

<p>Grade, Subject/Course: Electric Guitar Design & Manufacturing 9-12</p>	
<p>Unit 1: Safety</p>	<p><u> X </u> Essential <u> </u> Important <u> </u> Compact</p>
<p>Big Idea: Safety is an inherent part of technology and engineering design.</p>	
<p>STEELS/Tech and Engineering Strand: 3.5.9-12.L Interpret laws, regulations, policies, and other factors that impact the development and use of technology. 3.5.9-12.AA Safely apply an appropriate range of making skills to a design thinking process.</p>	<p>Pacing: 2 weeks</p>
<p>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 making products? LEQ: What four machines are used to square up a board? LEQ: Why is safety so important in the technology lab? LEQ: What are the machine safety rules and operations used in making design prototypes? LEQ: Why is it important to understand force when operating hand or power tools? LEQ: Why are cleanliness and organization important in the technology lab? LEQ: Who is OSHA? And What do they have to do with the production environment? LEQ How are cutting tools designed? LEQ: How can the ALICE Procedures be applied to this classroom?</p>	<p>Understandings: Students will know ...</p> <ul style="list-style-type: none"> ● 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 pertaining to the production environment are regulated by the Occupational Safety & Health Association (OSHA). ● Safety Data Sheets (SDS) contain information pertaining to 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.

<p><u>Knowledge:</u> General Lab Safety Personal Protective Equipment (PPE) Machine Specific Safety Lab Maintenance</p>	<p><u>Do/Skills:</u> Students will be able to...</p> <ul style="list-style-type: none"> ● 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 as well as be able to correctly select the appropriate fire extinguisher and use it efficiently to put out a fire. ● Properly maintain established clear standards for student work areas.
<p><u>Vocabulary:</u> OSHA, SDS, LOTO, Danger Zone, Exposure, Personal Protective Equipment</p>	<p><u>Core Resources:</u></p> <ul style="list-style-type: none"> ● Schoology LMS ● Woodworking Lab Machinery
<p><u>Common Assessment(s):</u></p> <ul style="list-style-type: none"> ● Safety Tests ● Guitar Portfolio Page(s) <ul style="list-style-type: none"> ○ Guitar Goals 	<p><u>Supplemental Resources:</u> <u>PDE Safety Guide</u> ITEEA Safety Resources</p>

<p>Grade, Subject/Course: Electric Guitar Design & Manufacturing 9-12</p>	
<p>Unit 2: Guitar Design & Manufacturing: Acoustic Box Guitar</p>	<p><u> X </u> Essential <u> </u> Important <u> </u> Compact</p>
<p>Big Idea: The skills needed to make a wooden project can be learned through making a wooden instrument. The box guitar project allows students to learn the fundamentals of woodworking while creating a simple functioning instrument. These skills can then be transferred to the actual guitar project or other wood projects or designs in the future..</p>	
<p>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.I (ETS) Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. 3.5.9-12.L Interpret laws, regulations, policies, and other factors that impact the development and use of technology. 3.5.9-12.P Apply a broad range of design skills to a design thinking process. 3.5.9-12.X Implement the best possible solution to a design using an explicit process.</p>	<p>Pacing: 6 weeks</p>
<p>Essential Questions: UEQ: How is an acoustic box guitar manufactured? LEQ: What is the difference between defect and character? LEQ: What is the difference between hardwoods and softwoods? LEQ: What are some of the unique characteristics of different wood species? LEQ: What woods work best in the applications for a guitar? LEQ: How are drill bits selected? LEQ: How are electrical connections made in a guitar? LEQ: What safety is needed when soldering? LEQ: What are the two Basic types of graphic images? LEQ: How can Illustrator be used to create images? LEQ: What is the difference between a Trademark and a Copyright? LEQ: How can a box guitar face be designed? LEQ: Why do we finish wood products? LEQ: What strings are on a three string box guitar and how are they tuned?</p>	<p>Understandings Students will know...</p> <ul style="list-style-type: none"> ● The difference between defect and character when utilizing lumber for a project ● The key differences between hardwood and softwood lumber as well as the advantages/disadvantages of each type ● That woods have different tonal qualities and are selected for instruments based on these qualities ● Hardware fasteners like screws need to be predrilled in order to be properly installed ● Drill bits for pre drilling need to sized appropriately or the fastener will bind or fall out ● Safety precautions need to be followed in order to solder safely ● That there are two basic forms of graphic images used in the digital environment are Vectors and Raster Images ● Vector images are scalable and resolution independent; while Raster are resolution dependant, not scalable, and often larger files ● Adobe Illustrator is a vector based software that is used to create graphic designs

<p>LEQ: How can music be played on a 3 string box guitar?</p>	<ul style="list-style-type: none"> ● Pickups transfer the sound or generate a signal in an electric guitar ● Adobe Photoshop is a raster based software that is used to create images ● Vector graphics can be utilized by the printer, laser, engraver, and vinyl cutter. ● Which 3 strings are used for a box guitar and how to tune them correctly
<p><u>Knowledge:</u> Wood terms Types of Character Types of Defects Types of warp Wood Species Tone Woods Drill Bit Types Solder, Soldering, Soldering Safety Graphics Vector & Raster</p>	<p><u>Do/Skills</u> students will be able to...</p> <ul style="list-style-type: none"> ● Use machine tools to process lumber safely to create the parts needed to make a 3-string box guitar ● Select the appropriate lumber and lay out the pieces to work around and with defects and character ● Utilize the appropriate fasteners and associated technologies to assemble their box guitars ● Safely utilize soldering technologies to construct a simple output signal circuit in the box guitar. ● Utilize Adobe products such as but not limited to Illustrator and Photoshop to design, create, and print a suitable box guitar face label that does not violate any copyright or trademark laws. ● How to measure and accurately determine the scale length of their guitar ● Apply mathematics to define the location of the frets on the box guitar ● Accurate measure to mark the locations of the frets for the box guitar ● Utilize the proper hand tools to create frets on the box guitar. ● Apply an appropriate finish to the box guitar project.
<p><u>Vocabulary:</u> Defect, character, hardwood, softwood, grain, wood species, types of grain patterns, plain sawn, quarter sawn, wood characteristics, hardwood, softwood, hardness, wane, checks, shakes, insect damage, foreign objects, knots, pitch pockets, honeycombing, bark inclusions, burls, spade, twist, brad point, forstner bit, spur bit, alloy, solder, flux, flow, melting point, fumes, vapors, raster, vector, Illustrator, Photoshop, dial caliper, thousandths of a inch, fret</p>	<p><u>Core Resources:</u></p> <ul style="list-style-type: none"> ● Teacher created box guitar plans ● Schoology LMS ● Woodworking Lab Machinery ● Cordless Power Tools ● Classroom Computers ● Adobe Illustrator ● Adobe Photoshop ● Color Printer ● Materials and supplies needed for box guitar manufacturing
<p><u>Common Assessment(s):</u></p> <ul style="list-style-type: none"> ● Guitar Portfolio Page(s) <ul style="list-style-type: none"> ○ Illustrator Basics ○ Box Guitar ● Box Guitar Label Proposal ● Box Guitar Artwork ● Box Guitar Project 	<p><u>Supplemental Resources:</u></p>

<p>Grade, Subject/Course: Electric Guitar Design & Manufacturing 9-12</p>	
<p>Unit 3: Guitar Design & Manufacturing Finishing</p>	<p><u> X </u> Essential <u> </u> Important <u> </u> Compact</p>
<p>Big Idea: Fine instruments require great finishes in order to be the best that they can be. It takes considerable time and effort to properly prepare a surface for a great finish on an instrument.</p>	
<p>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. 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.X Implement the best possible solution to a design using an explicit process.</p>	<p>Pacing: 3 Weeks</p>
<p>Essential Questions: UEQ: How is an electric guitar finished? LEQ: What is the proper order of abrasives needed to apply a finish? LEQ: Why is the grain filled? LEQ: How is a finish selected? LEQ: What are the steps needed to prepare a surface for painting? LEQ: What are the steps needed to prepare a surface for staining? LEQ: What is the difference between a stain and a finish? LEQ: How is a finish applied properly? LEQ: How is a finished buffed? LEQ: How is a Headstock designed? LEQ: How is a Headstock Logo designed? LEQ: What is the difference between a trademark and a copyright?</p>	<p>Understandings: Students will know...</p> <ul style="list-style-type: none"> ● Abrasives are classified according to their size, composition, backing material, and their application. ● Surfaces are prepared for finish by progression through the abrasives in the proper order. ● A smooth, pore-free finish can be achieved more easily by filling the pores in open-grain wood prior to applying the finish. ● Surface preparation varies according to the selected finish, painting requires a less perfect surface than staining requires. ● Stains consisting of pigments or dyes only change the natural color of the wood while finishes seal and protect the wood from the environment. ● Finishes can be applied through a variety of means such as a brush, spray, or cloth. ● In order to level a finish it is best to lightly sand the surface between coats ● The highest gloss finishes are achieved by utilizing polishing technologies such as wet sanding and buffing. ● That the headstocks on guitars are Trademarked and cannot be replicated. ● Headstocks have to be designed according to the desires of the end-user and where/how the guitar will be stored.

<p><u>Knowledge:</u> Abrasives Abrasive Numbering System Abrasive Order, Grain Direction Sanding with the Grain Types of Finishes Types of Stains Types of Dyes Burst Finish Spray Paint Spray Finish Equipment Finish Application</p>	<p><u>Do/Skills:</u> Students will be able to...</p> <ul style="list-style-type: none"> ● Select and utilize the proper abrasives in order to achieve the desired surface preparation. ● On wood that requires it, properly utilize a grain filler to fill the pores of the wood prior to applying a finish. ● Select a proper finish based on the desired end appearance, technologies available, and the environment in which the project will be utilized ● Select the best method available to properly apply the finish of their choice to the project. ● During the finishing process follow all directions such as drying times, coats, and level sanding between coats. ● If desired, polish the finish on their guitar to the desired shine. ● Design an appropriate headstock given the constraints and limitations set by the instructor.
<p><u>Vocabulary:</u> Abrasives, Abrasive Numbering System, Abrasive Order, Grain Direction, Sanding with the Grain, Open Grain, Closed Grain, Grain Filler, Stain, Dye, Pigment, Finish, Lacquer, Polyurethane, Paint, Enamel, Run, Drips, Overspray, Blushing, Level Sand, Dry Time, Cure Time, Wet-Sand, Rubbing Compound, Cleaner wax, polishing compound, trademark, copyright</p>	<p><u>Core Resources:</u></p> <ul style="list-style-type: none"> ● Paint Booth with extraction system ● Abrasives ● Spray Equipment ● Lacquer ● Stains ● Dyes ● Pigment ● Rubbing Compound ● Polishing Compound ● Bandsaw/Scroll Saw ● Dust extraction system ● Fusion 360, Revit, & Onshape
<p><u>Common Assessment(s):</u></p> <ul style="list-style-type: none"> ● Headstock Design Proposal ● Headstock Logo Design ● Guitar Portfolio Page(s) <ul style="list-style-type: none"> ○ Guitar Kit & Body Prep ○ Guitar Headstock Design ○ Guitar Finish 	<p><u>Supplemental Resources:</u></p>

<p>Grade, Subject/Course: Electric Guitar Design & Manufacturing 9-12</p>	
<p>Unit 4: Guitar Design & Manufacturing: Guitar Assembly</p>	<p><u> X </u> Essential <u> </u> Important <u> </u> Compact</p>
<p>Big Idea: All the individual parts of the guitar must be carefully assembled to create a fully functional and playable instrument. The goal is to create an instrument that is both comfortable to play and capable of producing the desired sound. The assembly requires knowledge of the parts, precision, patience, and attention to detail that ensures the guitar will be well-made and ready to be set up properly.</p>	
<p>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. 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.X Implement the best possible solution to a design using an explicit process.</p>	<p>Pacing: 3 Weeks</p>
<p>Essential Questions: UEQ: How is an electric Guitar Assembled? LEQ: What are the parts of a 6 string solid body guitar? LEQ: How is the Neck attached and aligned? LEQ: How is the Bridge properly mounted? LEQ: How are the Tuning machines installed? LEQ: How are Frets leveled, crowned, and polished? LEQ: How is the neck relief set? LEQ: How is a guitar shielded? LEQ: How is the pickguard mounted? LEQ: How is the trem claw mounted? LEQ: How are the strap buttons installed properly? LEQ: How are the string trees installed properly? LEQ: How are the strings installed properly? LEQ: How is a headstock Logo designed and applied to a guitar?</p>	<p>Understandings: Students will know ...</p> <ul style="list-style-type: none"> ● The different components that make up a guitar, such as the body, neck, frets, fretboard, bridge, pickups, tuners, and electronics. ● Students will know the hardware that is used to assemble the guitar. ● How the different structures of the guitar work together to form an instrument that is in tune. ● The process of putting together a guitar, including the role of each part and how they are combined (neck, body, bridge, electronics, etc.). ● Different guitar bridge systems, how they function, and inherent advantages or disadvantages with each type. ●

<p><u>Knowledge:</u> Parts of a solid body guitar Hardware Drill bits Drill bit sizing Proper hardware tightening procedure Measurement with rulers and scales Measurement with feeler gauges Fret leveling procedure Luthier specific tools for assembly</p>	<p><u>Do/Skills:</u></p> <ul style="list-style-type: none"> ● Students will be able to... ● Properly select the appropriate drill bit size based off of the fastener used. ● Safely utilize tools and machines to assemble a solid body guitar. ● Properly attach a guitar neck to a guitar body using the appropriate means such as bolt-on, glued/set-in, or neck-through assembly. ● Secure the bridge to the body, ensuring proper string alignment, intonation, and tuning stability. ● Attach tuners and strap buttons to a guitar body in the proper locations and with all of the necessary hardware. ● Using the correct scale measurement properly pre-intonate the bridge. ● Properly install and tune the guitar strings ● Utilize luthier tools to properly level, crown, and polish the frets on a guitar. ● How to properly install the strings on a guitar, correct number of wraps, order and wrap direction.
<p><u>Vocabulary</u> Hardware, threads, UNF, UNC, Major diameter, Minor diameter, hardware lubrication, snug & tight vs over torquing/thread stripping, scale length, luthier tools, fret rocker, fret crowning file, fret polishing sticks, guitar scale straightedge, feeler gauges, Allen wrenches, set screw, hand tools</p>	<p><u>Core Resource:</u></p> <ul style="list-style-type: none"> ● Teacher created video content ● Schoology LMS ● Woodworking Lab Machinery ● Cordless Power Tools & hand tools ● Classroom Computers ● Adobe Illustrator ● Adobe Photoshop ● Vinyl Cutter ● Luthier tools for fret leveling, crowning and polishing
<p><u>Common Assessment(s):</u></p> <ul style="list-style-type: none"> ● Guitar Portfolio Page(s) <ul style="list-style-type: none"> ○ Guitar Assembly 	<p><u>Supplemental Resources:</u></p> <ul style="list-style-type: none"> ● YouTube Guitar Assembly content

<p>Grade, Subject/Course: Electric Guitar Design & Manufacturing 9-12</p>	
<p>Unit 5: Guitar Design & Manufacturing: Setup</p>	<p><u> X </u> Essential <u> </u> Important <u> </u> Compact</p>
<p>Big Idea: One of the most critical steps in creating a fully functioning guitar is to properly set the instrument up. While this process is not overly complicated each instrument does require personal attention to get right.</p>	
<p>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. 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.X Implement the best possible solution to a design using an explicit process.</p>	<p>Pacing: 3 Weeks</p>
<p>Essential Questions: UEQ: How is a guitar setup to play? LEQ: What is neck relief and how is the neck relief set initially? LEQ: What are the risks associated with setting the neck relief? LEQ: What is the process of setting the string height at the nut? LEQ: How is the neck relief set? LEQ: How is the string height at the neck achieved? LEQ: What are the starting height measurements for each of the 6 strings at the neck? LEQ: What is the procedure for setting the proper intonation of an electric guitar? LEQ: What are the distances the pickup should be adjusted from the strings?</p>	<p>Understandings: Students will know that...</p> <ul style="list-style-type: none"> ● How the truss rod functions and the importance of neck relief in ensuring smooth playability and comfort, especially when adjusting for string action ● The action of a guitar depends on guitar type, string type, neck relief, string nut height and string height at the neck ● Proper intonation is important so that the instrument is in tune with itself. ● Pickup height can affect signal quality, signal output, and sustain. ● Because of the natural variations in the wood of an instrument each instrument requires the same setup but often varies in the degrees of operation when setting them up.

<p><u>Knowledge:</u> Guitar setup Neck relief Dial caliper Accuracy Tolerance Initial setup Problem solving, Luthier Setup Tools Intonation</p>	<p><u>Do/Skills:</u> Students will be able to...</p> <ul style="list-style-type: none"> ● Make truss-rod adjustments to control the curvature of the neck to properly set the action of their guitar. ● File the nut so that there is about 0.020” clearance between the first fret and each of the guitar strings ● Adjust the height of the saddles so that the strings do not buzz and the action is correct at the neck of the guitar. ● Use an electronic tuner and properly adjust the saddles on their guitar to make sure that the instrument is intonated. ● Adjust the pickup height so that the pickups sound the best and produce the best signal while maintaining the p[roper sustain.
<p><u>Vocabulary:</u> Guitar Straight Edge, Fritz Ruler, Allen Wrenches, Feeler Gauges, Neck Relief, Guitar Action, Nut files, Tuner, Intonation, Sustain, dial caliper</p>	<p><u>Core Resources:</u></p> <ul style="list-style-type: none"> ● Teacher created video content ● Schoology LMS ● Woodworking Lab Machinery ● Cordless Power Tools & hand tools ● Luthier tools for guitar setup ● Guitar Amps
<p><u>Common Assessment(s):</u></p> <ul style="list-style-type: none"> ● Guitar Portfolio Page(s) <ul style="list-style-type: none"> ○ Guitar Setup ○ My Guitar 	<p><u>Supplemental Resources:</u></p> <ul style="list-style-type: none"> ● YouTube Guitar setup content

<p>Grade, Subject/Course: Electric Guitar Design & Manufacturing 9-12</p>	
<p>Unit 6: Guitar Technology: Utilizing the Technology</p>	<p><u> X </u> Essential <u> </u> Important <u> </u> Compact</p>
<p>Big Idea: An electric guitar is like any other piece of technology that requires knowledge of the technological system, knowledge of the artifact, and skill to operate effectively and efficiently.</p>	
<p>STEELS/Tech and Engineering Strand: 3.5.9-12.F Evaluate a technological innovation that arose from a specific society’s unique need or want.</p>	<p>Pacing: 2 Weeks</p>
<p>Essential Questions: UEQ: How can an Electric Guitar be used to create music? LEQ: What does standard E tuning mean when referring to a 6 string electric guitar? LEQ: How is the fretboard of a guitar laid out? LEQ: What is the proper way to hold a guitar? LEQ: What is the proper way to fret a string? LEQ: How is Guitar Tablature read? LEQ: What advanced techniques are used when playing tabs? LEQ: Where can you find free guitar tablature? LEQ: What can be done with an electric guitar signal? LEQ: How do amplifiers work to boost a guitar signal? LEQ: How can a guitar output signal be modified?</p>	<p>Understandings: Students will know that...</p> <ul style="list-style-type: none"> ● To play a guitar it will take practice and proper technique in order to get the most out of this technology. ● Guitar Tabs are one way to quickly be able to play a guitar. ● The signal produced by an electric guitar is relatively small, in order for it to be made usable it has to go through some sort of amplification. ● The output of an electric guitar can be modified to sound vastly different using pedals and other technologies.
<p>Knowledge: Guitar Tablature Guitar Chords Guitar Playing Techniques Guitar Amplifiers Guitar Pedal Effects</p>	<p>Do/Skills: Students will be able to...</p> <ul style="list-style-type: none"> ● Properly hold and fret a guitar ● Read and decipher guitar tablature ● Utilize guitar tablature to play a simple song with their instrument ● Correctly select and setup an amplifier to increase the signal of an electric guitar ● Modify a signal if they choose to distort the natural signal

Vocabulary:

Guitar standard tuning, frets, finger picking, strumming, tab notation, sheet music, hammer-on, pull-off, slides, mute, bend, vibrato, pinch harmonics

Core Resources:

- Guitar Amplifiers
- Guitar Effects pedals or simulators
- Guitar Tuners
- Classroom set of guitars
- Classroom computers with internet access

Common Assessment(s):

- Guitar Portfolio Page(s)
 - Guitar Practice

Supplemental Resources:

- Ultimate Guitar
- GuitarLessons.com