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**Year:** 2025
**Credits:** .25 Credits, Related Arts

| Pacing: | Goals: | Connection to Vision of a Lakewood Ranger: | Learning and Performance Expectations: | Vocabulary: | Assessment of Learning Options: | Resource Options: |
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| 5 days | ● Work in a team to solve an instant design challenge.<br>● Design, build, test, and modify an orthosis that stabilizes the ankle and foot<br>● Explore the steps of a design process.<br>● Use a decision matrix to evaluate product | ● Collaboration<br>● Communication<br>● Empathy<br>● Global Awareness/ Citizen | **Activity 1.1 Foot Orthosis Instant Design Challenge**<br>Students begin the unit with an instant design challenge where they work in teams to design, build, and test a foot orthosis. Students present their solutions to the class and together use a decision matrix to choose the solution that best meets the design requirements. Students are formally introduced to the design process and compare it to the process they followed. They reflect on their team collaboration to develop a set of team rules to follow throughout the unit. | ● Decision Matrix<br>● Design Process<br>● Iterative (design)<br>● Prototype<br>● Solution | Activity 1.1 Student Document | Activity 1.1: Foot Orthosis Instant Design Challenge Teacher Resource<br><br>Activity 1.1: Decision Matrix<br><br>Sensitivity Addressing Cerebral Palsy |

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| | prototypes. | | | | | |
| 5 days | ● Draw and interpret visual representations of objects.<br>● When designing products, move fluidly among real-world, isometric, and multiview sketches.<br>● Communicate information using engineering drawings and measurement conventions. | ● Communication<br>● Growth Mindset | **Activity 1.2 A Picture Is Worth a Thousand Words**<br>Students learn thumbnail, perspective, isometric, and multiview sketching as methods of modeling and communicating design ideas effectively without the use of technology. The activity ends with students using a multiview sketch to build a three-dimensional object with linking cubes and completing an isometric sketch of the object. | ● Annotation<br>● Dimension<br>● Isometric Sketch<br>● Multiview Sketch<br>● Orthographic Projection<br>● Three-Dimensional<br>● Thumbnail Sketch | Activity 1.2 Student Document | Isometric Graph Paper<br>Orthographic Graph Paper<br>Multiview Graph Paper<br>Isometric Sketching<br>Multiview Sketching |
| 5 days | ● Introduce U.S. | ● Collaboration | **Activity 1.3 Measuring Matters**<br>Students are introduced to both the | ● Dimensioning | Activity 1.3 Student | Skimmer Sketches |

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| | Customary and metric systems.<br>● Use a ruler to measure accurately.<br>● Read dimensions on a sketch.<br>● Use a dimensioned sketch to build a paper skimmer. | ● Communication | U.S. Customary and Metric systems and accurately measure with rulers in both systems. They then learn how to analyze a sketch with dimensions. They apply these skills to accurately build and launch paper skimmers that slide across the floor. Students record all results to determine which skimmer travels the farthest. | ● Hatch Mark<br>● Metric System<br>● U.S. Customary Standard system | Document | |
| 2 days | ● Define and apply statistical concepts of center and spread.<br>● Read and interpret a box and whisker | ● Communication | **Activity 1.4 Skimmer Statistics**<br>Students explore the principles of basic statistical analysis. They use technology to create box-and-whiskers plots to statistically analyze their skimmer launch results. | ● Box and Whiskers Plot<br>● Center (statistics)<br>● Mean (statistics)<br>● Median (statistics) | Activity 1.4 Student Document | Box and whiskers plotting with Google Sheets |

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| | graph.<br>● Construct a box and whisker graph to visually represent data.<br>● Consider how statistical analysis can inform the design process. | | | ● Population (statistics)<br>● Sample (statistics)<br>● Spread (statistics)<br>● Statistical Analysis (statistics) | | |
| 3 days | ● Perform a mechanical dissection of an object to understand its design.<br>● Use sketching to document and | ● Collaboration<br>● Communication<br>● Critical and Creative Thinking | **Project 1.6 Investigate the Inside** Students are presented with a design challenge for a client who wants to modify a foam cube toy for a child with retinoblastoma. To help this client, students work in teams to mechanically dissect the toy and sketch and dimension its pieces. Extension opportunities include students sketching and dimensioning modified toys. | ● Design Brief<br>● Documentation<br>● Mechanical Dissection | Project 1.6 Student Document | Investigate the Inside Design Brief<br>Puzzle Cubes<br>Isometric Graph Paper<br>Orthographic Graph Paper |

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| | communicate designs with accuracy. | | | | | |
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| 3 days | • Learn CAD software tools.<br>• Use measurement tools to change the size of objects.<br>• Create holes in an object.<br>• Add text to an object. | • Communication<br>• Creative and Critical Thinking | **Activity 2.1 Taking Modeling to Another Dimension**<br>Students are introduced to Tinkercad solid modeling software. They work through tutorials to explore the tools in Tinkercad, and then use their knowledge and skills to create their own name tag. | • Additive Method<br>• Scale<br>• Solid Modeling<br>• Translation | Activity 2.1 Student Document | Tinkercad Class Setup<br>Tinkercad |
| 2 days | • Create solid models of solid and hollow objects. | • Communication | **Activity 2.2 For Good Measure**<br>Students are introduced to additional methods of creating and modifying solid models. Using Tinkercad, they create a rectangular storage container of their choosing. Once | • Area<br>• Subtractive Method<br>• Surface Area | Activity 2.2 Student Document | Tinkercad |

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| | ● Calculate the surface area and volume of rectangular prisms. | | built, they learn how to calculate the volume of their storage container. Extension opportunities for students include enhancing their model or creating a storage container with a different shape and calculating its volume. | ● Volume | | |
| 4 days | ● Create a nest box solid model. | ● Communication<br>● Creative and Critical Thinking<br>● Global Awareness/ Citizen | **Activity 2.3 It's For the Birds**<br>Students are given a design challenge to build a solid model of a birdhouse. Students investigate bird habitat loss and follow a set of design requirements to 3D model a bird house that could be manufactured to help solve this problem. | ● Cavity Nesting Birds<br>● Engineer | Activity 2.3 Student Document | Tinkercad |
| 9 days | ● Follow a design process to effectively develop a design solution.<br>● Use a CAD application to create a 3D | ● Collaboration<br>● Communication<br>● Creative and Critical Thinking | **Project 2.4 Puzzle Cube Design Challenge**<br>Students use the design process to work in teams to design, build, and test a puzzle cube. Through this project, students use various types of modeling, such as sketching, solid modeling, prototyping, and mathematical modeling. | ● Constraint<br>● Criteria<br>● Design Statement<br>● Problem Statement | Project 2.4 Student Document<br>Project 2.4 Rubric | Linking Cubes<br>Tinkercad<br>2.4 Design Brief<br>3D Printer |

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| | model of a design solution.<br><br>● Create a prototype to test a solution. | | | | | |