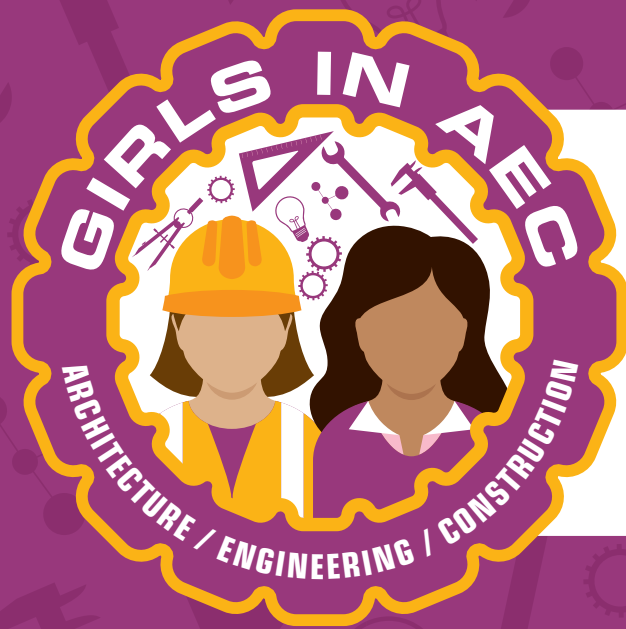




girl scouts
in the heart
of pennsylvania



BADGE REQUIREMENTS AND RESOURCES



What's in your tool box?



JEM Group, Warehaus, LIVIC Civil and Girl Scouts in the Heart of Pennsylvania partnered to develop the “What’s in your Toolbox” patch program. It will inspire Girl Scouts to learn more about architecture, engineering, and construction, and explore careers in the design and construction industry.



HELLO!

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Introduction

The patch program aligns with the Girl Scout Leadership Experience to achieve the following goals:

Discover:

Seek opportunities to learn about history, planning, creativity, mathematics, and problem solving.

Connect:

Collaborate with others to expand your knowledge of a building and systems that support both residential and commercial buildings.

Take Action:

Do something to support architectural preservation, public safety and building use or limit the carbon footprint of a building in the environment.

This patch program manual is for both the Girl Scout and the facilitator. It serves as a guide through the activities to complete the “What’s in your Toolbox” patch. It is a three-step process. All Girl Scouts will complete the step one activities. Step two and step three activities are age appropriate. Select one of the three activities provided for your age group.

Safety should always be the top priority in this patch program. Adults should review the Safety Activity Checkpoints manual to follow Girl Scout safety standards and guidelines. The intent is to provide a safe and positive experience for the girls.



Who Are You And What Do You Do?

When it comes to creating a new structure or renovating an old one of really any type, you need professionals to design and construct it to make sure it is functional and safe. The services of an architect, engineer, and contractor are required in most cases. Below are simple brief descriptions of each profession and what they do to support the design of a structure.

Structure could be anything from a building or bridge to a sculpture or water dam.

Architects are individuals who are experts in structure design. Architects focus on the function (or use) of a building and its impact on the five senses. The function of a building could be like a home, school, or hospital as an example. Each building has different types of “spaces” that are needed to perform its job. A school needs spaces like classrooms to support the teacher in teaching the students. You do not need a classroom in a hospital. You need exam rooms in a hospital to help a doctor or nurse help sick people. The impact on your five senses is like how you feel when you are in the space. Is it too loud? Are the colors calming? Do you see daylight? Does it smell moldy or fresh and clean? Are there materials of different types you can touch? Can you smell lunch cooking or coffee brewing that is making you hungry?

Engineers take the architects design and gives it beautiful surroundings and connects it to other spaces outside. There are four basic types of engineers that are involved in the creation of a structure. **CIVIL ENGINEERS** help create beautiful surroundings outside the building. This could be through what is called landscaping or planting plants/trees and creation of sidewalks and roadways to connect one building to another or through simply controlling all the rainwater that comes out of the sky, so flooding does not happen. **STRUCTURAL ENGINEERS** create the “bones” or “skeleton” of the structure that holds it up. Sometimes you can see those bones and sometimes they are hidden. Things you might see are called columns, trusses, or beams. **MECHANICAL ENGINEERS** create the clean air we need to breathe inside a building. They also design the heating and cooling systems to create comfortable temperatures. **ELECTRICAL ENGINEERS** design the power that is needed to light up a building and power up all the equipment. **PLUMBING ENGINEERS** create the piping in a building needed to provide fresh water we need at drinking fountains or sinks and piping we need to take away dirty water like in toilets. The term **MEP** is used in the industry to represent the combined effort of the **M**echanical, **E**lectrical, and **P**lumbing Engineering systems.

Contractors are men and women that read the drawings created by the Architects and Engineers and make a plan to build the structure. They have many responsibilities and steps in their job from budgeting the project to ordering all the material and making sure it is built properly with no injuries to the workers during the construction.



JESSICA MEYERS,
Owner/President

MEET A CONTRACTOR

JEM GROUP - A construction contractor plays an important role in building structures that shape our world. Jessica Meyers, CEO, started the business in 2003, as one of the first certified Women Business Enterprise construction firms in Pennsylvania! At each step, planning from the ground up is thorough and thoughtful with delivery at the highest quality.



ERIN HIMMELBERGER,
Architectural Practice Lead

MEET AN ARCHITECT

WAREHAUS – An architect provides the vision and direction of the structure from the start. They seek to understand the owners needs and make sure that the structure is design with purpose and feeling for all that will experience it. Erin Himmelberger, Architectural Practice Lead, started her career after college in 1997 in a male dominated industry and help set the bar with functional healthy buildings.



CATHERINE WILSBACH,
Civil Engineer

MEET AN ENGINEER

LIVIC – A civil engineer is the puzzle solver of the world. Not only do they support the creation of individual structures placement in the environment, but they also connect all buildings and areas of the world together through bridges, highways and tunnels. Catherine Wilbach, Civil Engineer, began her journey after graduating from Georgia Tech. Every day she makes a direct positive impact on the environment around her through thoughtful engineering that allows progression of construction while preserving our fragile natural environment for future generations to enjoy.





STEP 1

All Grade Levels

All age groups must complete all activities in this section.



Step 1

PATCH REQUIREMENTS (ALL GRADE LEVELS)

Complete ALL of the activities listed as an introduction to all parts of the Architectural, Engineering and Construction Industry.



Contractor

Identify women who work in either the architecture, engineering or construction trade and invite them to speak to your troop about their career. Another idea is to ask the girls if they have any careers they would like to hear about and then try and find speakers from those fields specifically. Before they come to speak, have the troop develop a list of questions they want to ask. This activity will help give them a feeling of what an Interview might be like later in life.

Print the worksheet of basic construction hand tools and safety PPE for the girl scouts to complete. Provide a copy of it to your speaker. Ask your speaker if they can bring some of the tools on the worksheet and demonstrate or discuss how they are used with the group during their visit.

Sample questions can include:

- Why did you choose to work in your industry?
- What has been the most surprising part of being a woman working in your role?
- What is your favorite part of your career?
- What led you to choose this career path?
- What is your favorite project you have worked on?
- What has been most challenging?
- What advice would you give to us?

Materials:

- telephone
- pen/pencil
- [tools worksheet \(Pg 35\)](#)
- tools as required in the worksheet for the activity
- Computer to Research to find a tour host (hint: Google Architect near me, or Contractor near me)

Resources:

Industry Associations:

<https://www.usgbc.org/community/usgbc-central-pennsylvania>; <https://philadelphia.uli.org/about/contact-us/>

Construction:

<https://nawicscpa.org/contact/>, <https://abckeystone.org/>, <https://www.asacentralpa.com/>

Architects:

<https://www.aia.org/firm-directory?query=>

Engineers:

<https://ashraeregion3.com/chapters/>, <https://www.womeninmanufacturing.org/wim-central-pennsylvania>, <https://www.ashe.org/>

Step 1

PATCH REQUIREMENTS (ALL GRADE LEVELS)

Complete ALL of the activities listed as an introduction to all parts of the Architectural, Engineering and Construction Industry.

Architecture, Structural & MEP Engineering

Download and print the activity [symbols worksheet \(Pg37\)](#) provided and study the symbols. They will be needed to support the activities in Step 2 and 3. Complete the worksheet individually or as a group.

Mechanical, Electrical and Plumbing (MEP) systems within a building provide daily FUNCTION along with the architecture. Mechanical items provide fresh clean temperature-controlled air within a building. Electrical items provide the Power and Lighting needed within a building. Plumbing items provide fresh water and disposal of dirty water in a building. Download the activity [symbols worksheet \(Pg37\)](#) and match the item to the name. Talk about each item and if each is Mechanical, Electrical or Plumbing (MEP) related. Walk around your house or you're building your troop meeting is in and identify more items and discuss them as a group.

Download the activity [architectural roof styles worksheet \(Pg 39\)](#) and match the photo to the key.

Watch the video provided in resources about the 40 Types of Architectural Styles.

Materials:

- pen/pencil
- [symbols worksheet \(Pg 37\)](#)
- [architectural roof styles worksheet \(Pg 39\)](#)

Resources:

<https://www.youtube.com/watch?v=n4dZduYMD9E>



Step 1

PATCH REQUIREMENTS (ALL GRADE LEVELS)

Complete ALL of the activities listed as an introduction to all parts of the Architectural, Engineering and Construction Industry.

Civil Engineer

Research two (2) women who made significant contributions to the architecture, engineering or construction trade. Prepare a presentation on these women to the troop and prepare questions you would ask these women if you could interview them today.

Activity:

Build a Miniature City. Introduce kids to the concept of civil engineering and urban planning through a creative and hands-on activity of building a miniature city. Perhaps use Legos to built little buildings and tag each one with a name and purpose and talk about how they support a City/Community (church, school, bank, pharmacy, hospital, grocery store, factory, houses, etc.)

Think about what you would want to live next to, what would you like to not live next to. Think of where streets and sidewalks could be located connecting the buildings.

Materials:

- computer or phone for research
- printer
- paper
- legos
- crayons or markers





STEP

All Grade Levels

2

Select and complete ONE of the activities listed for your troop level.

Step 2

PATCH REQUIREMENTS (DAISY/BROWNIE - K-3)

Materials:

- printer
- paper
- crayons or markers
- [worksheet \(Pg 41\)](#)

Contractor

Both the human body and a house have similar systems! Just like your house has different systems to keep it running smoothly, our bodies also have various parts that work together to keep us healthy and functioning.

Brainstorm a list of body systems and their functions (e.g., skeletal, digestive). Then identify household systems (e.g., heating, plumbing, electrical) and discuss how these can compare to human anatomy.

Each group can match similar systems to understand the analogy.

Ask girls what they learned from comparing their body parts to house systems. Encourage them to share their thoughts on the importance of different body parts and how they work together.

Activity:

You must take care of your body to help it grow and last for years and years. Buildings are the same way. How does your body compare to buildings? Draw, color, or paint a picture of a building or house. When adding the elements in your artwork, consider how the items below are like elements of a building:

- Façade (outside walls) = Face
- Roof = Hair
- Door = Mouth
- Windows = Eyes & Ears
- Siding or Brick = Skin
- Structural Framework = Skeleton
- Electrical System = Nervous System
- Plumbing System = Digestive System
- Ventilation = Respiratory System



Step 2

PATCH REQUIREMENTS (DAISY/BROWNIE - K-3)

Complete BOTH of the activities listed:



Architecture, Structural & MEP Engineering

Draw a floor plan of your bedroom. Print the graph paper provided or provide your own and draw a floor plan of your bedroom. Locate furniture items, windows, doors. Measure the overall width and length of the room and write that on the floor plan. If you share a bedroom with a sibling, mark your name on your bed and your siblings' name on theirs.

Don't forget to include your closet if you have one in your room as well!

Print and cut out the paper house template worksheet. Fold and tape/glue it together on the tabs to make a 3D house. Don't forget to add some color with pencils or markers before you fold it up and tape/glue it together!

The link in resources will help you explain a floor plan to the kids.

Materials:

- [Graph Paper \(pg 34\)](#)
- Colored markers or pencils
- Rulers
- measuring tape

- [Paper House Printable \(Pg 43\)](#)
- Colored markers or pencils
- scissors
- glue or clear tape

Resources:

<https://www.youtube.com/watch?v=2IzbSUNwZjs>



Step 2

PATCH REQUIREMENTS (DAISY/BROWNIE - K-3)

Materials:

- imagination
- ears for listening
- brain for thinking
- mouth for discussing
- respect for ideas from others

Civil Engineer

Civil Engineers and other designers have to solve problems for their projects everyday. Let's do an activity that gets the girl scouts through a process where they can evaluate/ identify a problem, brainstorm possible solutions and then Plan for the Solution to be completed.

Ask

Think of a problem you encountered today. Write down your thoughts or discuss them with others. (example problems provided in resources)

- What is the problem (or the challenge)?
- Why is it important to find a solution (note that not every challenge or problem will solve a real-world problem as kiddos are starting)?

Imagine

Brainstorm as many ideas as you can think of how to solve the problem and write them down. Sometimes your best idea will not be the first or second thing you think of.

- What are possible solutions?
- What information do I need to know?

Plan

Decide which possible solution you want to use from your brainstorm above. Think about what might be difficult about the solution and what would make it the best idea to try first.

Write out a plan for your solution project. List what materials you may need and draw a diagram if applicable. Make sure to label the items in your diagram.

- What materials do I need?
- What tasks do I need to do?

Resources:

Example Problem A:

You have to take your puppy to the dog park every day for some exercise. But the walking path to the dog park has a little dip in it that when it rains it gets deep with muddy water. Both your shoes and your puppy get wet every time when you try to cross. What can you do to not get wet?

Example Problem B:

The swing set at your favorite park has wood mulch over dirt and when the kids play they drag their feet and the mulch gets pushed away and a dirt hole is made down further into the ground. When it rains it then fills with water and takes forever to dry and you can't use your swings until its dry. What could you do to fix the problem?



Step 2

PATCH REQUIREMENTS (JUNOR/CADETTE – 4-8)

Complete ONE of the activities listed:

Contractor

Scavenger hunt

Oh no, you sprung a leak in your bathroom! You need to remodel! It's time to create a construction plan! First step is to brainstorm your design. Will you remove and replace items? How much do you have to spend?

This activity can be done online or at your local hardware store. Find materials you need for your project. See how much money it costs to get what you have planned in your project. Remember, you have options and some materials cost more than others. Learn where you can save money.

Safety first

It's so important to make sure your project gets done right, on time and safely! Find a construction site and observe what you see from a safe distance. Is there a fence? What other barriers are in place? Where do you spot bright colors? Do you see hard hats? Take notes on what you see that is keeping everyone safe.

Think about how your troop stays safe! Come up with a list of situations where you can put your own safety rules in place.

Resources:

For online scavenger hunt:

<https://www.lowes.com>

<https://www.homedepot.com>

<https://www.acehardware.com>

Materials:

- computer or phone for research or transportation to hardware store
- paper
- calculator
- pen/pencil
- [budget worksheet \(pg 45\)](#)



Step 2

PATCH REQUIREMENTS (JUNOR/CADETTE - 4-8)

Materials:

- [Graph Paper \(Pg 34\)](#)
- Measuring Tape
- Pen/Pencil
- Ruler
- Phone/Camera for picture
- clear tape
- color pencils/crayons/markers

Resources:

<https://www.youtube.com/watch?v=2IzbSUNwZjs>

Architecture, Structural & MEP Engineering

Individually or as a Group, draw a floor plan of one level of your home or possibly even the place your troop meetings are held.

Measure each room and use graph paper to draw it to a scale. Indicate windows, doors, cabinets, and plumbing fixtures. Measure the overall width and length of the room and write those measurements on the floor plan along with room identification tag (Troop Leaders and helpers can help reinforce reading the tape measure correctly). If you need to, print multiple pieces of graph paper and tape them together from the back so you can get a sheet big enough for the entire floor plan.

Draw a front elevation of your home or a friend's home. Use graph paper as a guide and draw the structure in elevation showing "approximate scale". This means we don't want you climbing ladders to measure the outside of your house. You can measure a brick or row of siding that is down low and then count how many you have between two points to represent "scale". This will provide a close representation of the elevation without safety danger. When you are done, take a picture of the same elevation and compare how close you got! Share with your group your before and after comparison.





Step 2

PATCH REQUIREMENTS (JUNOR/CADETTE - 4-8)

Civil Engineer

City Planning Adventure

A city planning simulation introducing key aspects and considerations involved in designing and organizing a city.

Instructions:

1. Begin a brainstorming session, where each student shares their ideas for the city they want to design.
2. Discuss essential city elements and features, such as green spaces, transportation, schools, business hubs, industrial uses, community centers manufacturing plants, banks, parks, hospitals, churches, etc.
3. Use the large poster paper or cardboard sheet and colored markers or pencils and draw their city map (i.e. label the areas where each of the city elements will be located), including various elements and features they discussed during the brainstorming session.
4. Create separate cut-outs or drawings of the city elements they wish to include (e.g., parks, schools, roads). Using construction paper, safety scissors, and glue sticks. Label each element to make it easy to identify on the city map.
5. Present their city plan to the troop; explain their city's layout, key features, and why they chose specific elements.
6. After all presentations, discuss the different city designs including similarities and differences between the city plans and why they made particular choices.

Materials:

- Large poster paper or cardboard sheets
- Colored markers or pencils
- Rulers
- Construction paper
- Safety scissors
- Glue stick
- Pictures or drawings of various city elements (parks, schools, residential areas, roads, etc.)



Step 2

PATCH REQUIREMENTS (SENIOR/AMBASSADORS - 9-12)

Contractor

Let's build a tree house!

Every project costs money. Learn how to estimate a budget. The budget is the total amount of money you'll need to finish a project. Use the steps below to plan in steps:

Design your dream treehouse!
Check all elements you want in your treehouse. Add the total costs to build.

Alternate Activity: Your family has set a budget of \$100 to build a treehouse. Choose materials that will stay within budget.



Materials:

- [Treehouse Pricing Sheet \(Pg 48\)](#)
- Pencil/Pen
- Calculator
- [Graph Paper \(Pg 34\)](#)
- Computer/Phone for Pricing Research

Resources:

For online materials:

<https://www.lowes.com>

<https://www.homedepot.com>

<https://www.acehardware.com>



Step 2

PATCH REQUIREMENTS (SENIOR/AMBASSADORS - 9-12)



Architecture, Structural & MEP Engineering

Time to use your imagination! Draw a floor plan that includes the following program elements. Make sure you include windows, doors, cabinets, furniture, and plumbing fixtures in your floor plan:

- Two bedrooms, (each with a closet)
- One (1) full bathroom with a tub or shower (connected to the Master Bedroom)
- One (1) half bath with a sink and toilet only
- Kitchen with refrigerator/stove/sink and island
- Living Room
- Dining Room for 4 people minimum

Draw the front elevation of a home to a scale (real or imaginative). Color your completed elevation with colored pencil and indicate what finish materials you would use (stone, siding, etc).

Can you take your floor plan and build 3D cardboard walls around it and put a roof on it? How cool if you could lift the roof off and see your floor plan inside!

Materials:

- [Graph Paper \(Pg 34\)](#)
- Ruler/Drafting Scale
- Paper
- Pen/Pencil
- Scissors
- Markers
- Colored Pencils,
- Tape/Glue
- Measuring Tape



Step 2

PATCH REQUIREMENTS (SENIOR/AMBASSADORS – 9-12)

Civil Engineer

Think about a candy wrapper or a milk jug. What happens to it after you've thrown it out or put it in recycling? The odds are good that the answer, in many cases, is...nothing. Many materials can't be used again. And although we've become more aware of the importance of recycling, we're still not doing it nearly enough.

Some engineers are thinking bigger: What if everything we use gets made into something we can use again, so it never goes into the garbage? What if we only used materials that are easy to repurpose and don't generate pollution? Thinking this way is the basis of what's called the circular economy. It is an answer to our garbage and pollution crisis. In a circular economy, we behave like nature, where nothing is wasted, and everything is constantly reused in one form or another.

We challenge you to use materials from your household garbage or recycling and design a prototype for something that people can enjoy or use.

There are two restraints for this challenge (an engineering constraint is a limitation on your design):

- Use only materials from recycling or garbage that can be cleaned.
- Use only materials that don't have sharp edges or are dangerous to handle.

Instructions:

Brainstorm

Sometimes the hardest step is deciding what you want to make—do you want to design a game or toy people can play with? Or something for your pet? Or is there a small problem you want to solve, like keeping your toys organized? Here are some examples to help give you ideas:

- birdhouse starting with a milk carton or plastic soda bottle
- pen/pencil holder starting with a cardboard tube
- wind chime starting with bottle caps
- jewelry holder starting with a cardboard box
- picture frame starting with popsicle sticks
- bookshelf starting with used pallets
- backpack starting with an old hoodie
- cat scratcher starting with cardboard boxes

Look at the wide variety of stuff in your garbage and recycling. Pick out some things that are pretty easy to clean. What are their different properties? Strong? Stiff? Flimsy? See-through? Imagine some ways these materials could be combined into a whole new object.

Draw a few designs you could make out of these materials.

Build and Test

As you're building, you might discover that you need to modify your design, or you might need to rethink how you're using the materials you collected or adjust them in some way. That's okay! Lots of times, things don't work out as we planned, and we need to make changes along the way.

When you're ready, test your design. How did it work?

Make Changes and Try Again!

Did it work the way you hoped? Think about changes to your design, exploring different materials, or starting over! Engineers rarely get it right on the first try. They learn from their mistakes and keep trying.

Materials:

- Stuff that usually ends up in garbage or recycling that you can clean and dry, such as:
- Paper bags
- Plastic bags, containers, wrappers, and beverage holders
- Cans
- Used paper
- Newspaper and magazines
- Cardboard
- Egg cartons
- Plastic bottles
- Toilet paper and paper towel rolls
- Stuff to hold things together, such as:
- String
- Ribbon
- Thread
- Shoelaces
- Elmer's glue (it's biodegradable)
- Gummed paper tape (plastic tape can't be recycled and doesn't biodegrade)
- Safety pins





STEP 3

All Grade Levels

Select and complete ONE of the activities listed for your troop level.



Step 3

PATCH REQUIREMENTS
(DAISY/BROWNIE - K-3)



Contractor

Everyone needs a place to live right!? Even the birds. Generate a list of materials you will need to build, hang and decorate a bird house. Apply a cost to each item that needs to be purchased to complete your project. Total the cost and then go shopping for your supplies (or order online).

Don't forget sales tax and shipping costs! Estimate how long it will take you to complete your build (don't forget time to let the paint dry). Did you stay in budget? Did you meet your deadline of time? What went wrong? Don't forget to hang it where it will be protected from the weather for the durability of your house.

Materials:

- Glue for Birdhouse,
- Paints or Markers for Decoration,
- String for Hanging,
- Clear Spray Paint to seal it for use outside
- Computer/Phone for Research of Materials
- [Budget Worksheet \(Pg 45\)](#)
- Pen/Pencil

Resources:

Bird House Kit
[LINK](#)

Step 3

PATCH REQUIREMENTS (DAISY/BROWNIE - K-3)

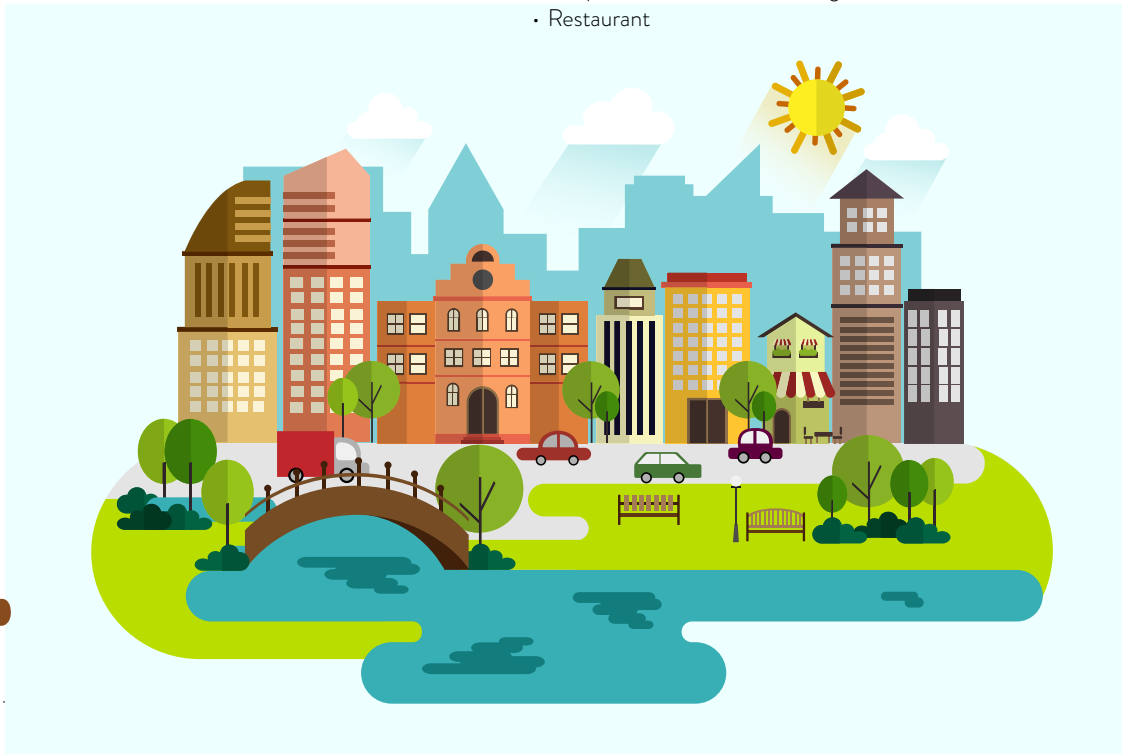
Architecture, Structural & MEP Engineering

A commercial building is any building that serves and provides the public a space to generate income or provide the public with a service. Go out exploring with your Troop or a parent and take a picture of one building that provides each of the following services for the public. Print your pictures and create a collage of all the different types of buildings you took photos of. Share your photos with your troop and talk about what services are provided in those buildings and why they are important to the public. If the weather is not cooperating to allow a physical trip to collect photos, collect photos off the internet.

- School or Educational Building
- Library
- Apartment Building
- Government Building like a Firehouse, Post Office or Courthouse
- Factory or Warehouse
- Hospital or Healthcare Building
- Restaurant

Materials:

- Walking Legs and/or Car
- Camera/Cell Phone Camera,
- Printer,
- Poster Board,
- Glue
- Scissors,
- Markers
- Computer and Internet for bad weather.



Step 3

PATCH REQUIREMENTS (DAISY/BROWNIE - K-3)

Civil Engineer

Civil Engineering Scavenger Hunt

Take a walk through the neighborhood or around the school, keeping an eye out for various civil engineering structures.

Observe and record one of each of the following structures:

- Roads and sidewalks: Identify the different types of roads and any road signs they come across.
- Bridges: Look for bridges over streams, rivers, or roads.
- Parks and playgrounds: Note the design and construction of play structures and recreational areas.
- Buildings: Observe the architecture and construction of nearby buildings.
- Streetlights and traffic signals: Explain their significance in ensuring safety on the roads.

At each location, draw what you see and write a brief description of the civil engineering element they've discovered.

Materials:

- Walking Legs and/or Car
- Camera/Cell Phone Camera,
- Printer,
- Paper/Pen or Marker
- Computer and Internet for bad weather.





Contractor

Contact a local contractor or design professional and schedule a site visit to a project under construction. Prepare and ask questions about the permitting process, what the structural system is that is holding it up, design hurdles that might have been an issue during design/construction and what the end use of the building will be when it is finished. Find out who the Architect or Engineer was that designed the building.

See the resource links for some formalized groups of professionals that you could reach out to for your site tour options. You can also cold call a local contractor, architect or engineer as well to see what active projects they have in construction for a tour. Online building construction timelapse videos are also a great resource to visualize a construction project. Links to some have been provided as well.

Watch the Time Lapse Construction Video link as a Troop prior to your site visit.

Materials:

- Long Pants, boots/closed toe shoes for your site visit,
- Hard Hat, Safety Glasses and Safety Vest will be provided by your site tour leader (confirm with them prior to your visit),
- Camera for Pictures,
- Ears to listen respectfully,
- Eyes to watch closely,
- Mouth to ask questions and to say thank you,
- Telephone
- Computer to Research to find a tour host (hint: Google Architect near me, or Contractor near me)

Resources:

Time Lapse Video:

<https://www.youtube.com/watch?v=IRuZmRnEtal>

Industry Associations:

<https://www.usgbc.org/community/usgbc-central-pennsylvania>; <https://philadelphia.uli.org/about/contact-us/>

Construction:

<https://nawicscpa.org/contact/>, <https://abckeystone.org/>, <https://www.asacentralpa.com/>

Architects:

<https://www.aia.org/firm-directory?query=>

Engineers:

<https://ashraeregion3.com/chapters/>, <https://www.womeninmanufacturing.org/wim-central-pennsylvania>, <https://www.ashe.org/>

Step 3

**PATCH REQUIREMENTS
(JUNOR/CADETTE - 4-8)**



Step 3

PATCH REQUIREMENTS (JUNOR/CADETTE - 4-8)

Architecture, Structural & MEP Engineering

A commercial building is any building that serves and provides the public a space to generate income or provide the public with a service. Go out exploring with your Troop or a parent and take a picture of one building that provides each of the following services for the public. Print your pictures and create a collage of all the different types of buildings you took photos of. Along the side of each of the images, write a list of services that each provides to the public and why they are important. Create a short list of what makes the buildings the same AND different. Discuss those lists with the group. Are the similarities and differences related to location, time period of construction, building material types, orientation on the site, etc.? If the weather is not cooperating to allow a physical trip to collect photos, collect photos off the internet.

- School or Educational Building
- Library
- Apartment Building
- Government Building like a Firehouse, Post Office or Courthouse
- Factory or Warehouse
- Hospital or Healthcare Building
- Restaurant
- Fitness or Exercise Facility
- Office Building
- Retail, Mall, Grocery, Shopping Facility

Materials:

- Walking Legs and/or Car
- Camera/Cell Phone Camera,
- Printer,
- Poster Board,
- Glue
- Scissors,
- Markers
- Computer and Internet for bad weather.



Step 3

PATCH REQUIREMENTS (JUNOR/CADETTE - 4-8)

Civil Engineer

Civil engineers are very concerned about water quality. They devise systems for taking water from rivers, underground reservoirs, and even the ocean to provide water for drinking, irrigation, and flushing toilets. They also figure out how to clean the water after it's been used so people and animals downstream have safe water to drink and use. Complete the Water Pollution Clean Up Activity Instructions located in the resources section of this page.

Materials:

Part 1: Polluted Water

- bowl
- items to pollute water
 - dry grass
 - potting soil
 - toilet paper
 - fishing line
 - plastic pieces
 - detergent
 - paper pieces

Part 2: Filtration System

- cups or recycled bottle
- items to filter water
 - cotton balls
 - coffee filters
 - spoons
 - funnels
 - strainers
 - cloth
 - paper towels
 - kitty litter
 - sand
 - ricks
 - marbles
 - charcoal

Resources:

[Activity Instructions \(Pg 46\)](#)





Step 3

PATCH REQUIREMENTS (SENIOR/AMBASSADORS - 9-12)

Contractor

Volunteer to create and donate time or resources to Habitat for Humanity (or other similar non-profit in your area). Girl Scouts under the age of 16 can not be part of the building construction projects but the non-profit does support construction of supporting items for their home builds.

Links provided in resources is to York County Habitat for Humanity “Do-it-yourself build at home” page. Find the similar group in your local community and select a supporting project for a Non-Profit Home Build. If you are over 16 years old, you can also volunteer time to support a physical Home Build project in your area.

This site also provides “how to” videos to prepare for the construction before arriving for your volunteer construction work.

Watch the Video Link provided individually or as a group and discuss what type of Architecture is your favorite and least favorite and why.

Materials:

- Computer/Phone for research
- Telephone for calling to schedule
- Refer to the tool/material requirements of the Habitat Program you select,
- Hard Hat, Safety Glasses, Safety Vest, Gloves (could be required depending on the project you volunteer for),

Resources:

Need to find your local Habitat For Humanity Chapter. Use this link and search with your zip code.

<https://www.habitat.org/>

York CountyHabitat for Humanity

<https://www.yorkhabitat.org/options-for-children.html>

<https://www.yorkhabitat.org/collegeandworkcamps.html>

<https://www.yorkhabitat.org/constructionvoluteer.html>
(age limit)

Video Link to an Introduction to the 40 Types of Architectural Styles

<https://www.youtube.com/watch?v=n4dZduYMD9E>



Step 3

PATCH REQUIREMENTS (SENIOR/AMBASSADORS - 9-12)



Architecture, Structural & Mep Engineering

A commercial building is any building that serves the public a service or provides a service to generate income. Visit the website linked below and read the History of Architectural Styles of Pennsylvania. Use the links on the right side of the page to review each of the different Pennsylvania architectural time periods and the key elements of architecture that were key in each of those time periods. Choose one of those time periods and either visit a local building that fits into the Pennsylvania Traditional Architectural periods or find one on the intranet that is within your Local Area. Take some photos of the building and make a poster board with the photos. Tag and point to the elements of that building's architecture that are indicative of that time period.

Bonus points if you can research and identify the original architect that designed the building, the date of its construction (historically this can be found on a date stone near the main entrance) and what its original functional purpose was when it was built.

Watch the video provided in resources about the 40 Types of Architectural Styles.

Materials:

- Legs for Walking,
- Car to get from here to there,
- Computer/Phone for Research,
- Phone/Camera for Photos,
- Printer,
- Scissors,
- Glue,
- Markers,
- Poster Board,

Resources:

Historic Architectural Styles in Pennsylvania | PHMC
Pennsylvania Architectural Field Guide
<http://www.phmc.state.pa.us/portal/communities/architecture/styles/index.html>

40 Types of Architectural Styles.
<https://www.youtube.com/watch?v=n4dZduYMD9E>



Step 3

PATCH REQUIREMENTS (SENIOR/AMBASSADORS – 9-12)

Civil Engineer

Review Modern civil engineering history, developments, breakthroughs, and challenges that have shaped civil engineering over the past century. Explore iconic projects, innovative technologies, environmental considerations, and the evolving role of civil engineers in shaping our world.

As a group of individually select one or two of the topics below and complete the items indicated under it based on the topic.

Complete ONE of the activities listed:

Overview of civil engineering and its historical context

- Identify key milestones and influential figures in modern civil engineering.
- Introduction to landmark projects that have transformed cities and infrastructure.
- [LINK](#)

The Rise of Megastructures

- Study iconic megastructures like skyscrapers, bridges, and dams.
- Discuss the impact of technological advancements on constructing large-scale projects.
- [LINK](#)

Sustainable Engineering and Environmental Concerns

- Explore sustainable engineering practices.
- Case studies on green buildings and eco-friendly infrastructure.
- Discuss the role of civil engineers in addressing environmental challenges.
- [LINK](#)

Transportation Revolution

- Research the evolution of transportation systems, from highways to high-speed trains.
- Identify modern transportation projects and their social and economic impact.
- Discuss future options for transportation engineering.
- [LINK](#)

Technological Innovations in Civil Engineering

- Research cutting-edge technologies such as BIM, AI, and drones.
- Discuss the integration of technology in design, construction, and maintenance.
- [LINK](#)

Infrastructure Resilience and Disaster Management

- Research resilient engineering and disaster preparedness.
- Find two (2) case studies on civil engineering responses to natural disasters.
- Discuss the role of civil engineers in ensuring infrastructure sustainability.
- [LINK](#)

International Projects and Global Collaborations

- Research global civil engineering projects and their significance.
- Identify cultural, political, and ethical considerations in international collaborations.
- Discuss the importance of diverse perspectives in civil engineering.
- [LINK](#)

Future of Civil Engineering

- Discuss emerging trends and challenges in civil engineering.
- Identify the role of innovation and sustainable practices on the future of cities.
- [LINK](#)





WHAT'S IN YOUR TOOLBOX PLEDGE



- ✿ I pledge to the planet to be an integral part of my community by supporting the longevity of my architectural history by using care around older or aging buildings.
- ✿ I will collect and properly dispose of trash that could get washed into storm sewers or natural waterways.
- ✿ I will conserve electricity by turning off the lights when I leave a room, not let my electronics turned on when they are not in use and I will adjust my body temperature through proper layering of clothing instead of adjusting the thermostat of a room.
- ✿ I will conserve water by not letting the water run before/after a shower, while washing dishes or while I am brushing my teeth. I will not run the dish washer or laundry machine until they are full.
- ✿ I will maintain a safe distance and never cross safety barriers in place to protect active construction work areas.
- ✿ I will use proper protective equipment when using or being around construction activities at home.
- ✿ I will share my knowledge of Architecture, Engineering and Construction with others so that we can all be better stewards and users of the buildings that support our everyday life and future generations.

Signature

Date



Resources

—
All Grade
Levels



Resources

Pennsylvania Points Of Interest That Offer Architectural/History Tours

Eastern State Penitentiary (Philadelphia, PA) - Eastern State Penitentiary was once the most famous and expensive prison in the world, but stands today in ruin, a haunting world of crumbling cellblocks and empty guard towers. Its vaulted, sky-lit cells held nearly 85,000 people over its long history, including bank robber “Slick Willie” Sutton and “Scarface” Al Capone.

<https://www.easternstate.org>

George Spangler Farm and Field Hospital (Gettysburg, PA) - Historic Farmstead that was used as a Military Field Hospital in the Civil War. It has been restored by Warehaus as a Living Museum Site.

<https://www.gettysburgfoundation.org/george-spangler-farm>

Kinzua Bridge State Park (Kane, PA) - The 339-acre Kinzua Bridge State Park, located in McKean County, is the home of the reinvented Kinzua Viaduct. The Viaduct, once the longest and tallest railroad structure at 2,053 feet long and 301 feet high, was partially destroyed by a tornado during 2003. Reinvented as a pedestrian walkway during 2011, visitors can stroll 600 feet out on the remaining support towers, peer miles out into the Kinzua Gorge, and gaze down through the partial glass platform at the end of the walkway.

<https://www.dcnr.pa.gov/StateParks/FindAPark/KinzuaBridgeStatePark/Pages/default.aspx>

Falling Water (Mill Run, PA) – Fallingwater is among eight Frank Lloyd Wright designed buildings now inscribed to the UNESCO World Heritage List. This inscription represents the first modern architecture designation in the United States.

<https://fallingwater.org/>

Resources For Technical Information To Support Your Projects

Golden Gate Bridge (San Francisco, CA) - The Golden Gate Bridge is one of the longest suspension bridges in the world and has become an internationally recognized symbol of San Francisco and California.

<https://www.goldengate.org/bridge/history-research/>

Panama Canal (Panama City, Panama)

The Panama Canal is a major ship canal connecting the Atlantic and Pacific oceans is also one of the biggest and most difficult engineering projects ever undertaken.

<https://pancanal.com/en/history-of-the-panama-canal/>

Empire State Building (New York, New York)

The Empire State Building in New York City is one of the most famous skyscrapers in the world, known for its history, architecture, and as a symbol of American industry.

<https://www.esbnyc.com/>

The American Society of Civil Engineering (ASCE) provides great insight for kids and teens at the following link:

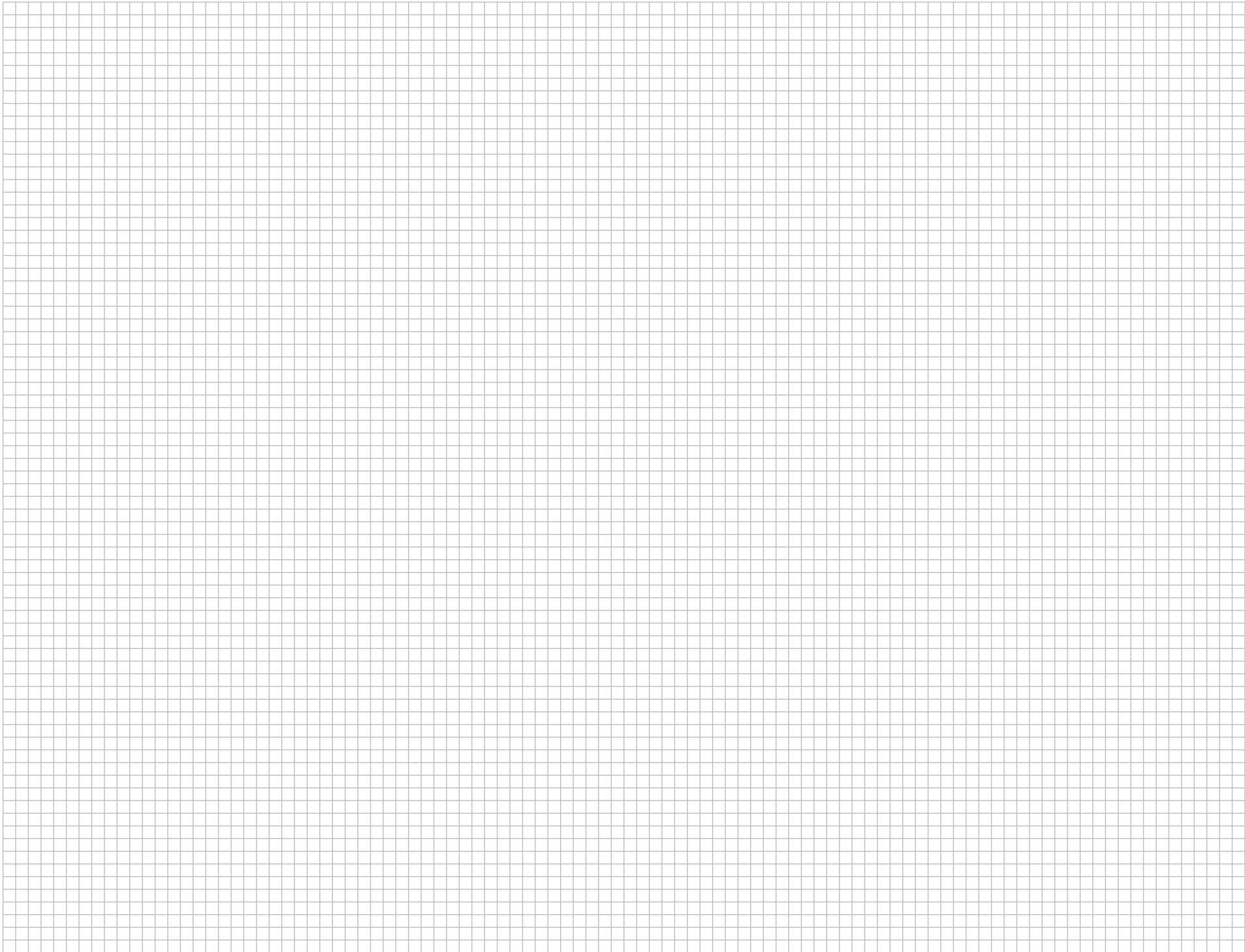
<https://www.asce.org/career-growth/pre-college-outreach/kids-and-teens>

For materials estimating:

<https://www.lowes.com>

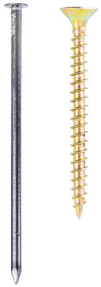
<https://www.homedepot.com>

<https://www.acehardware.com>



STEP 1 – CONSTRUCTION HAND TOOLS AND SAFETY PERSONAL PROTECTION EQUIPMENT (PPE)

Match the photo or image to the matching word/description. Touch and use the physical tools your troop leader brought in and discuss how they are used.



WORK BOOTS (STEEL TOED)

SAFETY GLASSES

SAFETY VEST

HARD HAT

PHILLIPS SCREWDRIVER

FLAT HEAD SCREWDRIVER

CLAW HAMMER

DEAD BLOW HAMMER

PLYERS

WRENCH

SOCKETS

LEVEL

MEASURING TAPE

FRAMING SQUARE

NAIL and SCREW

BOLT, NUT and WASHERS



ANSWER KEY:



WORK BOOTS (STEEL TOED)

SAFETY GLASSES

SAFETY VEST

HARD HAT

PHILLIPS SCREWDRIVER

FLAT HEAD SCREWDRIVER

CLAW HAMMER

DEAD BLOW HAMMER

PLIERS

WRENCH

SOCKETS

LEVEL

MEASURING TAPE

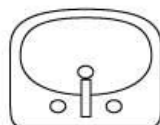
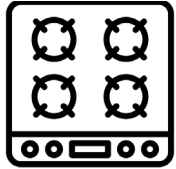
FRAMING SQUARE

NAIL and SCREW

BOLT, NUT and WASHERS

STEP 1 - ARCHITECTURAL - MEP (MECHANICAL, ELECTRICAL AND PLUMBING) SYSTEMS WORKSHEET

Match the photo OR floor plan symbol used for the item to the name. Mark an M, E, or P beside each item to identify if it is related to Mechanical, Electrical, or Plumbing system of a building.:



WASHER AND DRYER_____

REFRIGERATOR_____

CEILING FAN_____

THERMOSTAT_____

POWER OUTLET_____

LIGHT SWITCH_____

AIR CONDITIONER_____

STOVE_____

TOILET_____

SMOKE ALARM_____

SOLAR PANELS_____

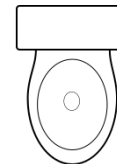
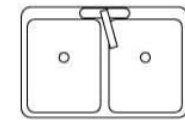
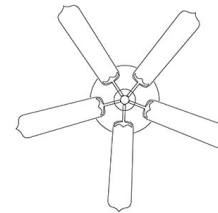
KITCHEN SINK_____

BATHROOM VANITY_____

BASEBOARD HEATER_____

HOSE BIB CONNECTION_____

HOT WATER HEATER_____



ANSWER KEY:

WASHER AND DRYER MEP

REFRIGERATOR EP

CEILING FAN ME

THERMOSTAT ME

POWER OUTLET E

LIGHT SWITCH E

AIR CONDITIONER ME

STOVE E

TOILET P

SMOKE ALARM E

SOLAR PANELS E

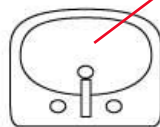
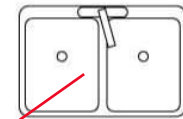
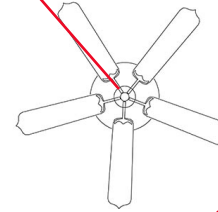
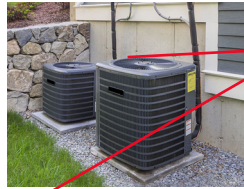
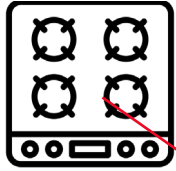
KITCHEN SINK P

BATHROOM VANITY P

BASEBOARD HEATER ME

HOSE BIB CONNECTION P

HOT WATER HEATER MEP



STEP 1 - ARCHITECTURAL SYMBOLS/ITEMS WORKSHEET

Using the roof type key below – match the building photo to the correct roof style from the key:



Gable Roof



Hip Roof



Saltbox Roof



Bonnet Roof



Cross Gable Roof



Pyramid Hip Roof



Gambrel Roof



Shed Roof



Mansard Roof



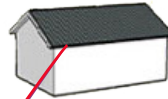
Cross Hipped Roof



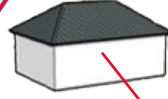
Flat Roof



ANSWER KEY:



Gable Roof



Hip Roof



Saltbox Roof



Bonnet Roof



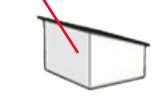
Cross Gable Roof



Pyramid Hip Roof



Gambrel Roof



Shed Roof



Mansard Roof



Cross Hipped Roof



Flat Roof



Your Body is Like a House Activity

Match each body system to a comparable household system



Nervous System



Circulatory System



Digestive System



Skeletal System



Structural System



Plumbing System



Electrical System

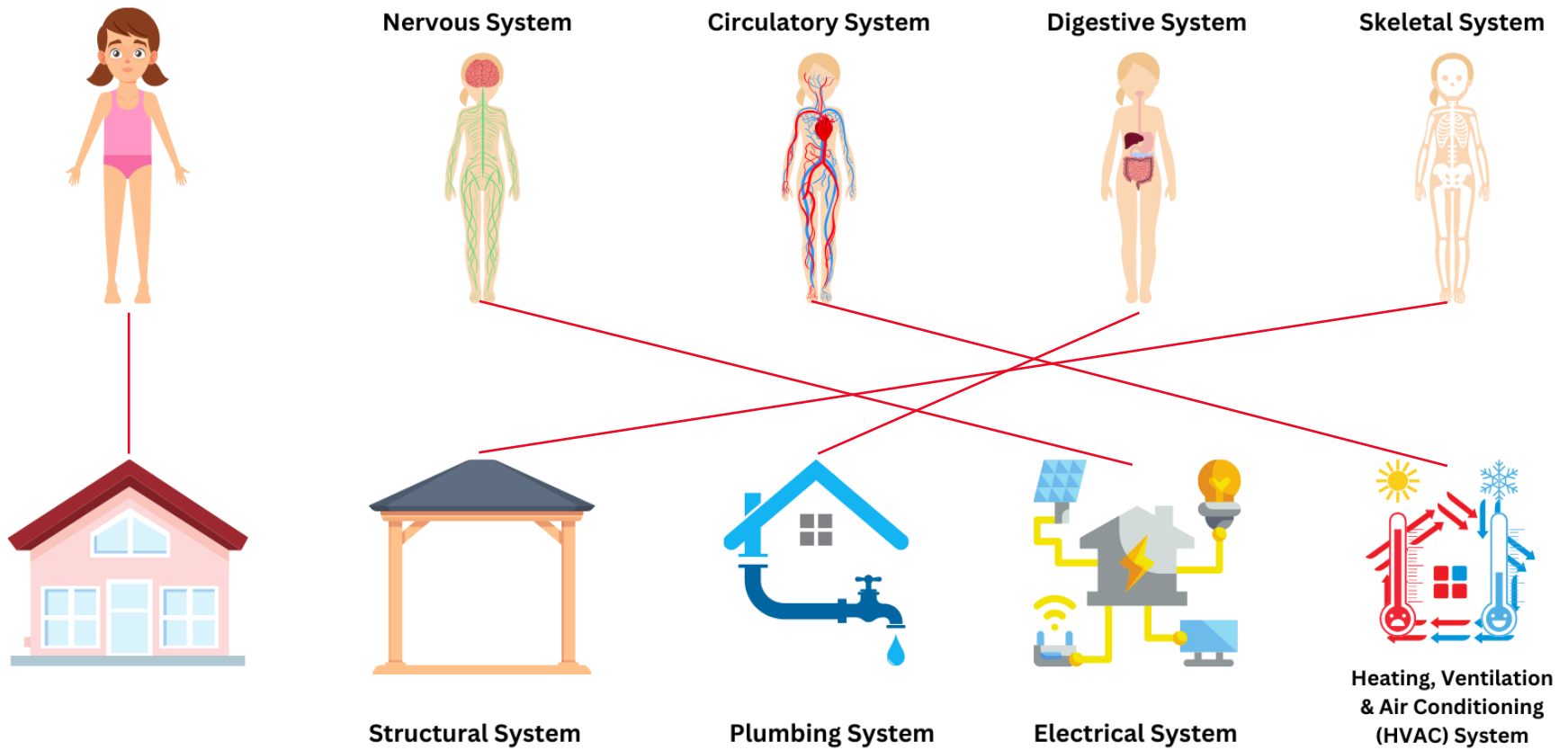


Heating, Ventilation & Air Conditioning (HVAC) System

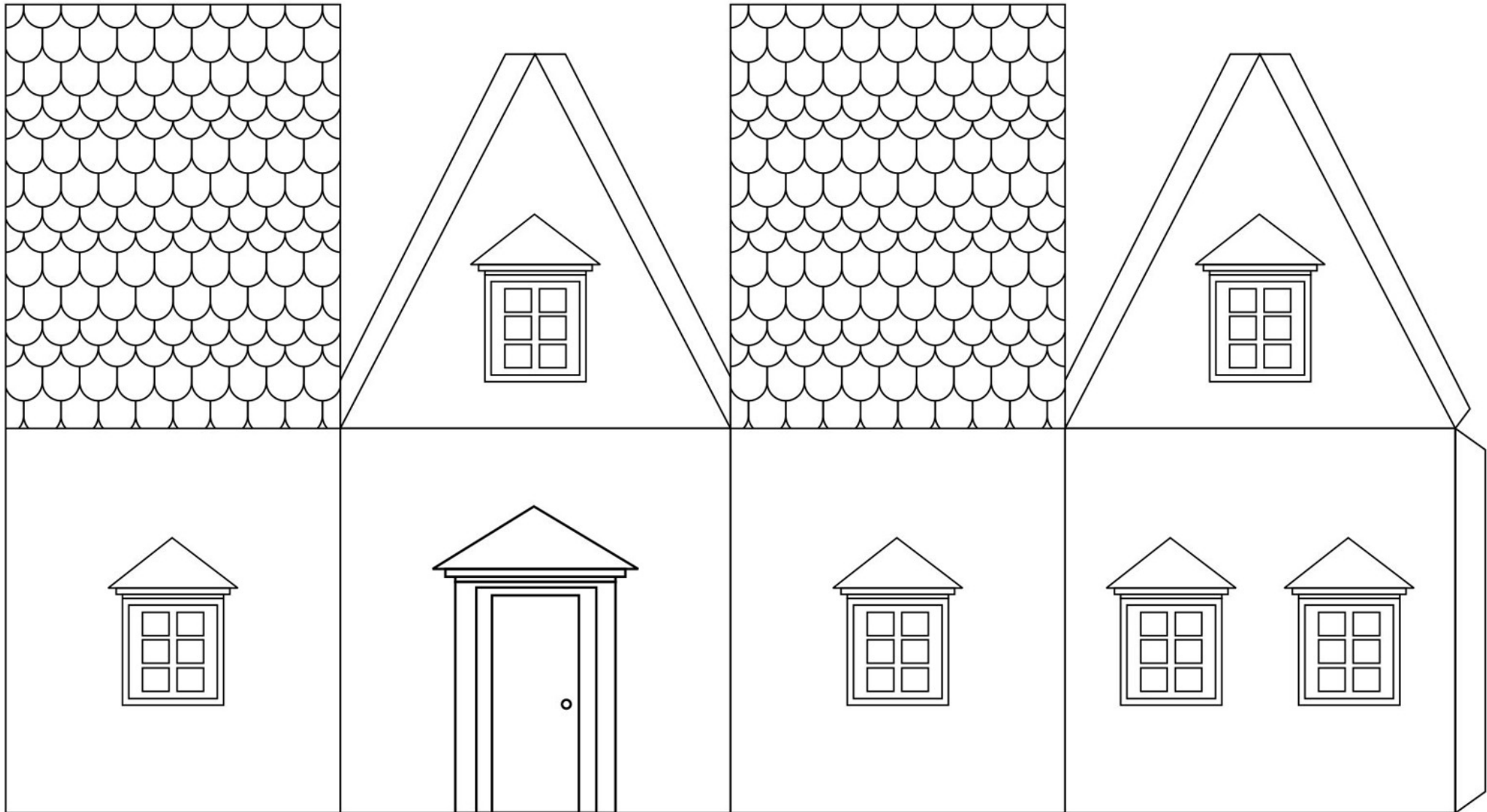
ANSWER KEY:

Your Body is Like a House Activity

Match each body system to a comparable household system



STEP 2 - DAISY/BROWNIE - ARCHITECTURAL PAPER HOUSE TEMPLATE



STEP 2 - DAISY/BROWNIE - ARCHITECTURAL PAPER HOUSE INSTRUCTIONS



Step 1

Decorate your house and cut it out taking care to keep the tabs along the roof and right edge



Step 2

Fold along the lines including the tabs



Step 3

Apply glue to the tabs and construct your house as shown

Activity: Water Pollution Clean Up

INTRODUCTION:

Civil engineers are very concerned about water quality. They devise systems for taking water from rivers, underground reservoirs, and even the ocean to provide water for drinking, irrigation, and flushing toilets. They also figure out how to clean the water after it's been used so people and animals downstream have safe water to drink and use.

WATCH THIS:

Quenching a Thirsty World: Water Engineering <https://youtu.be/YGZOK6H7OZ4>. See how civil engineers can take wastewater and purify it so that it can be consumed.

Water Wishes: Engineering for Those in Need https://youtu.be/4VnPo_OATgE. University students design a water system for a needy community in Peru.

MATERIALS:

Part 1: Polluted water

Bowl

Items to pollute the water: dry grass, potting soil, toilet paper, fishing line, plastic pieces, detergent, paper. Use your imagination!

Part 2: Filtration system:

Cups or recycled bottles

Items to filter/clean the water which could include: cotton balls, coffee filters, spoons, funnels, strainers, cloth, paper towels, kitty litter, sand, rocks, marbles, charcoal from the grill. You might need to pre-rinse items like kitty litter, rocks, and charcoal to remove tiny pieces that could actually add to the dirt in the water.

DO THIS:

Part 1: Make some polluted water by mixing water and several pollutants in a bowl. The exact proportions aren't important.

You might want to make more of a personal connection by telling a simple story as each pollutant is added to the water. For example, talk about people flushing toilet paper, a farmer plowing a field that allows dirt into a stream, or picnickers who leave behind trash as you add each item.

Part 2: Design a way to clean the water using materials from around the house. Engineers need to sequence water treatment. They may start with scooping out large items and disposing of them as trash. Then they can move on to removing smaller pollutants.

Design a filter system that removes as much of the pollutants as possible. Hint—it will take several layers of filters to do the best job. You might want to figure out how to remove bigger pieces at the start of the system so that they don't block the entire filter.





Everyday Engineering: STEM@Home



GRADE LEVEL:
ELEMENTARY
THROUGH HIGH
SCHOOL

If you have a large, 2-liter bottle you may be able to assemble your filter in one system. If you have small cups or bottles you can design a system where you treat the water one step at a time, pouring the results from one step into the next.

What can be scooped out? What needs to be filtered?



Try a couple different systems. You can use 2-3 items per system.



TALK ABOUT THIS:

Did anything clog your filter? Is there a step you can add to prevent this?

Could you reuse your water treatment system? If you couldn't, do you think this is a problem? Would real water treatment systems need to be reused? Can you redesign it so that it can be reused? Would you drink the water after it's been cleaned? Why or why not? What additional steps would it take to make you feel the water was safe to drink? Even if you are able to get the water to look clean there may be microscopic pollutants in it, so don't drink it!



WANT MORE CHALLENGE?

Sometimes we can see the pollutant, but sometimes we can't. Some common pollutants that get into water include oils and acids. You may have heard of oil spills that occur when ships carrying oil spring a leak. Acids and other chemicals get into water from factory waste.

You can add to the challenge by adding an acid to the water such as vinegar and lemon juice. When you add them to the water it might not be visible to the naked eye. That's why engineers use chemical indicators that change color in the presence of acids and bases. The activity *Colorful Chemistry* has more information about measuring acids in water using red cabbage juice as an indicator. You can neutralize excess acid by adding a base such as baking soda.

Can you figure out how to test for and neutralize acids in your treatment system?

Oil and water generally don't mix. Oil floats on top of the water, and one way of removing it is to skim it off the surface. Can you design a skimmer that would work to remove oil?



WANT TO GO FURTHER?

This activity and over 65 others were developed in support of the award-winning documentary *Dream Big: Engineering Our World*. This version has been adapted to showcase how to do it at home.

For more in-depth coverage download the *Water Pollution Cleanup* activity from the *Dream Big: Engineering Our World* website: <http://discover.org/dreambig/activities>. There you will find discussion questions for younger as well as older children, relevant vocabulary, and more.

Dream Big: Engineering Our World is available on Netflix and Vimeo.

The free library of over 65 activities and webisodes can be found at discover.org/dreambig.

STEP 2 – SENIOR/AMBASSADORS – TREEHOUSE PRICING SHEET

Specifications	Unit Cost	Number of units	Total Cost
Size			
Fit 3 people	\$25		
Fit 6 people	\$50		
Lumber			
Ladder	\$10		
Railing	\$10		
Deck	\$20		
Paint (how many colors?)			
Budget	\$10		
Premium	\$15		
Extras			
Electric power	\$20		
Lights	\$15		
Table and stool	\$20		
Sleeping bag	\$10		
Hammock	\$10		
Rope Swing	\$5		
Zip Line	\$10		
Slide	\$15		
Fire pole	\$10		
Storage for toys	\$10		
Carpet	\$10		
Decorative garland	\$5		
Chalkboard	\$5		
Other			
Final Cost			

Congratulations!

If you have satisfied all of the requirements of the AEC curriculum, be sure to claim your patch! Click [HERE](#), fill out the form, and we will make sure your patch is delivered to you.



girl scouts 