Orange Public Schools

Office of STEM-Focused Learning

Curriculum Guide

PLTW Gateway
Green Architecture

Curriculum Framework

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Curriculum Framework – Gateway
Green Architecture – Lesson 1 Architectural Basics

<table>
<tr><th colspan="3">Desired Results (stage 1)</th></tr>
<tr><td rowspan="3">ESTABLISHED GOALS
It is expected that students will…

• G1 – Demonstrate an ability to identify, formulate, and solve engineering problems.
• G2 – Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
• G3 – Demonstrate an ability to design and conduct experiments, as well as to analyze and interpret data.
• G4 – Demonstrate an ability to apply knowledge of mathematics, science, and engineering.</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">TRANSFER: Students will be able to independently use their learning to …

• T1 – Apply principles and practices related to designing and documenting a structure.
• T2 – Apply techniques (measuring), skills (reading an architectural scale), and modern engineering tools (Revit) necessary for engineering practice.</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>UNDERSTANDINGS: Students will understand that …

• U1 – The ability to measure accurately is important at school and at home, at work, and when pursuing hobbies.
• U2 – Precision measuring tools are needed for accuracy, but tools must be used correctly to ensure that accurate measurements are taken.
• U3 – Quality of workmanship and accurate measurements with precise instruments are necessary to successfully solve problems.
• U4 – The use of scale is important in design in order to create a functional space that is proportional and aesthetically pleasing to the client.
• U5 – Dimensioning and measuring are required for any architectural project as well as many careers in related fields.</td><td>ESSENTIAL QUESTIONS: Students will keep considering …

• Q1 - Why is knowledge of area and perimeter important when designing and constructing a building?
• Q2 - Describe a potential consequence if you do not pay attention to accuracy and precision when designing and constructing a building.
• Q3 - How do architects pay attention to both form and function when designing and constructing a building?</td></tr>
</table>

Format guided by: Wiggins, G. & McTighe, J. (2011). The understanding by design guide to creating high quality units. Alexandria. VA: ASCD

<table>
<tr>
<td rowspan="3">

G5 – Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
G6 – Pursue the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
G7 – Demonstrate an understanding of professional and ethical responsibility.
G8 – Demonstrate an ability to function on multidisciplinary teams.
G9 – Demonstrate an ability to communicate effectively.
G10 – Gain knowledge of contemporary issues.
G11 – Recognize the need for, and develop an ability to engage in life-long learning.

</td>
<td>

U6 – Area and perimeter are used to find the square footage of a floor, a wall, or the length and width needed to build the exterior of a home.
U7 – When designing a home, standard rules must be followed in regards to traffic flow, room sizes and relationships, and the layout of kitchens and bathrooms.
U8 – A set of architectural plans includes: plot plan, foundation plan, floor plan, elevations, 3-D views, and construction details.

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<tr>
<td colspan="2">Acquisition</td>
</tr>
<tr>
<td>
KNOWLEDGE: Students will …

K1 – Identify the systems required in a residential home, including electrical, plumbing, heating, ventilation, and air conditioning. U7
K2 – Describe the three areas of a house and the rooms that belong to them. U7
K3 – Identify common roof styles. U7
K4 – Describe the working triangle and its purpose. U7
K5 – Identify and use appropriate symbols in a basic floor plan for a residential home. U8

</td>
<td>
SKILLS: Students will …

S1 – Demonstrate the proper use of a standard ruler and an architectural scale. U1, U2, U3, U4, U5
S2 – Use proper notation in regards to dimensioning an architectural drawing. U1, U2, U3, U4, U5
S3 – Calculate area and perimeter of a floor plan given dimensions. U6
S4 – Measure a room and draw it to scale using common symbols. U2, U3, U4, U5, U6, U7
S5 – Read and interpret a blueprint of a floor plan. U7, U8

</td>
</tr>
</table>

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Evidence *(stage 2)*		
Activities (A) Projects (P) Problems(B)	Assessment FOR Learning	Assessment OF Learning
A.7.1.1 Measuring Practice	• Essential Questions	• Conclusion Questions
A.7.1.2 Architectural Measurement	• Essential Questions	• Conclusion Questions
A.7.1.3 Architectural Dimensioning	• Essential Questions	• Conclusion Questions
A.7.1.4 Measuring Your Classroom	• Essential Questions	• Conclusion Questions
A.7.1.5 Using Autodesk Revit – Creating Your Classroom Tutorial	• Essential Questions	• Conclusion Questions
A.7.1.6 Estimating Flooring Materials	• Essential Questions	• Conclusion Questions
A.7.1.7 Bedroom Floor Plan Homework	• Essential Questions	• Conclusion Questions
A.7.1.8 Fundamentals of Construction	• Essential Questions	• Conclusion Questions
A.7.1.9 Reading a Floor Plan	• Essential Questions	• Conclusion Questions
A.7.1.10 Room Sizes and Relationships Study Guide	• Essential Questions	• Conclusion Questions
P 7.1.11 My Bedroom Using Revit	• Essential Questions	• Conclusion Questions
P 7.1.12 Bedroom Remodeling	• Essential Questions	• Conclusion Questions

Learning Plan *(stage 3)*	
Activities (A) Projects (P) Problems(B)	Knowledge and Skills
A.7.1.1 Measuring Practice	S1, S2
A.7.1.2 Architectural Measurement	S1, S2
A.7.1.3 Architectural Dimensioning	S2, S3
A.7.1.4 Measuring Your Classroom	S2, S3, S4
A.7.1.5 Using Autodesk Revit – Creating Your Classroom Tutorial	S4
A.7.1.6 Estimating Flooring Materials	S3, S4
A.7.1.7 Bedroom Floor Plan Homework	S1, S2, S3, S4
A.7.1.8 Fundamentals of Construction	K1, S5
A.7.1.9 Reading a Floor Plan	K1, S5
A.7.1.10 Room Sizes and Relationships Study Guide	K1, K2, K3, K4, S5
P 7.1.11 My Bedroom Using Revit	K5, S4, S5
P 7.1.12 Bedroom Remodeling	K5, S4, S5

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Curriculum Framework – Gateway
Green Architecture – Lesson 2 Introduction to Sustainability and Architecture

<table>
<tr><th colspan="3">Desired Results (stage 1)</th></tr>
<tr><td rowspan="3">ESTABLISHED GOALS
It is expected that students will…

• G1 – Demonstrate an ability to identify, formulate, and solve engineering problems.
• G2 – Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
• G3 – Demonstrate an ability to design and conduct experiments, as well as to analyze and interpret data.
• G4 – Demonstrate an ability to apply knowledge of mathematics, science, and engineering.
• G5 – Demonstrate an ability to use the techniques, skills, and modern engineering tools</td><td colspan="2">Transfer
TRANFER: Students will be able to independently use their learning to …

• T1 – Make informed decisions about environmentally friendly construction and its impact on the economy, human health and society.</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>UNDERSTANDINGS: Students will understand that …

• U1 – Sustainable building solutions are an important part of the world today as our resources are dwindling.
• U2 – Many different processes are used to recycle a variety of materials.
• U3 – Researching the various recycling processes helps one better understand the requirements and the complexity of recycling processes.
• U4 – The air we breathe inside a room can contain contaminants and particles, making it potentially dangerous for humans.
• U5 – The health consequences of poor indoor air quality include coughs, colds, cancer, and even death.
• U6 – Building green refers to methods of fabricating both commercial and residential structures to reduce their impact on human health and the natural environment.
• U7 – Architectural designs are created based on the needs of humans and function of the building in relationship to the climate, region, and culture.</td><td>ESSENTIAL QUESTIONS: Students will keep considering …

• Q1 - Where do the products that you recycle end up?
• Q2 - How does the air you breathe every day affect your health?
• Q3 - What can you do to make the environment better for future generations?
• Q4 – How can you remodel a house to make it more “green”?</td></tr>
</table>

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<table>
<tr>
<td rowspan="3">necessary for engineering practice.
• G6 – Pursue the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
• G7 – Demonstrate an understanding of professional and ethical responsibility.
• G8 – Demonstrate an ability to function on multidisciplinary teams.
• G9 – Demonstrate an ability to communicate effectively.
• G10 – Gain knowledge of contemporary issues.
• G11 – Recognize the need for, and develop an ability to engage in life-long learning.</td>
<td colspan="2">• U8 – Within a local community there can be a variety of construction materials and architectural styles depending on purpose.
• U9 – Architects, engineers, designers, and engineering technologists are in high demand for the development of future technology to meet societal needs and wants.</td>
</tr>
<tr>
<td colspan="2">Acquisition</td>
</tr>
<tr>
<td>KNOWLEDGE: Students will …

• K1 – Describe the steps of the recycling system. U2, U3
• K2 – List ways to improve indoor air quality. U4, U5
• K3 – Explain the consequences of poor indoor air quality. U4, U5
• K4 – Identify the local home styles in the region and outside of the region. U7, U8
• K5 – Describe different house styles and how they can be built green. U7, U8</td>
<td>SKILLS: Students will …

• S1 – Communicate, using a variety of media, the effects that daily living has on the environment. U1, U2, U3, U4, U5
• S2 – Categorize concepts related to building eco-friendly. U6, U7, U8
• S3 – Provide examples of STEM careers and the need for these professionals in our society. U9</td>
</tr>
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Evidence *(stage 2)*		
Activities (A) Projects (P) Problems(B)	Assessment FOR Learning	Assessment OF Learning
A 7.2.1 Rebuilding Grennsburg	• Essential Questions	• Conclusion Questions
A 7.2.2 Green Vocabulary	• Essential Questions	• Conclusion Questions
A 7.2.3 Why Recycle?	• Essential Questions	• Conclusion Questions
A 7.2.4 Save the Earth Comic Strip	• Essential Questions	• Conclusion Questions
A 7.2.5 Indoor Air Quality	• Essential Questions	• Conclusion Questions
A 7.2.6 Building Green	• Essential Questions	• Conclusion Questions
A 7.2.7 House Styles	• Essential Questions	• Conclusion Questions
A 1.1.5 Engineering Careers	• Essential Questions	• Conclusion Questions

Learning Plan *(stage 3)*	
Activities (A) Projects (P) Problems(B)	Knowledge and Skills
A 7.2.1 Rebuilding Grennsburg	S1
A 7.2.2 Green Vocabulary	S1
A 7.2.3 Why Recycle?	K1, S1
A 7.2.4 Save the Earth Comic Strip	K1, S1
A 7.2.5 Indoor Air Quality	K2, K3, S1
A 7.2.6 Building Green	S2
A 7.2.7 House Styles	K4, K5
A 1.1.5 Engineering Careers	S3

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Curriculum Framework – Gateway
Green Architecture – Lesson 3 Architectural Challenge

Desired Results *(stage 1)*

ESTABLISHED GOALS
It is expected that students will…

- G1 – Demonstrate an ability to identify, formulate, and solve engineering problems.
- G2 – Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- G3 – Demonstrate an ability to design and conduct experiments, as well as to analyze and interpret data.
- G4 – Demonstrate an ability to apply knowledge of mathematics, science, and engineering.
- G5 – Demonstrate an ability to use the techniques, skills, and modern engineering tools

Transfer

TRANSFER: *Students will be able to independently use their learning to …*

- T1 – Design a sustainable home using repurposed materials.
- T2 – Design and conduct experiments, analyze and interpret data to determine the best building material and insulation for an energy-efficient home.

Meaning

UNDERSTANDINGS: *Students will understand that …*

- U1 – The ability to measure precisely and accurately is important at school and at home, at work, and when pursuing hobbies.
- U2 – Numerous symbols are part of architectural plans. It is important to be able to identify such symbols.
- U3 – Wood frame construction is popular because it is economical and strong.
- U4 – Using graph paper and an architectural scale can help in the visualization of a space before the start of the prototype phase.
- U5 – Architecture today uses computer-aided design (CAD) systems to quickly generate and annotate working drawings.
- U6 – Three-dimensional computer modeling uses descriptive geometry, geometric relationships, and dimensions to communicate an idea or solution to a technological problem.

ESSENTIAL QUESTIONS: *Students will keep considering …*

- Q1 –What are the advantages and disadvantages of using repurposed materials, such as a shipping container, for constructing living or work space?
- Q2 - What materials are used in construction to improve the energy-efficiency of a building?
- Q3 - How is the environment affected by shipping containers sitting on the dock?

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• G7 – Demonstrate an understanding of professional and ethical responsibility.
• G8 – Demonstrate an ability to function on multidisciplinary teams.
• G9 – Demonstrate an ability to communicate effectively.
• G10 – Gain knowledge of contemporary issues.
• G11 – Recognize the need for, and develop an ability to engage in life-long learning.</td>
<td>• U7 – Using alternative materials in construction is beneficial to our environment.
• U8 – Architecture and construction emphasize using environmentally friendly practices in their career fields.
• U9 – Architects and engineers use the design process when designing and building structures.
• U10 – Shipping containers stack up as waste unless they are repurposed; they offer many benefits as construction materials that are strong, water proof, pest proof, recycled, easy to build with, etc.
• U11 – Creating a functional and environmentally friendly home is considered sustainable housing that could be adapted for emergency shelter in disaster areas.</td>
<td></td>
</tr>
<tr>
<td colspan="2">Acquisition</td>
</tr>
<tr>
<td>KNOWLEDGE: Students will …

• K1 – Demonstrate knowledge of measurement, construction, and design. U2, U4
• K2 – Identify the parts of a wall section. U3</td>
<td>SKILLS: Students will …

• S1 – Measure accurately using a tape measure and architectural scale. U1
• S2 – Read and interpret a blueprint of a floor plan. U2
• S3 – Construct a model of the framing of a wall section. U3
• S4 – Demonstrate use of the Design Process including a Design Brief, Sketching, and Decision Making Matrix. U4, U9
• S5 – Use Autodesk Revit Architecture to create an architectural drawing. U5, U6
• S6 – Design an environmentally friendly home U7, U8, U9, U10, U11</td>
</tr>
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Evidence *(stage 2)*		
Activities (A) Projects (P) Problems(B)	Assessment FOR Learning	Assessment OF Learning
A.7.3.1 Wood Frame Construction	• Essential Questions	• Conclusion Questions
A 7.3.2 Building a Shed (Wall)	• Essential Questions	• Conclusion Questions
A 7.3.3 Why Insulate?	• Essential Questions	• Conclusion Questions
B 7.3.4 Shipping Container Home	• Essential Questions • Shipping Container Rubric	• Conclusion Questions • Shipping Container Rubric

Learning Plan *(stage 3)*	
Activities (A) Projects (P) Problems(B)	Knowledge and Skills
A.7.3.1 Wood Frame Construction	K1, K2, S1
A 7.3.2 Building a Shed (Wall)	K1, K2, S1, S2, S3
A 7.3.3 Why Insulate?	K1, K2, S1, S2, S3
B 7.3.4 Shipping Container Home	K1, S2, S4, S5, S6

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