

## DEFINE THE PROBLEM

1. What features of the three hot packs shown in the video keep them from getting hot before you want them to?

The one that rusts is sealed to keep out oxygen so the rusting reaction can't start.

The one that works by dissolving has water in a little bag that keeps it separate from the substance that will be dissolved.

The one that works by crystalizing has a little metal disc inside that needs to be bent to cause the crystalizing process to begin.

2. The features that a device must have to make it work are called the **criteria**.

As you begin to think about a temporary portable reptile egg incubator, what features might be useful to borrow from the design of the hot packs?

Should be small and light-weight so it's portable

It should use a small amount of chemicals to be economical and not wasteful

Needs to achieve the right temperature and stay there long enough to transport the egg

Needs to support and protect the egg during relocation

3. What are possible constraints, or challenges, which would prevent you from achieving the features you listed above?

The chemicals might not produce the right temperature

Might need a large amount of chemicals to make it work (too expensive and wasteful)

The temperature might not stay in the right range long enough

Supporting and protecting the egg might interfere with other features

## DEVELOP POSSIBLE SOLUTIONS

4. Look at the Reptile Egg Identification chart on the next page to answer the following questions:

- a. Do these eggs belong to a snake, turtle, or lizard?

Snake

- b. What characteristics helped you identify these eggs?

They were on top of the ground so they were not turtle eggs and they are larger than lizard eggs.

- c. What temperature range should you aim for when you mix calcium chloride, baking soda, and water?

The temperature range for incubating snake eggs is 28-32 °C

5. Does enough heat transfer through the bag to warm a snake egg enough?

Yes. The bag feels warm on the surface and should get up to about 28-32 °C.

6. The bag inflates slightly. How could this feature be useful in the design of the portable snake egg incubator?

If we place the bag under, around, or on top of the egg, it may be able to hold the egg in place so that it is not flipped, turned, or jostled when it is being transported.

## **OPTIMIZE THE DESIGN**

7. Draw your design for a temporary portable snake egg incubator in the large space below. In your drawing use captions to point out how your device meets the following requirements:

- Keep the egg at the ideal temperature for as long as possible
- Hold the egg in the proper orientation
- Protect the egg from impact

The bag could be placed in a paper, plastic, or Styrofoam cup so that the bottom of the bag would be insulated, and the egg could be placed on top of the bag in the cup.

The container that the plastic bag and egg are placed in will insulate to a certain extent. Crumpled or torn paper, paper towels, or a lid could keep the egg warm for a longer time.