

# SCIENCE·3D

## CROCODILE COUNTRY

In this packet, sample student answers are provided in **red** and notes to teachers are in **blue**.

In this **STEM Project**, students will explore the properties of matter and how to measure them. Next, they will use this understanding to create designs for a crocodile trap used to relocate problem crocodiles. They will identify places where a trap might fail and go through an iterative process to improve their design.





You need to come up with a new design for a crocodile trap. The first step is to think about the properties of the material that you are going to use.

## Activity 1: What Matters? How Do You Measure?

1. For the list of properties of matter listed in Table 1, **state** whether the property of matter is important or not important to consider when building a crocodile trap. Then, **describe** why you made this decision. Think of the different parts you might use in making the trap and setting the trap (including the bait)!

Students may come up with logical answers that are different than those suggested in the table. The important part of the exercise is that students make logical arguments and demonstrate that they understand the properties of matter. This activity could be completed by small groups or as a class.

Students may want to use their **Mission Research** answers to help support this activity. That would also reinforce some of their previous learning.



**Table 1. Properties of matter and why they are or are not important in building a crocodile trap**

Property	Important or Not important	Why
Color	Not important (Important)	Crocodiles will be interested in the bait and the color should not matter much (some students might say it does matter so crocs don't notice the trap).
Conductivity	Not important	There won't be electricity or heat transmitted through the cage.
Shape	Important	The shape of the cage needs to be able to fit the shape of the crocodile.
Texture	Not important	Whether the trap is smooth or rough doesn't matter.
Taste	Not important (Important)	The taste of the trap won't matter; the taste of the bait might matter.
Magnetism	Not important	The trap won't have magnets on it.
Boiling point	Not important	The materials used for the trap won't be boiled.
Melting point	Not important (Important)	The materials won't be in temperatures high enough to melt (or important that the materials don't melt in the heat).
Solubility	Important	Trap will be in the water, so it is important it doesn't dissolve in the water.
Reflectability	Important	A croc might notice the trap if too much light is reflected.
Flexibility	Important	Rope (or wire) needs to be flexible; the trap needs to be hard and not bend too much so the crocodile can't escape.
Odor	Important (Not important)	Bait needs to attract crocs (if they are talking about the cage itself they might say not important).
Hardness	Important	Must be able to withstand the force of a crocodile hitting it.

**Extend the lesson:** Have students complete a similar table for different possible projects (such as building a bridge). Have them compare and contrast what properties are important based on the problem that they are trying to solve.

2. For the properties listed in Table 2, **describe** how you would measure them for a set of objects.

**Table 2. Ways to measure different properties**

Property	How would you measure the property?
Color	Have people record the color they see.
Conductivity	Hook up electricity and measure to see if it passes through.
Texture	Feel the outside; record how it feels.
Magnetism	See if a magnet sticks to it.
Boiling point	Add heat and measure the temperature; see when it starts to boil.
Melting point	Add heat and measure the temperature; see when it starts to melt.
Solubility	Put it in water and stir; see if it dissolves.
Flexibility	Apply different amounts of force; see when it starts bending.
Hardness	Apply force; see when the object breaks or dents.

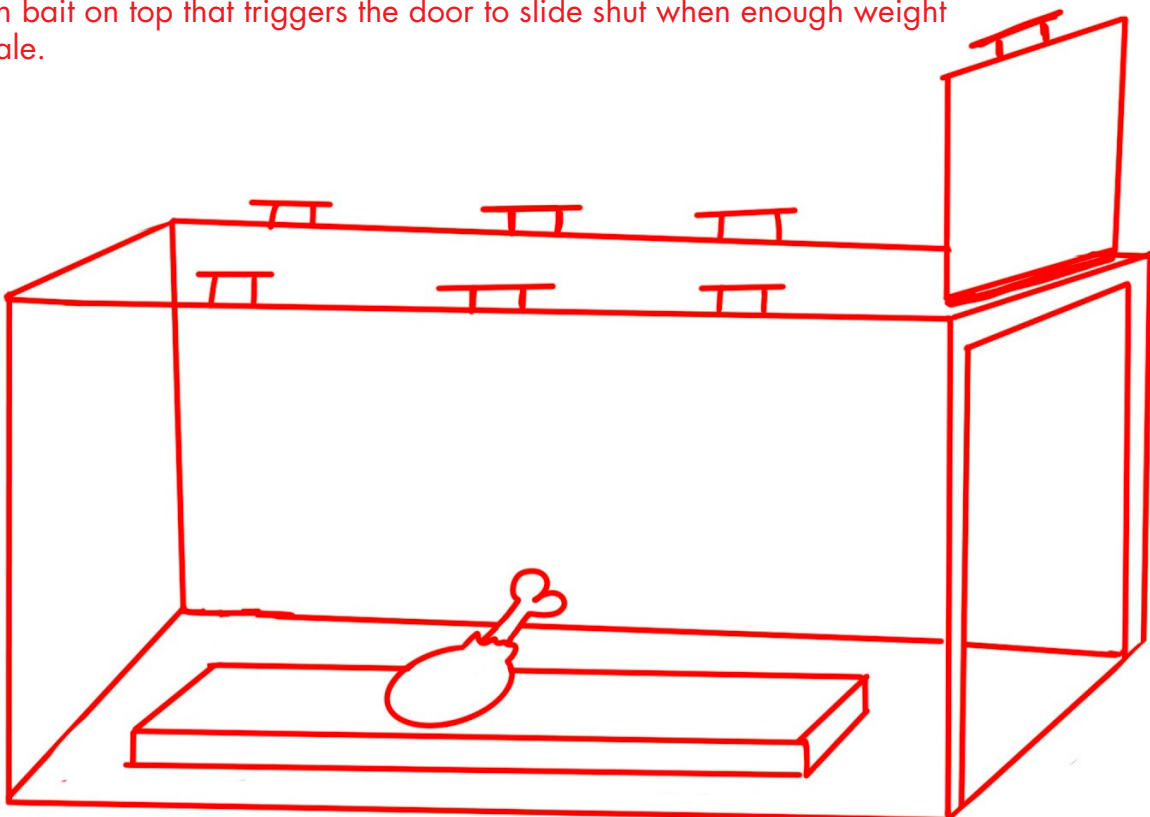
## Activity 2: Design Your Crocodile Trap

Now, you need to plan your trap!

1. In the space below, **draw** a design for your trap. Remember to consider the following design criteria.
  - a. Must not harm the animal.
  - b. Must be able to withstand the force of a crocodile trying to break out.
  - c. Must have a way to keep people safe when moving and releasing the crocodile.
  - d. Plans must show areas where force is important for operating the trap.
  - e. Plan must list properties of matter that are important for the materials you use in your trap. Remember, you will probably use different materials for different parts of your trap.
  - f. The materials to build the trap (or the trap itself) needs to be able to be transported on a boat or in a truck.

### My croc trap design:

- Large enough to fit an adult crocodile.
- Made from pieces of thin but strong metal that can be assembled on site.
- Handles for transport.
- Sliding front door (one way in and out).
- Scale with bait on top that triggers the door to slide shut when enough weight sits on scale.



2. **Describe** how you might test your design before you take it to the field to catch a crocodile.

Good answers might include: **checking mechanisms to close the trap or the breaking/**

**bending points of materials.**

**Extend the lesson:** Have students talk about why testing the design is important before taking it into the field (cost of deployment, safety of people and crocodiles, crocodiles are smart and will learn if it doesn't work the first time).

### Activity 3: Get Feedback and Redesign

Getting feedback on your design is an important component of the engineering design process. Make sure that students see questions 1 and 2 at the same time. Have them critique their classmates' designs in a respectful way. Make sure students understand that getting feedback and improving designs is important to the process. Also, discuss how incorporating the best parts from multiple ideas often results in the best design!

1. Present your design to your class. If you are not presenting your design in class, share it with a relative or friend. Take notes on any improvements that your reviewers suggest and **record** them in the space below.

Accept all reasonable answers.



2. In the space below, make notes on the other designs that were presented to the class. Help your classmates think of ways to improve their designs. **Record** parts of other designs that might help you improve your own design.

Accept all reasonable answers.

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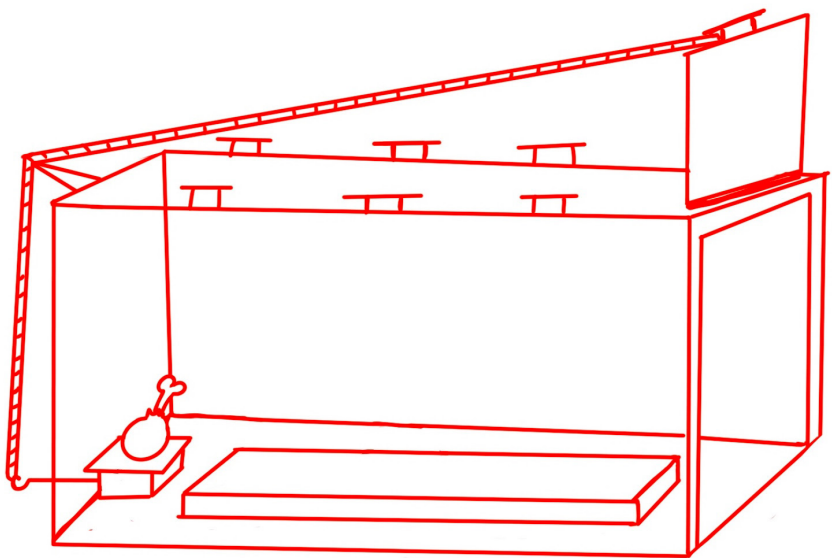
3. **Redraw** your design. Make notes that **describe** any changes you made after seeing other designs and getting comments on your design.

Accept all reasonable answers.



### My croc trap redesign adjustments:

- Bait moved to back of trap to make sure croc fits completely inside.
- Bait sits on lever that triggers the door to shut only when being eaten (connected by rope).
- Scale makes sure door only closes if croc enters (measures croc weight). This way, small animals (mice, birds) don't trigger door to close.



4. Point out any parts in your design that might fail if a huge crocodile enters the trap.

Accept all reasonable answers; most will probably relate to something breaking.

5. Point out any parts in your design that might fail if a small crocodile enters the trap.

Accept all reasonable answers; most will probably relate to not triggering the trap.