Name_____ States of Matter Models Period _____ MS.PS1-1 MS.PS1-4

Group members:

Develop a model to describe the atomic composition of simple molecules and extended structures. Be sure to include how the addition and subtraction of energy affect the phase of matter.

How does your model communicate the pieces of information?

Communicate: (Groups)

Take turns to present your models. How is their explanation different? List positive and negative parts below. Make sure your take detailed notes.

Comparisons

Similarities	Differences

Name_____ States of Matter Models Period _____

Analysis:
Which model is better? Use evidence from your models to compare/ contrast. Provide arguments for your explanation and critique arguments, respectfully.

Claim, Evidence, Reasoning

C:
E:
R:

Name_____ States of Matter Models Period _____

Evaluate: (Whole Class)

After each of you have read your explanation engage in argument from evidence as to which of your explanations you think is the better or more complete one.

Which group's argument is more complete? Make sure that you have a complete argument and not "Mine is Better".

Activity Sheet
Chapter 6, Lesson 1
What is a Chemical Reaction?

Name _____ MS.PS1-2
MS.PS1-5

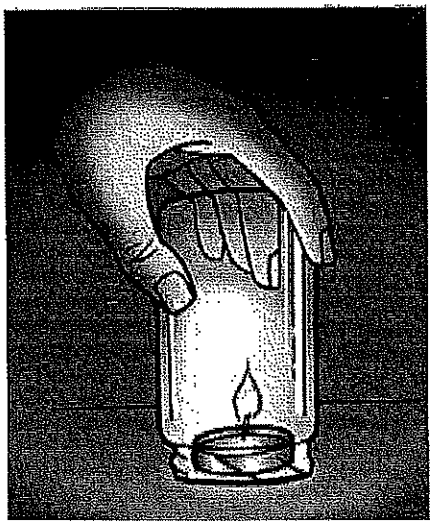
Date _____

DEMONSTRATION

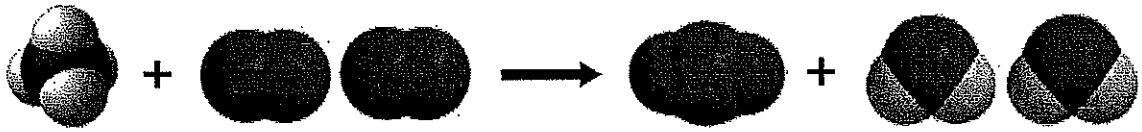
1. Your teacher lit a candle and told you that this was a chemical reaction. What are the *reactants* in this chemical reaction?

2. What are the *products* in this chemical reaction?

3. Why did the flame go out when your teacher put a jar over the candle?



4. Where do the atoms come from that make the carbon dioxide and the water on the right side of the equation?



CH_4	$2O_2$	CO_2	$2H_2O$
methane	oxygen	carbon dioxide	water

ACTIVITY

Question to Investigate
Where do the atoms in the products of a chemical reaction come from?

Materials for Each Student

- Atom model cut-outs (carbon, oxygen, and hydrogen)
- Sheet of colored paper or construction paper
- Colored pencils
- Scissors
- Glue or tape

Procedure

Prepare the Atoms

1. Color the carbon atoms black, the oxygen atoms red, and leave the hydrogen atoms white.
2. Use scissors to carefully cut out the atoms.

Build the Reactants

3. On a sheet of paper, place the atoms together to make the molecules of the reactants on the left side of the chemical equation for the combustion of methane.
4. Write the chemical formula under each molecule of the reactants. Also draw a + sign between the reactants.

Build the products

5. Draw an arrow after the second oxygen molecule to show that a chemical reaction is taking place.
6. Rearrange the atoms in the reactants to make the molecules in the products on the right side of the arrow.
7. Write the chemical formula under each molecule of the products. Also draw a + sign between the products.

Tell students that in a chemical reaction, the atoms in the reactants come apart, rearrange, and make new bonds to form the products.

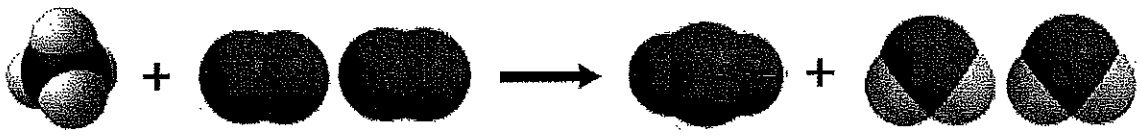
Represent the chemical equation

8. Use your remaining atoms to make the reactants again to represent the chemical reaction as a complete chemical equation.
9. Glue or tape the atoms to the paper to make a more permanent chemical equation of the combustion of methane.

EXPLAIN IT WITH ATOMS & MOLECULES

In a chemical equation, like the one below, you will notice that there are regular-sized numbers in front of some of the molecules and small numbers after certain atoms within a molecule. The little number is called the *subscript* and tells how many of a certain type of *atom* are in a molecule. The bigger number is called the *coefficient* and tells how many of a particular type of *molecule* there are.

If there is a coefficient in front of the molecule and a subscript after an atom, multiply the coefficient and the subscript to get the number of atoms. For example, in the products of the chemical reaction there are two water molecules, or $2H_2O$. The coefficient means that there are two molecules of water. The subscript means that each water molecule has two hydrogen atoms. Since each water molecule has 2 hydrogen atoms and there are two water molecules, there must be 4 (2 × 2) hydrogen atoms.



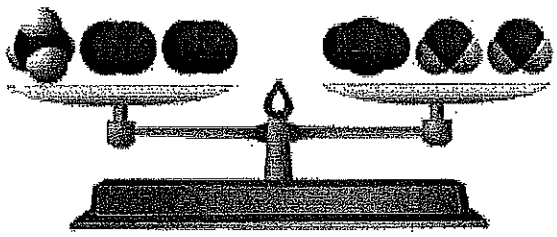
CH_4	$2O_2$	CO_2	$2H_2O$
methane	oxygen	carbon dioxide	water

5. Count up the number of atoms on each side of the equation below and write this in the chart.

$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$		
Atom	**Reactant side**	**Product side**
Carbon		
Hydrogen		
Oxygen		

6. Are atoms created or destroyed in a chemical reaction?

   How do you know?



7. In a physical change, like changing state from a solid to a liquid, the substance itself doesn't really change. How is a chemical change different from a physical change?

TAKE IT FURTHER

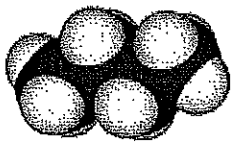
Molecules made up of only carbon and hydrogen are called *hydrocarbons*. The candle and the hydrocarbons listed below react with oxygen in a chemical reaction called *combustion*.

CH_4
methane

Fuel in gas stoves in many home kitchens

C_3H_8
propane

Fuel in outdoor gas grills



C_4H_{10}
butane

Fuel in disposable lighters

8. Count the number of carbon, hydrogen, and oxygen atoms in the reactants and products of each equation to see if the equation is balanced. Record the number of each type of atom in each chart.

Combustion of Propane

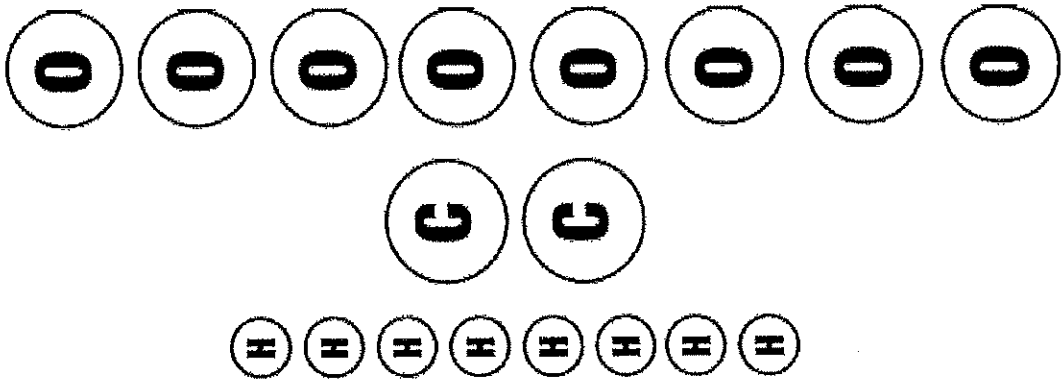
$C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$

$C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$		
Atom	**Reactant side**	**Product side**
Carbon		
Hydrogen		
Oxygen		

Combustion of Butane

$2C_4H_{10} + 13O_2 \longrightarrow 8CO_2 + 10H_2O$

$2C_4H_{10} + 13O_2 \longrightarrow 8CO_2 + 10H_2O$		
Atom	**Reactant side**	**Product side**
Carbon		
Hydrogen		
Oxygen		



MS.PSI-3

Name _____ Date _____ Period _____

Synthetic Material from Natural Resources Brochure

- You will gather and make sense of information to describe that synthetic materials come from natural resources and impact society. The end product will be a color, typed, and well-designed informative brochure on one synthetic material. ***This is a Test Grade.***

My Synthetic Material is _____

- This is an in-class project. If you are absent you will have to complete the assignment at home.

Computer Days:
***Written* Research Checkpoint:**
Printed Color Brochure *Early* Due Date:
Printed Color Brochure Due Date:

Written Research	**5 pts**
Spelling/Grammar	**3 pts**
Colored Brochure	**3 pts**
3 pictures	**3 pts**
Neatness	**3 pts**

Format of Brochure

Page 1

Impact on Society – 10pts	**Bibliography – 5pts**	**Cover/Title Page – 3pts**
▪ This is at least a 7-10 sentence **paragraph** explaining how your synthetic material has impacted society. This is not something you research. YOU synthesize your research and explain how your material has impacted our society.	▪ ALL sources of information, including graphics in MLA Citation format (minimum of **3** sources) ▪ Make sure your citations are listed alphabetically	▪ Name of Synthetic Material ▪ Picture of your Synthetic Material ▪ Your Name ▪ Date: December 5, 2014 ▪ Hour

Page 2

Natural vs Synthetic – 5pts	**Background Information & Uses – 10pts**	**Advantages & Limitations – 10pts**
▪ Natural Resource Definition ▪ Synthetic Material Definition ▪ What is the difference between natural resources & synthetic materials? ▪ Graphic is optional	▪ What is your material made of? What elements are present? ▪ Why is your material considered a synthetic material? How is it made? ▪ Uses of your synthetic material ▪ Graphic is optional	▪ How is your synthetic material helpful and harmful? ▪ Why would we use your material instead of a natural resource? ▪ Graphic is optional

Activity Sheet
Chapter 6, Lesson 11
Chemical Reactions & Engineering Design

Name _____ MS.PS1-6
MS.PS3-3
Date _____ MS.PS3-4

DEFINE THE PROBLEM

Imagine that you volunteered to rescue reptiles (turtles, snakes, and lizards) that are in the unlucky position of living in the path of new construction. Typically in these cases, animals move. They search for new homes and food sources nearby. However, eggs cannot crawl, slither, or swim to another location. And construction projects will not wait for eggs to hatch.

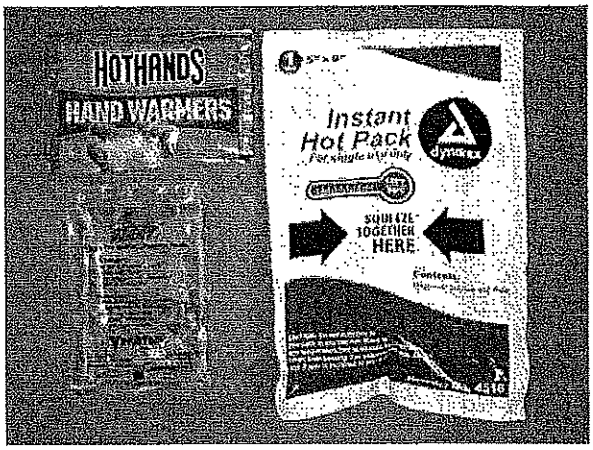
You have talked with the construction workers and with a nearby reptile conservation center. The workers are willing to notify you when they come across reptile eggs. The center is able to incubate the eggs until the babies hatch and then return them to the wild. Your role is to design a reptile egg incubation device that keeps an egg warm and safe as it is transported from the worksite to the reptile conservation center.

Reptile eggs are leathery and soft. While they are not prone to crack easily, they need to remain in the same orientation they were originally laid—whatever is facing up, must stay facing up. They cannot be flipped, turned, or jostled. Very importantly, the eggs must be kept warm, but not too warm, to properly develop and hatch.

You have a job to do before the first batch of eggs is found—build a temporary portable reptile egg incubator device that will keep one egg warm and properly positioned while you take it to the reptile conservation center. Let's give these young lizards, turtles, and snakes their best chance at life!

1. Inspiration for an invention can come from just about anywhere. Sometimes it can come from products that already exist.

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



2. The features that the device must have 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?

3. Possible problems that might prevent the design from successfully meeting all the criteria are called *constraints*. What are possible constraints, or challenges, which would prevent you from getting the features you listed above?

DEVELOP POSSIBLE SOLUTIONS

Think back to the story about transporting reptile eggs from a construction site to a reptile conservation center. Read the text message from one of the construction workers in the illustration to the left.

4. Take a 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?

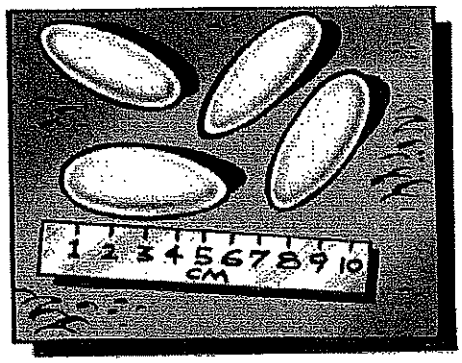
b. What characteristics helped you identify these eggs?

c. As you design your temporary portable reptile egg incubator, you will need to consider the ideal temperature the reptile eggs need. What temperature range should you aim for when you mix calcium chloride, baking soda, and water?

Reptile Egg Identification Chart

Reptile eggs have a leathery shell and are found on or just under the ground. Care must be used when handling them, because they can be quite fragile. Also, the eggs should never be turned over: Whichever part is facing up must always face up until the reptile has hatched. Turning the eggs over could harm the developing embryo!

Snake



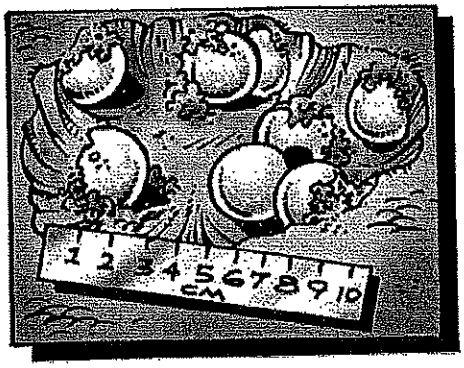
Location
Snake eggs are found in a hidden location on top of soil, dried leaves, or mulch.

Length
4-10 cm

Shape
Snake eggs are oblong and irregularly shaped.

Incubation temperature
28-32°C

Turtle



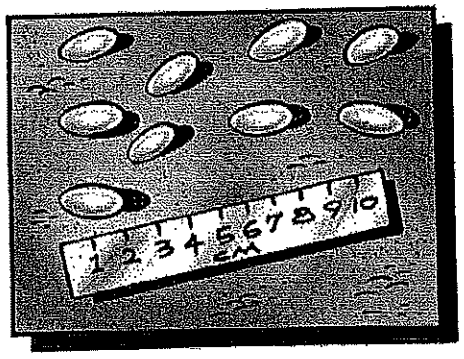
Location
Turtle eggs are buried in loose soil. A spoon and paint brush can be used to carefully remove these.

Length
2-5 cm

Shape
Turtle eggs are about the size and shape of ping pong balls.

Incubation temperature
24-28°C

Lizard



Location
Lizard eggs are laid on soil, mulch, or dried leaves.

Length
1-3 cm

Shape
Lizard eggs are oblong and irregularly shaped.

Incubation temperature
26-30°C

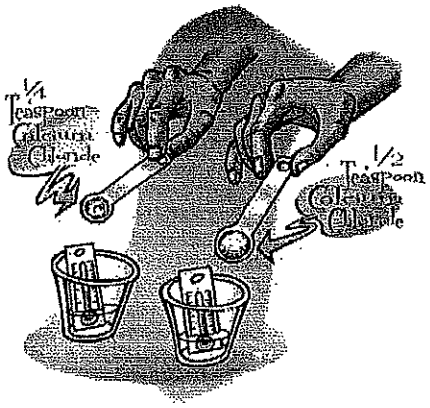
Question to investigate

Does the amount of calcium chloride dissolved in water affect the temperature change?

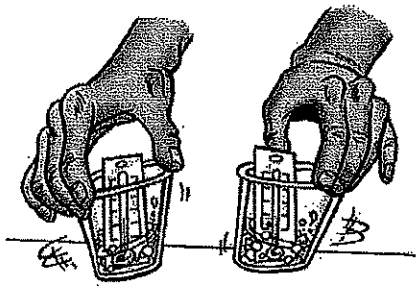
You will need

- Goggles
- 2 small thermometers
- Calcium chloride
- Baking soda
- Water
- 2 small clear plastic cups
- 1 graduated cylinder
- Measuring spoons (⅛ tsp., ¼ tsp., and ½ tsp.)

Procedure



1. Pour 15 mL of water into each of two small clear plastic cups.
2. Place a small thermometer in each cup and record the initial temperature in the chart below.
3. With the help of a partner and at the same time, add ¼ tsp. calcium chloride to one cup and ½ tsp. of calcium chloride to the other cup.

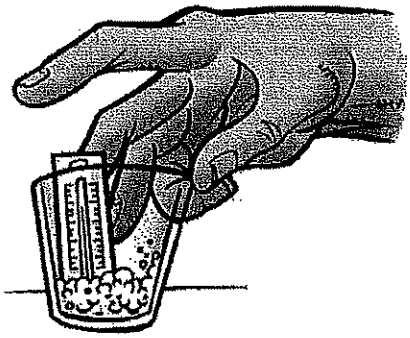


4. With the thermometers still in the cups, gently swirl both cups and check the temperature of both. Record the highest final temperature each reaches.

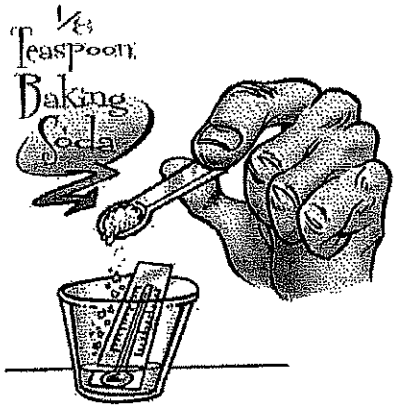
How much does the temperature increase?		
	¼ tsp. calcium chloride	½ tsp. calcium chloride
Initial temperature Just water	°C	°C
Final temperature Water plus calcium chloride	°C	°C
Change in temperature Final temp.– Initial temp.	°C	°C

Procedure, continued

5. Add about ⅛ teaspoon of baking soda to the solution that reached the highest temperature. Watch the solution and the thermometer.



6. With the thermometer still in the cup, gently swirl and check the temperature. Record the lowest final temperature reached.



How does baking soda affect the temperature of the calcium chloride solution?	
Temperature of the calcium chloride solution from Step 4	°C
Calcium chloride solution plus ⅛ teaspoon baking soda	°C
Change in temperature	°C

Should we use baking soda in the design of a portable reptile egg incubator?	
Disadvantages	Advantages

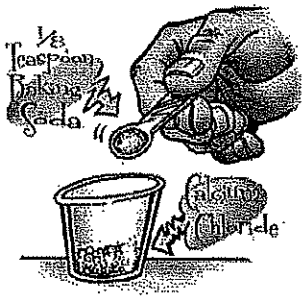
Question to investigate

About how much calcium chloride, baking soda, and water should be mixed to reach the right temperature range to incubate snake eggs?

You will need

- Calcium chloride
- Baking soda
- Measuring spoons (⅛ tsp., ¼ tsp., and ½ tsp.)
- 2 small clear plastic cups
- Water
- Thermometer

Procedure



1. Place ½ tsp. of calcium chloride in a cup.
2. To the same cup, add ⅛ tsp. of baking soda.
3. Swirl the cup to mix these dry ingredients.
4. In a separate cup, add 15 milliliters of water, place a thermometer in the cup, and record the temperature.

5. With the thermometer in the cup, add all of the mixture of calcium chloride and baking soda and gently swirl to mix.
6. Record the final temperature.
7. Adjust the amount of calcium chloride or baking soda and try the reaction two more times to achieve the target temperature.

About how much calcium chloride, baking soda, and water should be mixed to reach the right temperature range to incubate snake eggs?			
Calcium chloride	½ tsp.		
Baking soda	⅛ tsp.		
Water	15 mL	15 mL	15 mL
Initial temperature Just water	°C	°C	°C
Final temperature Highest temperature reached	°C	°C	°C

DEVELOP POSSIBLE SOLUTIONS

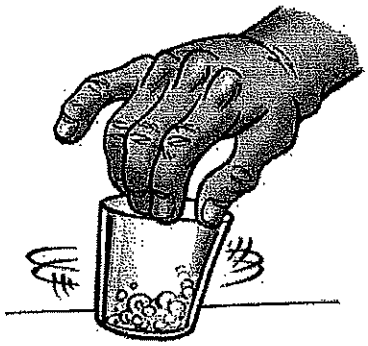
Would the chemical reaction you tested in this lesson work if it were sealed in a plastic bag? Sealing the chemicals in a plastic bag would mean that you would be able to bring just the portable reptile egg incubator with you rather than carry all the supplies needed for each of your tests. In this lesson, you will combine calcium chloride and baking soda in a zip-closing plastic bag to see if this design will keep reptile eggs warm enough.

Question to investigate

Does enough heat transfer through the plastic bag to reach the right temperature range?

You will need

- Calcium chloride
- Baking soda
- Measuring spoons (⅛ tsp., ¼ tsp., and ½ tsp.)
- Graduated cylinder
- 2 small clear plastic cups
- Small zip-closing plastic bag
- Water
- Thermometer



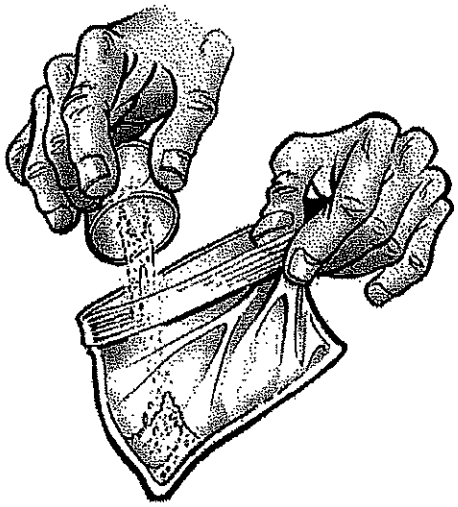
Procedure

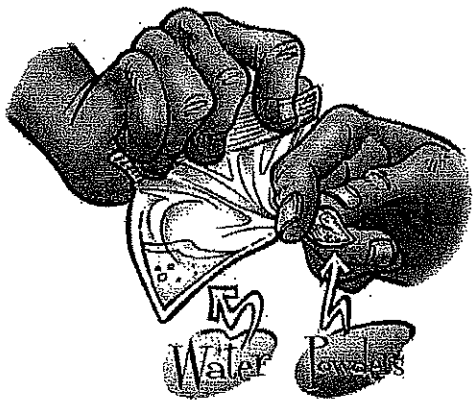
Combine chemicals in a cup

1. Place the amount of calcium chloride and baking soda, which resulted in the best temperature in the previous procedure, in a cup.
2. Swirl the cup to mix these dry ingredients as well as you can.

Prepare the bag

3. Pour the combined powders into one corner of a small zip-closing plastic bag. Tilt the bag so that all the calcium chloride and baking soda stays in one corner.

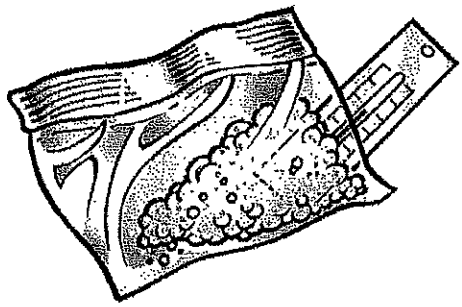




4. Use your fingers to seal off that part of the bag.
5. Have your partner pour 15 milliliters water into the other corner of the bag so that the water does not touch the dry powders.
6. While keeping the water and powders separated, try to get the air out of the bag as you close it and make sure that it is tightly sealed.

Start the chemical reaction

7. Let go of the corner and tilt the bag so that the water and the powders mix and react.
8. Position a thermometer under the bag so that the bulb is beneath the solution where the chemical reaction is taking place. Be sure you can read the temperature without having to remove the thermometer. Record the highest temperature reached.



What temperature does the thermometer reach when it is placed beneath the solution where the chemical reaction is taking place?	
Final temperature Highest temperature reached	°C

5. Since the plastic bag will be part of the portable egg incubator, enough heat needs to transfer through the bag to the egg. Does enough heat transfer through the bag to warm a snake egg enough?

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

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

Reptiles rescued!

Congratulations, your device works! It was used to take the snake eggs from the construction site safely to the reptile conservation center. The eggs were carefully placed in incubators and both the temperature and humidity were ideal for the growth of healthy snakes.

Because most reptiles are able to feed and take care of themselves as soon as they hatch, the baby snakes will be taken to a new location and released into the wild. There they will make their new home as they strive to survive and thrive.