Habitat Heroes

Building Animal Homes with STEM Magic POWERs

Activity Guide Book

by Dr. Kelsey Kirrene & The Princess Program STEM

Meet Your Fairy Godengineer

The Fairy God Engineer is a whimsical and wise mentor known throughout the kingdom for her enchanting STEM Magic Powers. With a passion for problem-solving and designing magical solutions, she helps princesses, inventors, and dreamers alike bring their grandest ideas to life!

From a young age, the Fairy God Engineer was fascinated by creating and dreamed of making the world a better place. Her gift for engineering grew as she crafted clever contraptions to solve everyday challenges, proving that a little creativity and a lot of science can make anything possible!

Her STEM journey has taken her on thrilling adventures across castles, forests, and even the stars. Armed with her shimmering blueprint scroll and a wand that sparks with innovation, she also guides young minds in designing and building their own marvelous creations—from enchanted bridges and twinkling towers to flying carriages and glowing gardens.

The Fairy God Engineer has a deep love for discovery and believes that magic and engineering go hand in hand. Through interactive workshops and hands-on experiments, she inspires

kids to dream big, design boldly, and helps them build the STEM confidence to engineer their own happily ever afters.

Join the Fairy God Engineer on an exciting adventure where creativity meets STEM Magic, and together, we'll build a world of endless possibilities!

What is Engineering?

Engineering is like being a problem-solving superhero! Engineers use their creativity and knowledge to design and build things that help people and the world.

They might create cool gadgets, build strong bridges, make fast cars, or even design amazing buildings. Engineering is all about using design, science, and math to come up with solutions to make our lives better and solve important challenges!

Engineers often work as a team, combining their unique skills and ideas to tackle big challenges and create amazing inventions that would be difficult to do alone.

WHAT ARE SOME THINGS YOU HAVE SEEN THAT AN ENGINEER BUILT?

WRITE OR DRAW THEM BELOW!

Engineering Magic POWER

The Fairy God Engineer is no ordinary mentor; she possesses extraordinary STEM Magic Powers that she uses to champion creativity, innovation, and problem-solving. Her unique approach, known as her engineering “STEM Magic POWERs,” is a unique blend of science, technology, engineering, and a touch of creative enchantment.

Here’s how the Fairy God Engineer uses her STEM Magic to make a positive impact:

P

Plan for Known Needs

The Fairy Godengineer begins her mission by planning meticulously. She studies and understands the specific needs of various animals and their habitats. Whether it's a burrow for rabbits, a nest for birds, or an aquatic home for fish, The Fairy Godengineer ensures that her designs cater to every creature's unique requirements.

O

Organize Innovative Designs

Armed with insights into animal needs, The Fairy Godengineer uses her engineering skills to organize innovative habitat designs by brainstorming! She gets creative, thinking about how to make these homes safe, cozy, and sustainable. Her designs are not just functional but also environmentally friendly, using materials that blend with the natural world.

W

Work on Prototypes

The Fairy Godengineer doesn't stop at sketches or rely on her magic wand. She rolls up her sleeves and gets to work on building prototypes of her habitat designs. Using twigs, leaves, and other natural materials, she brings her visions to life, ensuring that the designs can work in the real-world.

E

Evaluate and Enhance Solutions

Once the prototypes are ready, The Fairy Godengineer subjects them to rigorous testing. She observes how animals interact with these habitats, making note of any improvements needed. She listens to their feedback and uses her engineering mindset to improve the designs’ comfort and safety.

R

Refine for the Perfect Habitat

The Fairy Godengineer understands that perfection is a journey, not a destination. She takes the feedback from testing and iterates on her designs, making them even better. She pays attention to every detail, from door size to the warmth of insulation, ensuring that her habitats are cozy.

Drawing Inspiration from Nature

The Fairy God Engineer draws inspiration from nature and animal engineering for their ingenious, sustainable, and harmonious solutions. She admires the efficiency and resilience displayed by animals in crafting habitats that seamlessly integrate with the environment and the creativity of animals to use the resources around them.

These creations teach the Fairy God Engineer valuable lessons in sustainability and adaptation to challenges. She believes that by learning from nature's engineering marvels, she can develop innovative solutions that benefit wildlife and ecosystems, making the world a better place for all living creatures.

The Fairy God Engineer’s deep sense of environmental stewardship and the potential to nurture curiosity in young minds drive her passion for blending sustainable engineering with insights from the natural world.

CAN YOU THINK OF SOME EXAMPLES OF ANIMAL HABITATS THAT OTHER ANIMALS BUILD?

WRITE OR DRAW THEM BELOW!

Example Engineered Habitats

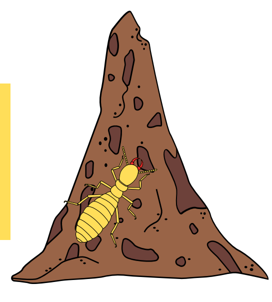
There are many examples of ingeniously engineered animal habitats that inspire The Fairy Godengineer's own habitat designs, but here's a few of her favorites!

Beehives!

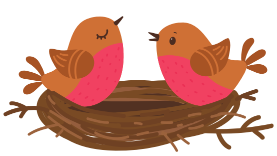
Beehives are intricately designed by bees to provide shelter, store honey, and raise their young. The hexagonal cells are not only efficient for honey storage but also thermally efficient, keeping the hive warm in cold weather.

Termite Mounds!

Termite mounds are engineered by termites to provide temperature control within the mound, with chimneys and vents for airflow. The structure allows termites to farm fungi for food.



Bird Nests!



Birds are master architects, with each species crafting unique nests to suit their needs. Weaverbirds, for example, weave intricate nests from grass and twigs, while cliff-nesting birds use ledges and crevices.

Beaver Dams!

Beavers, like Buddy, construct dams and lodges in freshwater habitats. Dams alter water flow to create ponds that provide protection from predators and access to food during winter.

Spider Webs!

While not technically habitats, spider webs are impressive engineering feats. Each web is meticulously designed to catch prey efficiently so the spiders can eat, utilizing various silk types and intricate patterns.

Build Your Own Animal Habitat

The Fairy Godengineer wants to build a special rainproof shelter for her rubber ducky friend Sunny because she cares deeply about keeping her cozy and dry, even on the rainiest of days in the animal kingdom. As rainy season approaches, let's help The Fairy Godengineer build a sustainable and cozy shelter for Sunny!

Collect Your Materials

- Recycled materials (e.g., cardboard, plastic bottles, old fabric)
- Natural materials (e.g., leaves, sticks, twigs)
- STEM kit items (if available)
- A pen or pencil
- Scissors
- Tape or glue
- String or rubber bands
- A small rubber ducky toy (or other small toy)
- A squirt bottle or a small container for pouring water
- A bowl or sink for testing

Now, let's get started and help The Fairy Godengineer build a cozy animal shelter using her STEM Magic POWERs to Plan, Organize, Work on Prototypes, Evaluate and Enhance Solutions, and Refine her design!

Tip!

IF YOU WANT TO MAKE THIS ACTIVITY MORE FOCUSED ON SUSTAINABLE ENGINEERING, READ THE LATER SECTION OF THIS GUIDE FIRST

Let's start by planning! First, we'll want to identify what some of the things Sunny needs, and what things she might want to have in her house. We can also think of questions we might want to ask her to learn more!

Needs are the basic criteria, or requirements, for the engineering project. The Fairy Godengineer knows that Sunny needs to stay nice and dry in her home during rainy season, but let's brainstorm some other things she might need!

WHAT ARE SOME OF SUNNY'S NEEDS?

WRITE OR DRAW THEM BELOW!

The needs cover the very basics, but there might also be other characteristics or traits that Sunny really wants in her house! For example, do you think Sunny has a favorite color she'd like to see around her house? What do you think some of Sunny's wants might be?

WHAT ARE SOME OF SUNNY'S WANTS?

WRITE OR DRAW THEM BELOW!

Now that we've identified a few needs, or requirements, and wants, are there any more questions you might ask Sunny to learn more about her needs, her wants, or how she will use her habitat?

WHAT QUESTIONS WOULD YOU ASK TO LEARN MORE?

WRITE OR DRAW THEM BELOW!

Now let's start to Organize our Ideas by brainstorming! Sketch out some ideas on ways you might build Sunny's shelter. Right now, there no such thing as a bad idea so sketch out the craziest, cookiest habitat you can think of!

BRAINSTORMING - WHAT COULD SUNNY'S HABITAT LOOK LIKE?

WRITE OR DRAW A FEW IDEAS BELOW!

Now that we have some ideas collected, lets' Work on Prototypes!

It's time to get your hands dirty - let's pick your favorite idea you brainstormed and start building! As you start building your habitat you might even want to experiment with smaller prototypes to test things like the materials you have - do you think recycled paper and plastic both will have the same amount of water resistance? Is the cardboard strong enough to hold up the roof you drew?

Tip!

MAKE SURE TO USE YOUR TOOLS SAFELY AND ASK A PARENT OR TEACHER FOR HELP IF YOU NEED IT!

As you build, it's okay if things don't look exactly like your drawing. Learn as much as you can as you play with materials. In real life, engineers are always constantly learning new things, especially when they try to build things they haven't built before and even though The Fairy Godengineer is a pro at building, she's never built a duck habitat before so she's bound to make a few mistakes. Hopefully you can help her learn!

Once you have your first prototype built, let's Evaluate and Enhance your design by testing it and taking notes!

To test the design:

- **Place Sunny comfortably inside her nice new habitat**

- Use your spray bottle to squirt a light mist directly above Sunny's habitat
- Watch what happens as the mist (simulating rain) falls on her house
- Take notes and consider the following questions:

Did any materials change color?

Did the overall shape change?

Did Sunny get wet? If so, where did the water come from?

EVALUATING & TESTING - WHAT HAPPENED WHEN IT RAINED AT SUNNY'S HOUSE?

WRITE OR DRAW A FEW NOTES BELOW!

If you'd like to continue to Refine to Build the Perfect Habitat, continue with the Learn Some More section below.

Otherwise congratulations, you performed your first engineering project using your STEM Magic POWERs! What are you going to build next?

Learn Some More

Now that we've mastered the engineering design process, you can always work your way through it again and improve your design!

Iterate:

Did you have any leaks you need to patch up?

Did Sunny fit comfortably in the habitat?

Was it easy for Sunny to get in and out of her habitat?

Add more constraints:

Do you think Sunny might get some wind and need a sturdier house?

What about testing Sunny's house for earthquake resistance? (You can put your house prototype on a baking sheet and give it a little shake, or just wiggle the table you built on to test this)

If Sunny was going to help her friend build a house, do you think her friend would have all the same materials? How could you simplify the design to make it easier to duplicate?

Considering Sustainability

The Fairy Godengineer understands the profound connection between engineering and the well-being of the wildlife that lives in her kingdrom. Witnessing firsthand the devastating impact of pollution on animal habitats, she has dedicated her life to crafting sustainable solutions. The Fairy Godengineer believes that by harmonizing the principles of engineering with a deep respect for nature, we can pave the way to a brighter and more balanced future for all living creatures.

WHAT ARE SOME WAYS YOU CAN DESIGN WITH SUSTAINABILITY IN MIND?

WRITE OR DRAW THEM BELOW!

Sustainability in POWER Engineering

Incorporating sustainability into the engineering POWER design process is not only environmentally responsible but also essential for creating lasting solutions. Here are some ways to do this at each step:

Plan for Needs with Sustainability in Mind

Environmental Assessment: Begin by conducting a thorough environmental assessment to understand the impact your project may have on the local ecosystem. Identify potential environmental challenges and opportunities.

Resource Efficiency: Plan to use resources efficiently. Minimize waste, choose eco-friendly materials, and consider how your project can have a positive impact on the environment, such as enhancing biodiversity.

Natural Integration: Design habitats that integrate seamlessly with the natural environment. Mimic natural features and processes to reduce disruption to the ecosystem.

O

Organize Designs with Sustainable Features

Green Materials: Select sustainable and recyclable materials for construction. Use renewable resources whenever possible, and opt for materials with low environmental impact.

Energy Efficiency: Design habitats with energy-efficient features, like natural lighting and ventilation. Explore renewable energy sources, such as solar panels, for powering any habitat-related systems.

Life-Cycle Analysis: Consider the entire life cycle of the habitat, from construction to maintenance and eventual removal. Design for durability and ease of maintenance to extend the habitat's lifespan.

W

Work on Prototypes w/ Sustainability at Heart

Testing Eco-Impact: When testing prototypes, assess their ecological impact. Monitor how the habitat affects the local ecosystem, including plant and animal behavior, water quality, and soil health.

Adaptive Prototyping: Be prepared to make adjustments based on ecological feedback. If the prototype disrupts the environment or harms wildlife, modify the design to minimize negative impacts.

Low-Impact Construction: If the habitat requires significant construction, implement sustainable building practices. Avoid habitat destruction and erosion by using erosion control measures and re-vegetation strategies.

Evaluate & Enhance with Environmental Goals

Monitoring and Data Collection: Continuously monitor the habitat's performance and its impact on the environment. Gather data on species interactions, water quality, and other relevant metrics.

Environmental Education: Educate stakeholders and the community about the importance of sustainability in engineering design. Foster a sense of responsibility and stewardship for the natural world.

Iterative Improvements: Use the collected data to make iterative improvements to the habitat. Address any environmental issues promptly and refine the design to align better with sustainability goals.

Refine with Environmental Stewardship

Environmental Partnerships: Collaborate with environmental organizations, experts, and local communities to ensure that your habitat aligns with broader conservation efforts and sustainability goals.

Ecosystem Integration: Encourage the habitat to become an integral part of the local ecosystem. Seek ways to enhance biodiversity and support the habitat's resilience in the face of environmental changes.

Long-Term Sustainability: Plan for the long term. Sustainable engineering isn't just about immediate results; it's about creating habitats that can thrive for generations while minimizing harm to the environment.