high-quality finishes for custom product designs.
Analyze material properties, such as wood and acrylic, to determine the best options for durability, appearance, and functionality in product design.
Create a cohesive design style across multiple product components to achieve visual unity and a professional, unified appearance.
Prepare digital files correctly for dye sublimation printing and laser cutting by following specific steps and settings required for each process.
Select and use wood joinery techniques appropriate for laser-cut designs to enhance structural strength and aesthetics.
Implement safety protocols when operating dye sublimation printers and laser cutters to minimize risks and ensure safe practices.
Utilize design elements like color, texture, and shape to produce visually appealing and functional products suited for regular use.
Integrate ergonomic and functional design principles to develop user-friendly and durable coaster sets that meet the needs of the end user.
Utilize the appropriate tools and resources necessary to design and fabricate their own coaster set and holder.</td>
</tr>
<tr>
<td><u>Vocabulary:</u>
Dye Sublimation, heat transfer, polymers, synthetic vs organic, color management, color profiles, International Color Consortium (ICC), Cyan Magenta Yellow Key (CMYK), Red Green Blue (RGB), Finger Joint, Dovetail Joint, Tab and Slot, Living Hinge, Butt Joint, Kerf Adjustment, Interference Fit, Press Fit</td>
<td><u>Core Resources</u>:
Schoology LMS
Adobe Illustrator
Laser Cutter and Engraver
Dye Sublimation Printer
Heat Press</td>
</tr>
<tr>
<td><u>Common Assessment(s):</u>
Coaster Set Project
Coaster Holder Project
Coaster Set Portfolio Page</td>
<td><u>Supplemental Resources:</u>
Teacher created activities, tutorials and assignments</td>
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Grade, Subject/Course: Design & Fabrication / Honors (10-12)	
Unit: Independent Research and Development	**__X___ Essential _____ Important _____ Compact**
Big Idea: The engineering design process enables designers to create functional and innovative products.	
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.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.Q Implement and critique principles, elements, and factors of design. 3.5.9-12.S Conduct research to inform intentional inventions and innovations that address specific needs and wants. 3.5.9-12.U Evaluate and define the purpose of a design. 3.5.9-12.W Optimize a design by addressing desired qualities within criteria and constraints while considering trade-offs. 3.5.9-12.X Implement the best possible solution to a design using an explicit process. 3.5.9-12.Y (ETS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. 3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.	**Pacing:** 3 weeks
Essential Questions: UEQ: How does the engineering design process enable designers to create functional and innovative products? LEQ: How does the engineering design process guide the development of functional and innovative products? LEQ: What are the key components of a successful project proposal, and how do they ensure the viability of a product design? LEQ: How do designers balance form and function when creating products that meet both aesthetic and practical needs? LEQ: What factors must be considered when selecting materials and output technologies for a specific design project?	**Understandings:** Students will know that… ● The engineering design process is a structured method that helps designers create functional and innovative products by following key steps such as ideation, prototyping, testing, and refinement. ● A successful project proposal outlines the goals, scope, materials, and technologies for a design, ensuring that the product is viable and feasible within its constraints. ● Balancing form and function is essential in product design to ensure that the product is both aesthetically pleasing and practical for its intended use.

LEQ: How can research questions be developed effectively to guide the design and testing of a product? LEQ: What is the role of research in the engineering design process, and how can it inform decisions about product functionality and feasibility? LEQ: How does iterative testing and prototyping contribute to refining and improving a product during development? LEQ: What steps are involved in selecting the best materials and technologies to achieve the desired product outcomes? LEQ: How can the design process be adapted based on feedback from testing and real-world applications? LEQ: What are the ethical and practical considerations in selecting materials and manufacturing methods for a product?	● Material selection and the choice of output technologies are critical decisions in the design process, as they directly impact the durability, appearance, and functionality of the final product. ● Research questions guide the design process by framing the challenges and directing focus toward solving specific problems related to product design and functionality. ● Research plays a pivotal role in the design process by providing insights and data that help inform decisions on product feasibility, materials, and technologies. ● Iterative testing and prototyping are vital for refining a design, as they allow designers to make adjustments based on real-world feedback and performance. ● Selecting the best materials and technologies involves evaluating their properties and how they align with the product's goals, ensuring that the final outcome meets the design requirements. ● The design process is dynamic and can be adapted based on feedback and testing, allowing for continuous improvement of the product as it moves through different stages of development. ● Ethical and practical considerations, such as environmental impact, sustainability, and cost, must be considered when selecting materials and manufacturing methods to ensure responsible and effective product design.

Knowledge:	**Do/Skills:** Students will be able to…
Engineering Design Process Laser Cutting and Engraving 3D Printing Technical Drawing CADD Dye Sublimation Vinyl Printing and Cutting	● Understand and apply the engineering design process, including ideation, prototyping, testing, and refinement, to create functional and innovative products. ● Develop a clear and structured project proposal that outlines the goals, scope, materials, and technologies for a design, ensuring the product's feasibility and viability. ● Analyze and balance form and function in product design to create items that are both visually appealing and practical for their intended use. ● Evaluate and select appropriate materials and output technologies that enhance the durability, appearance, and functionality of a product. ● Formulate research questions that guide the design process and focus on solving specific challenges related to product design and functionality. ● Integrate research findings into the design process to inform decisions on product feasibility, material choices, and technology selection. ● Use iterative testing and prototyping to refine and improve product designs based on real-world feedback and performance data. ● Assess the properties of different materials and technologies to select the most appropriate ones for achieving the desired design outcomes. ● Adapt the design process based on ongoing feedback and testing to ensure continuous improvement throughout development. ● Consider ethical and practical factors, such as environmental impact, sustainability, and cost, in material selection and manufacturing methods for responsible and effective product design. ● Utilize the appropriate tools and resources necessary to design and fabricate a unique product designed to meet their own needs.
Vocabulary: Engineering Design Process, Ideation, Prototyping, Testing, Refinement, Project Proposal, Scope, Materials Selection, Output Technologies, Form vs. Function, Product Feasibility, Research Questions, Product Functionality, Iterative Testing, Prototyping Feedback, Material Properties, Technology Evaluation, Design Adaptation, Continuous Improvement, Ethical Considerations, Sustainability, Environmental Impact, Cost Analysis, Manufacturing Methods, Responsibility in Design	**Core Resources:** Schoology LMS Adobe Illustrator Laser Cutter and Engraver Dye Sublimation Printer Heat Press 3D Printer CADD software Vinyl Cutting machine Vinyl Print and Cut machine
Common Assessment(s): Independent Design Project Proposal Independent Design Project Independent Design Project Portfolio Page	**Supplemental Resources:** Teacher created activities, tutorials and assignments

Grade, Subject/Course: Design & Fabrication / Honors (10-12)	
Unit: Honors Project	**__X__ Essential _____ Important _____ Compact**
Big Idea: Technological and engineering advancements are built on continuous improvements to past inventions and knowledge.	
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.F Evaluate a technological innovation that arose from a specific society's unique need or want. 3.5.9-12.G Evaluate a technological innovation that was met with societal resistance impacting its development. 3.5.9-12.S Conduct research to inform intentional inventions and innovations that address specific needs and wants. 3.5.9-12.U Evaluate and define the purpose of a design. 3.5.9-12.GG Evaluate how technology and engineering have been powerful forces in reshaping the social, cultural, political, and economic landscapes throughout history. 3.5.9-12.KK Relate how technological and engineering developments have been evolutionary, often the result of a series of refinements to basic inventions or technological knowledge.	**Pacing:** Every 2 weeks throughout the semester

Essential Questions: UEQ: How have technological and engineering advancements evolved through a series of refinements to previous inventions and knowledge, and how can understanding this progression inform modern design and fabrication practices? LEQ: How can laser engraving technology be utilized to create intricate designs and patterns on various materials, and what are its advantages over traditional methods? LEQ: How can vinyl cutting be used to translate digital designs into tangible products, and what are the key considerations for successful vinyl projects? LEQ: How can CAD software be used to create precise and functional designs that can be easily translated into physical objects through fabrication technologies? LEQ: How can LED lighting be incorporated into design projects to enhance aesthetics, functionality, and energy efficiency? LEQ: How can laser cutting be applied to create strong, precise joinery in woodworking and other materials, and what are the benefits of this method over traditional joinery techniques? LEQ: How can dye sublimation technology be used to transfer vibrant, high-quality designs onto various materials, and what makes it a preferred method for certain applications?	**Understandings:** Students will know that… ● Technological and engineering advancements are often the result of continuous refinements to previous inventions and knowledge. ● Laser engraving technology can create intricate designs with precision and offers advantages such as speed, accuracy, and versatility over traditional methods. ● Vinyl cutting requires careful design preparation, material selection, and machine settings to achieve successful outcomes. ● CAD software enables the creation of precise digital designs that can be translated into physical objects using various fabrication technologies. ● LED lighting can enhance design projects by improving aesthetics, functionality, and energy efficiency. ● Laser cut joinery techniques provide strong, precise connections in woodworking and other materials, often improving efficiency and design complexity. ● Dye sublimation technology produces vibrant, durable designs on various materials by infusing ink directly into the substrate.
Knowledge: Laser Engraving Technology Vinyl Cutting Technology CAD Software LED Lights Laser Cut joinery Dye Sublimation Technology	**Do/Skills:** Students will be able to… ● Research and present information about a real-world problem, the solution to the problem, how design and fabrication works, and the positive and negative impacts on society.
Vocabulary: Vector, Raster, Engraving Depth, Power Settings, Speed Settings, Kerf, Alignment, Weeding, Transfer Tape, Node Editing, Path, Extrusion, Dimensioning, LED Strip, Soldering, Circuit, Diffusion, Finger Joint, Dovetail, Interlocking Tabs, Heat Press, Sublimation Ink, Substrate, Gamut, Resolution, Bleed	**Core Resources:** Schoology LMS Wix

Common Assessment(s):	**Supplemental Resources:**
1. Blog (8 Posts)	Teacher created activities, tutorials and assignments