

Activity title: Exothermic Reactions: Make a Gnome

Assembled by: Barry Neeson

Description: Participants make plaster cast gnomes using plaster of Paris which heats up as it sets. The temperature can be measured with the infra-red thermometer. The gnomes can then be painted with thermochromic paint and placed inside the gardens' hot beds to illustrate the difference in temperatures.

Group size/number of repetitions in kit box: 8

Any other comments: Thermochromic pigment can be mixed prior to the workshop or as part of the activity (use a 5 to 1 paint to pigment ratio). Plaster of Paris can cause injury if misused, this activity should be supervised at all times.



While the plaster of Paris sets, ask participants to measure the temperature of the mixture. This can be recorded at set intervals (e.g. every 5 minutes), providing data for graph-drawing. The area of the mixture which is measured e.g. head, abdomen, feet can also be measured and compared, to see where the temperature is highest.

Exothermic Reactions: Make a Gnome

SAFETY WARNING: plaster of Paris can reach high temperatures. This activity requires close adult supervision. Do not inhale plaster of Paris dust or have direct contact with the skin. Do not make casts of hands or other body parts.

Kit list

You will need:

- Gloves
- Plaster of Paris
- Water
- Mixing bowl
- Measuring jug
- Measuring cup/spoon
- Gnome cast
- Thermochromic paint (*for details on how to mix this, see end of document*)
- Acrylic paint
- Infra-red thermometer
- Paintbrushes





Exothermic Reactions: Make a Gnome



How to:

1. Put on the gloves
2. Measure the volume of the gnome mould by filling it with water and emptying it back into a measuring jug. This will tell you how much mixture you will need to fill the mould.
3. Mix the plaster of Paris with water in the mixing bowl (this should be done by an adult). Follow the instructions on the side of the plaster of Paris tub.

The mixture should be a ratio of about 1.5 plaster to 1 water (so if you use 150 ml plaster of Plaster, add 100ml water). Using a measuring cup or spoon to measure out enough mixture to fill the mould.

4. Sit the gnome mould in a narrow vase or other container to keep it upright.



Exothermic Reactions: Make a Gnome

Empty the mixture into the mould. Pour it carefully down the sides of the mould, to avoid air bubbles.

5. While setting, use the infra-red thermometer to measure the temperature of the mixture
6. Once set (this will take about an hour), remove the gnome and ensure it is dry. Pick which part of the gnome you would like to be temperature-sensitive – the beard? Hat? Feet? Paint it using the thermochromic paint. Paint the rest of the gnome using regular acrylic paint.
7. Try sitting your finished gnome in different hot beds in the garden e.g. the compost heap. When the gnome warms up, it will change colour!



Exothermic Reactions: Make a Gnome



How to Mix the Thermochromic Paint

You will need:

- White acrylic paint
- Thermochromic pigment (in syringes)
- Cup or beaker
- Paintbrush
- Jam jar or small container for storage

How to:

Thermochromic pigment is provided in a variety of colours, inside syringes. To make the thermochromic paint, you will be mixing this pigment with white acrylic paint.

1. Choose a colour of pigment. Syringe the 5ml of pigment into the cup or beaker.
2. Use the (now empty) syringe to suck up 1.25ml of white acrylic paint.

Exothermic Reactions: Make a Gnome

3. Syringe the white acrylic paint into the cup containing the 5ml of pigment.
4. Mix up the pigment with the paint using the paintbrush.

Your thermochromic paint is now ready to use! If you don't use all of the paint this time, pour it into a small jam jar or Tupperware to use next time.



Exothermic Reactions: the Science

When **plaster of Paris** and **water** are mixed, there is a chemical reaction and **heat** is released.

A reaction that gives off energy like heat is called an **exothermic** reaction.

We can show that this reaction is exothermic by measuring the rise in temperature using a **thermometer**.



The gnome that you made in this experiment is covered in **thermochromic paint** which changes colour when there is a rise in temperature.

...this means that you can use your gnome to detect **exothermic reactions!**



Composting is an exothermic reaction. As the food, grass, leaves and other organic matter breaks down into compost, **heat** is released.

Try sitting your gnome in a compost heap. Does it change colour?

Can you think of any other warm places in the garden? What happens when you sit your gnome in direct sunlight?

Exothermic Reactions: Questions to Think About

In an **exothermic** reaction, **energy** is **released**. What do you think an **endothermic** reaction is?

How can you use a **thermometer** to decide if a reaction is exothermic or endothermic?

How does the temperature change over time as the plaster of Paris sets?

Which parts of the gnome get the hottest?



Glasgow Science Festival Risk Assessment Form

Activity Title	Exothermic reactions: make a gnome		
Potential Hazard:	Who's at risk?	Risk: High, Medium, Low	Measures to prevent hazard
Burn from plaster of Paris	Everybody	Low	Supervise at all times, wear gloves, do not make cast of body parts as can lead to serious injury