




# **MAKEngineering Kit**

## **Instructions:**

# **All Terrain Animal** **House**

Task adapted from Teach Engineering STEM curriculum developed at the University of Colorado Boulder.  
Some of the images are from previous individuals who completed a similar task.



# ENGINEERING TASK

It is challenging for stray animals to survive extreme weather conditions. Your task is to design a prototype of an animal house that will help stray animals survive extreme weather conditions common to where you live—rain storms, really hot and really cold temperatures, earthquakes, or tornados.





## DID YOU KNOW...?

- Only 1 out of every 10 dogs born will find a permanent home.
- The main reasons animals are in shelters: owners give them up, or animal control finds them on the street.
- Many strays are lost pets that were not kept properly indoors or provided with identification.
- It's impossible to determine how many stray dogs and cats live in the United States. Estimates for cats alone range up to 70 million.

Source: [dosomething.org](http://dosomething.org)

## MATERIALS IN KIT



- 20 Popsicle sticks
- 10 Aluminum foil sheets
- 30 Cotton balls
- 1 Deck of playing cards
- 4-5 Felt pieces
- 15 Thumbtacks
- Yarn
- Scissors
- Masking tape
- Measuring tape
- 2 Thermometers
- Cardboard base



## STEP 1—RESEARCH

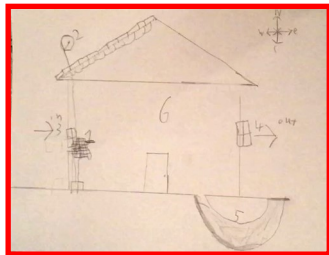
What are the elements to keep an animal warm in winters and cool in summers? Think about wall isolation, roof design, and other feature that would make an animal house useful and offer protections against other weather conditions. Here are some videos to get you started and be sure to take notes about what you notice and might use in your own design.

<https://youtu.be/d6xLYlg8qm8>

<https://youtu.be/0anNT4yVH08>

<https://youtu.be/9HH9HsP1TPI>

## STEP 2—PLAN



How will the structure of the house withstand weather conditions where you live (e.g., wind, rain, snow)?

Based on your research, brainstorm and sketch 2-3 detailed designs of your animal house. List or label the materials you will use. You will build your house on a piece of cardboard.

# MATERIALS IN YOUR HOME DID YOU KNOW...?

Newspapers can be used in your prototype as a form of structure and support. The key is to take one sheet of newspaper and roll it tightly from one corner to another.



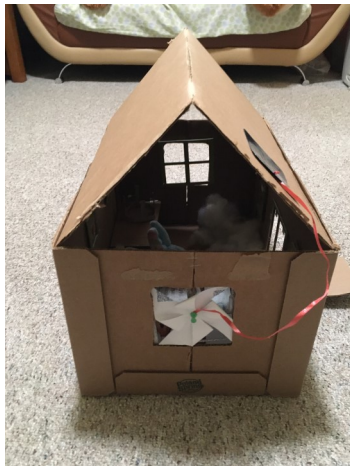


## MATERIALS IN YOUR HOME— SCAVENGER HUNT

In addition to using materials from the kit, you can find items inside and outside your house that start with the letters below. Only one object per letter, but you can have more than one of that object. For example, for the letter L, you can use 30 leaves. Be strategic.

N P B L S T W





## STEP 3—CREATE

Pick one of your designs from Step 2 and build your prototype. You can only use materials in the kit and those you gathered from the scavenger hunt.



## STEP 4—TEST (TEMPERATURE)

Place the animal house outside. Place one thermometer inside the animal house and the other thermometer outside the animal house. Read the temperature of both thermometers at least seven times over a 12-hour period. Document the time (in minutes) and temperatures in the table on the next page.

Is the temperature inside the house more than, less than, or the same as the temperature outside the house? Why? How does the inside temperature reflect how you designed the animal house?



## STEP 4—TEST (TEMPERATURE)

PSST. You do know that engineers keep track of their data like you are doing here.

Time	Time (min)	Inside Temperature	Outside Temperature
12:33 pm	0		

## STEP 4—TEST (WIND)

Do you think your animal house can withstand a windstorm for 8 seconds? Why or why not?

If it is a windy day, place your house outside to test. If it is not a windy day, use a hair dryer on full speed to simulate the windstorm.



## STEP 4—TEST (RAIN/SNOW)

How well will the animal house withstand rain and/or snow? Pour water onto the roof of your house using a watering can. Wait! You don't have a watering can? Let's make one. Use a thumbtack to punch holes into a bottle cap.





## STEP 5—REFLECT & IMPROVE

How would you rate your prototype on a five-star scale?



What things did you consider for your five-star rating?  
What “tag line” captures your rating (e.g., “Built well.  
Animals of all kinds will enjoy.”)

What improvements would you make? Why? What did you learn from your testing results? How can we make these improvements with the materials that we have?

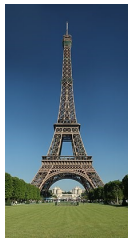
## PARALLEL PROTOTYPE

Choose another design from Step 2, create another prototype and test it in the same manner. How would you rate this house? Why? Based on your tests, which house is more likely to withstand different weather conditions?



## DID YOU KNOW...?

Structural engineers design the “bones and muscles” for man-made structures such as buildings, bridges, and tunnels. It is their responsibility to calculate the stability and strength for things such as snow, wind, and earthquake forces. Can you identify these famous building designs?





# WHAT TYPE OF ENGINEER ARE YOU?

Add a sticker to your Engineering Passport that identifies the type of engineer you were most like in the design of an all-terrain animal house. Don't forget to write why you chose the type of engineer.



This engineering kit would not have been possible without funding and support from the National Science Foundation.