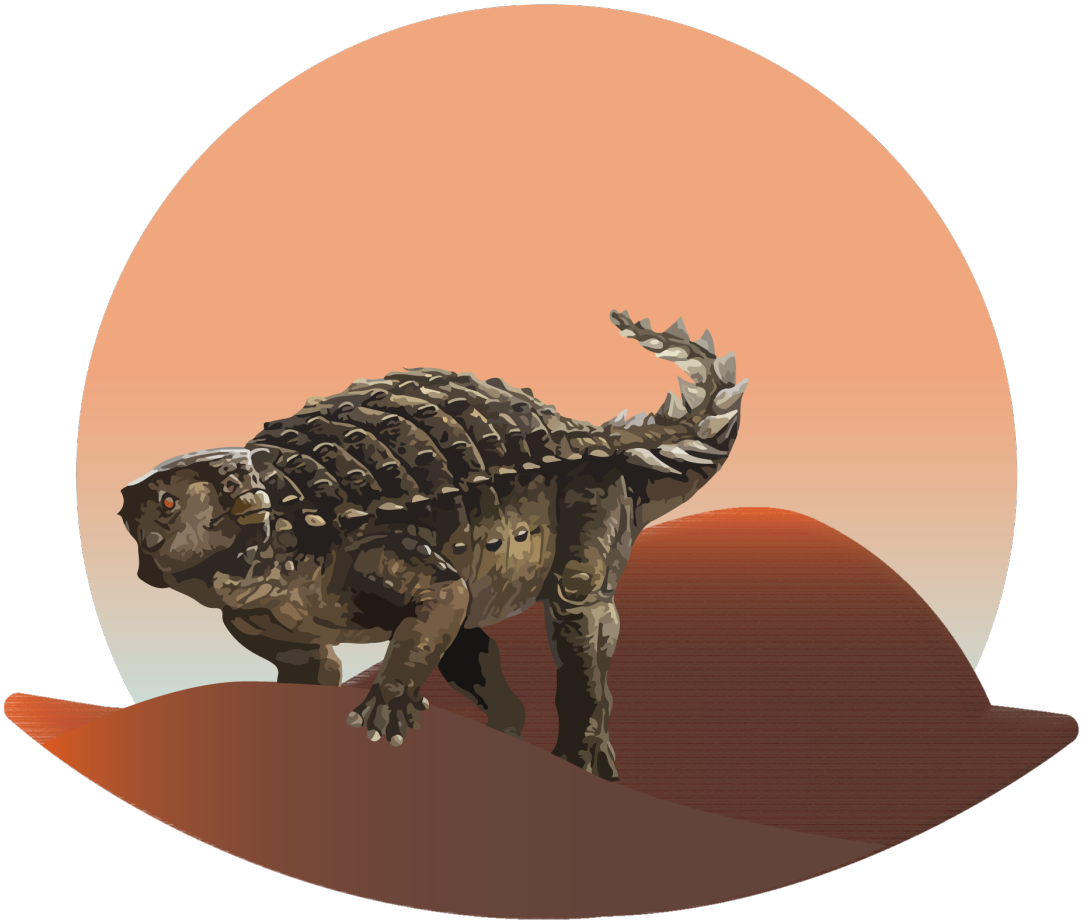

DINOSAUR DISCOVERY

Form a Fossil

Facilitator Booklet

Central Highlands SCIENCE CENTRE

An Australian Government Initiative

Inspiring AUSTRALIA

"Science is simply the word we use as a method of organising our curiosity."

Tim Minchin

Central Highlands SCIENCE CENTRE

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Booklet Contents

Session Plan

Welcome to Science Club!

Dinosaur Discovery: Form a Fossil

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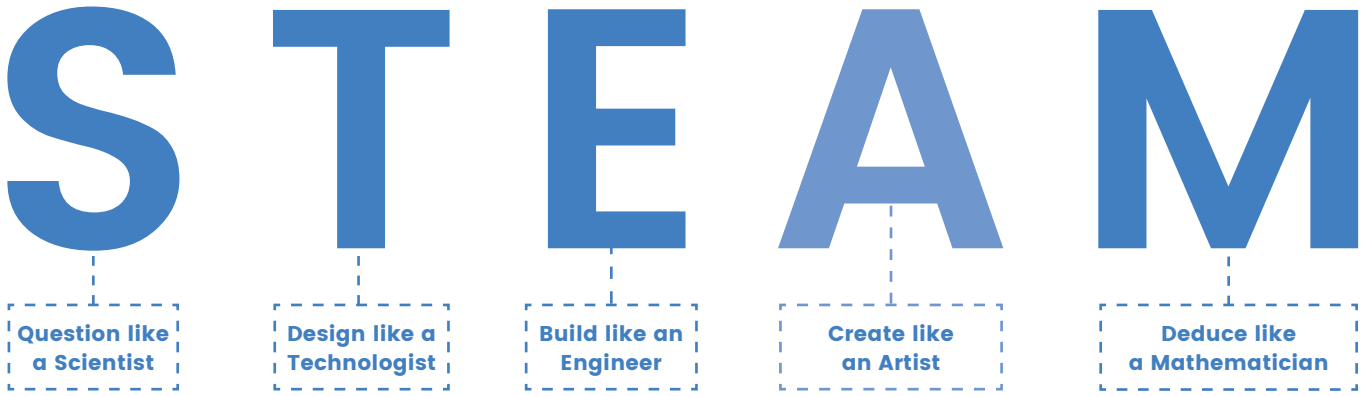
Introduction

- The following activities are designed for 6-12 year old children.
- We recommend that each group is between 16-20 children, with two facilitators (or one facilitator and a volunteer, such as a high school student).
- Each session is of one to one and half hours duration.
- The facilitator's role is not one of teaching per se, but facilitating children's natural curiosity about the world around them and to **engage/excite** them with the STEM concept being presented.
- Each child gets to **explore** the **STEAM** concepts by experimentation and may take home their 'Young Scientist Booklet', so they may replicate the experiments at home.
- Table prompts are on the back page of the facilitator's booklet, we recommend that these are cut out, laminated and put on the tables (or under the clear plastic covers on the tables) to prompt discussion and to **explain** and **extend** the **STEAM** concepts to young scientists.
- Facilitators may **evaluate** the session by means of an evaluation poster (to be laminated) as provided (children can tick the emoticons as they leave the room).
- **Safety note:** the experiments are intended to be performed under adult supervision. Appropriate and reasonable caution is recommended when activities use items that could be of risk, including but not limited to, sharp scissors, hot glue, batteries, small items that could be a choking hazard. If you are unsure about the safety of age appropriateness of the experiments please consult your child's doctor.
- Form a Fossil has two linked experiments which explore the chemistry related to fossilisation
- In the first experiment, Spongey Bone, children will dissolve washing soda in water and drip it onto sponges. Washing soda will make the sponges hard, like the way bones become fossils when mineral-rich water flows slowly over them
- The second experiment, Sudden Solid, explores a chemical reaction. Children mix washing soda and Epsom salts with water. A white solid appears. They will identify this solid as magnesium carbonate by mixing it with vinegar and observing that it forms carbon dioxide bubbles. Magnesium carbonate is chemically similar to calcium carbonate, a chemical found in fossils



Session Information

Dinosaur Discovery: Form a Fossil

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Session Information

Background

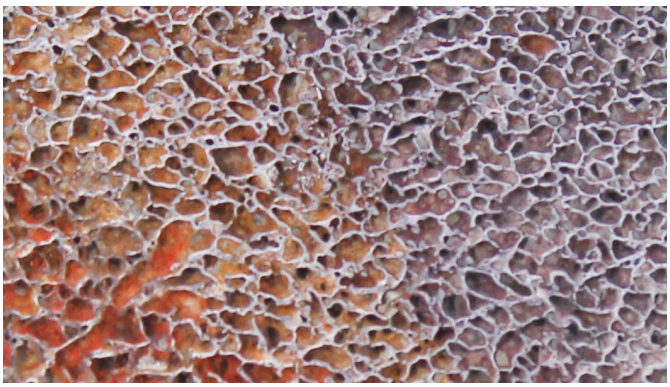
In 2016, scientists in Australia named a new sauropod dinosaur: Savannasaurus elliottorum (pronounced sav-ah- nah-SOAR- us ell-ee- ot-TOR- um). It was found near Winton in Queensland, and lived around 95 million years ago. The fossil bones of this dinosaur were buried under the ground. Over time, water mixed with soil and trickled over the bones. This replaced chemicals in the bone with another chemical called silica. The bone became hard like a rock, and changed from a bone to a fossil bone. Sometimes you can still see the spongey structure of the original bone inside, which has pores l ike a kitchen sponge. Other times, the spongey structure has been filled with silica as well. In the first experiment, children will make a model bone from a sponge and slowly drip a mixture of water and washing soda on to it. Like a real bone becoming fossil, the sponge will soak up chemicals and become harder.

Fossil bones can be made from different kinds of minerals. The ones found near Winton in Queensland contain silica, which is often found in nature as quartz or sand. Other fossils found around the world contain calcite or pyrite. The chemical names for minerals often found in fossils are: Silica: Silicon dioxide/Calcite: Calcium carbonate/ Pyrite: Iron sulfide. Form a Fossil contains two linked experiments, which explore the chemistry related to fossilisation.

In the first experiment, Spongey Bone, children explore the concept of **permineralisation** by dissolving washing soda in water and drip it onto sponges. They will find that washing soda dissolves better in hot water than cold water. Washing soda will make the sponges hard, like the way bones become fossils when mineral-rich water flows slowly over them. Washing soda is a salt called **sodium carbonate**. When it dissolves in water, the sodium breaks away from the carbonate, and each part becomes surrounded by water molecules. When water evaporates from the sponge, the sodium connects with the carbonate again and forms sodium carbonate crystals. This experiment is a good model of permineralisation, where the empty spaces in spongey bone fill with water containing minerals, which then become hard fossils. Similar to what happened to the fossil bones found in Winton. Water containing silica (not washing soda) dripped into the bones and hardened. But this is not exactly the same as what happened to the dinosaur bones in Winton. To be a better model, the sponge itself would need to dissolve and be replaced with washing soda! The Winton dinosaur bones experienced **replacement**, where the bone was replaced with another mineral, silica.

The second experiment, Sudden Solid, explores a chemical reaction **(precipitation)**. Children mix washing soda **(sodium carbonate)** and Epsom salts **(magnesium sulphate)** with water in separate cups. Then they add one to the other. A white solid appears. You can tell a chemical reaction happened because something changed – a solid was formed (precipitated). In the chemical reaction, the sodium carbonate split up and swapped partners with magnesium sulfate to create **sodium sulfate** and magnesium carbonate. In this experiment, two solutions are mixed to cause a chemical reaction and which forms a solid. You can do a test to identify which solid you made. This is identified as magnesium carbonate by mixing it with vinegar and observing that it forms carbon dioxide bubbles. **Magnesium carbonate** is chemically similar to calcium carbonate, a chemical found in fossils. The chemical in the solid magnesium carbonate is very similar to the chemical in calcite, which can be found in fossils. Calcite is a mineral found in limestone rock, marble, and sometimes fossils. Like magnesium carbonate, calcium carbonate also bubbles with vinegar. The bubbles are carbon dioxide gas.

Safety glasses and gloves are required for all chemical experiments. Take care with the electric kettle and hot water.



Experiment Notes and Resources

Dinosaur Discovery: Form a Fossil

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Please click on the image, the underlined hyperlink OR scan the QR code to access the online video.

Resources and Video Links

Introductory Video

Latest discovery in Winton. Half a sauropod!

http://www.abc.net.au/news/2017-06-27/aussie-farmers-find-near-complete-dinosaur-skeleton/8655666

Extra Video

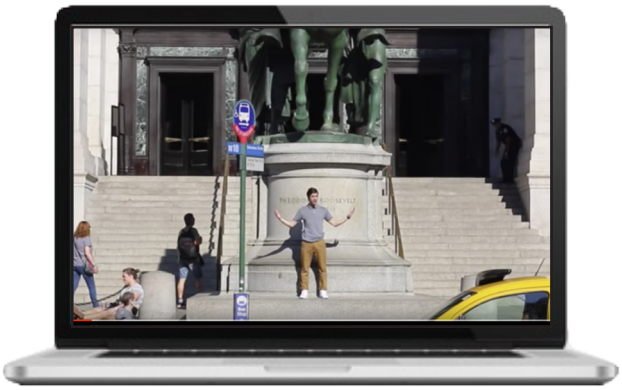
Spongey Bone.

https://www.youtube.com/watch?v=BBSRo-_xxZo

Explanatory Video

Permineralisation and replacement explained.

https://www.youtube.com/watch?v=9f5HehQovx8



Helpful Experiment Video

How to do experiment.

https://www.youtube.com/watch?v=c-YHebZDd4Y

Clipboard: Facilitator's run sheet 1/3

Dinosaur Discovery: Form a Fossil

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Facilitator Run Sheet

Before the Session:

If you are able to, plan an information session with your fellow facilitators/volunteers and run through the experiments together, this will make the session flow more smoothly on the day. At the very least make sure everyone has watched the video links.

Brainstorm for any issues with materials or methods, and adapt as you see fit for your particular audience (in this instance 6-12 year olds). Print out the helpful resources, laminate these and have them on the tables for the children to read/and as prompts during the experiments.

1. Pre-preparation:

Work out the materials you will need for each experiment:
Number of students = N ( )
Number of groups = G ( )

Materials – Experiment #1:

- ▫ N x Young Scientist Booklets = ___
- ▫ N x 2 kitchen sponges = ___
- ▫ N x bone template = ___
  (Spare template within Facilitator booklet)
- ▫ N x 1 dish filled with sand = ___
- ▫ N x plastic gloves and safety glasses = ___
- ▫ N x 1 measuring jug = ___
- ▫ N x 250ml hot water = ___
- ▫ N x 500ml cold water = ___
- ▫ N x 1 whiteboard marker = ___
- ▫ N x 3 pipettes = ___
- ▫ N x 3 empty cups = ___
- ▫ G x kettle, for boiling water = ___
- ▫ G x scissors = ___

Materials – Experiment #2:

- ▫ N x 2 empty cups = ___
- ▫ N x 250ml cold water = ___
- ▫ N x Epsom salts = ___
- ▫ N x 1 measuring jug = ___
- ▫ N x 1 pipette = ___
- ▫ N x 1 teaspoon = ___
- ▫ N x plate = ___
- ▫ N x 1 cup washing soda
  (+ water from last experiment) = ___
- ▫ G x paper towel = ___
- ▫ G x vinegar = ___

On the day:

- ▫ Ensure parent sign-in sheet is on display
- ▫ Set up tables for groups
- ▫ Make name tags for Young Scientists (YS) and Facilitators (F) and Volunteers (V)
- ▫ Meet and greet:
- ▫ Welcome YS, show where to sign in and put their name tag on
- ▫ Allocate YS to groups:
- ▫ Quick Health & Safety briefing (as per noted on experiment sheet)

Starting the experiment:

- ▫ Explain why we don't eat/drink in a science lab
- ▫ Introduce the topic and the two experiments:
  Form a Fossil: Spongey bone & Sudden Solid
- ▫ Give children a booklet with experiment instructions

During the Experiments:

- ▫ Give step by step instructions of experiments (Refer to faciltator experiment sheets for **What to Expect** and **The Science**)
- ▫ Allow each child to do the experiments

Reflection & Conclusion:

- ▫ Ask final questions
- ▫ Finish activity
- ▫ Ask Young Scientists to tidy up
- ▫ Ensure Parents sign their children out
- ▫ Clean the room and complete closing procedure
- ▫ Ask children to make a mark on the evaluation poster as they leave, which best represents how they felt about the session.

Finally, after the session don't forget to:

- ☐ Ask Young Scientists to tidy up
- ☐ Ensure parents sign their children out
- ☐ Clean the room and complete the closing procedure
- ☐ Ask children to make a mark on the evaluation poster as they leave, which best represents how they felt about the session

Notes & Calculations

Dinosaur Discovery: Form a Fossil

Briefly discuss the STEAM concept behind the experiment verbally or via the YouTube links provided (explain in your own words here)

Clipboard: Facilitator's run sheet 2/3

Dinosaur Discovery: Form a Fossil

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Spongey Bone Experiment

What to Expect

Hot water can dissolve more washing soda than cold water. The spongey bone with hot water is slightly harder than the one made with cold water. The longer you wait, the harder the spongey bones become.

The Science

Water is made up of millions of tiny molecules, too small to see with your eyes or a microscope. When you add washing soda to water, it dissolves, it mixes in with the water and seems to disappear. This is called a solution. But water can only hold so much washing soda. When it is 'full' of washing soda and no more can dissolve, it is called a saturated solution. Hot water can dissolve more washing soda than cold water because water molecules move faster in hot water. Hot water has more energy, so all the molecules have more energy, and they can mix in better with the washing soda. What does washing soda look like before it dissolves? It's a solid white powder. This solid stuff forms inside the sponge, spreading out through the pores like a network of tiny crystals. When you poke the spongey bone, it feels just a little bit harder and firmer compared to the one with water only. The hot water contains more washing soda than the cold water, so it has a stronger effect on the sponge. This is like what happened to the fossil bones found in Winton. Water containing silica (instead of washing soda) dripped into the bones and hardened. But it's not exactly the same. To be a better model, the sponge itself would need to dissolve and be replaced with washing soda!

Experiment Procedure

1. Put on your safety glasses and gloves (for both experiments)
2. Cut out the dinosaur bone template and the labels
3. Use a whiteboard marker to trace out two dinosaur bones side by side onto the sponge.You should now have four spongey bones.
4. Put one spongey bone aside. Place the other three spongey bones into a dish filled with sand.
5. Make the following three different mixtures in three cups. Cold water only / Cold water mixed with washing soda / Hot water mixed with washing soda
6. Measure half a cup of cold water and put it in a cup. Label it as "cold water only".
7. Measure half a cup of cold water, add a teaspoon of washing soda and stir it until it dissolves. Count how many teaspoons of washing soda you can add to the cold water until no more will dissolve. You'll see a small amount of Page 4 washing soda at the bottom of the cup. Label "cold water and washing soda".

8. Measure half a cup of hot water, add a teaspoon of washing soda and stir it until it dissolves. Count how many teaspoons of washing soda you can add to the cold water until no more will dissolve. You'll see a small amount of washing soda at the bottom of the cup. Label "hot water and washing soda".
9. Get your tray with the spongey bones, and label one spongey bone "cold water only".
10. Use a pipette to drip 15 drops of water from the "cold water only" cup onto the spongey bone.
11. Repeat using the second spongey bone. Use the label "cold water mixed with washing soda" and 15 drops from the "cold water mixed with washing soda" cup.
12. Repeat using the third spongey bone. Use the label "hot water mixed with washing soda" and 15 drops from the "hot water mixed with washing soda" cup.
13. Gently fan the spongey bones with your hand for 30 seconds.Use your finger to gently poke each of the spongey bones. How do they feel? Are some slightly harder than the others?
14. Put the spongey bones aside, and check on them again at the end of the session, and next week. Compare to the untreated spongey bone. Have they changed? Which ones are the hardest?

Notes & Calculations

Dinosaur Discovery: Form a Fossil

Clipboard: Facilitator's run sheet 3/3

Dinosaur Discovery: Form a Fossil

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Sudden Solid Experiment

What to Expect

Fossil bones can be made from different kinds of minerals. The ones found near Winton in Queensland contain silica, which is often found in nature as quartz or sand. Other fossils found around the world contain calcite or pyrite. In this experiment, you are going to mix two solutions to cause a chemical reaction to form a solid. Then you can do a test to identify which solid you made. The chemical in the solid is very similar to the chemical in calcite, which can be found in fossils. When you add a solution of washing soda to a solution of Epsom salts, you immediately see a white substance appear. It might look like a cloud, or it might look like little bits of solid material collecting on the bottom of the cup. A chemical reaction (precipitation) has occurred. When you add vinegar to the solid, you can see tiny bubbles appearing. The bubbles are carbon dioxide gas. This is another chemical reaction.

The Science

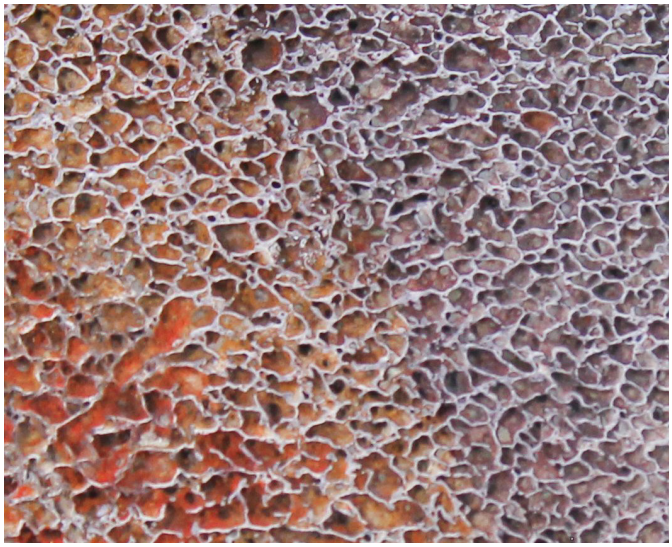
The chemical names of the materials mentioned in this experiment are: Washing soda: Sodium carbonate Epsom salts: Magnesium sulfate. In this experiment, you added washing soda (sodium carbonate) to epsom salts (magnesium sulfate) and a chemical reaction occurred. You can tell a chemical reaction happened because something changed – a solid was formed. In the chemical reaction, the sodium carbonate split up and swapped partners with magnesium sulfate to create sodium sulfate and magnesium carbonate. One of these is the solid. But which one? Here's a hint: Magnesium carbonate forms bubbles in vinegar. But sodium sulfate does not.

(Answer: Bubbles appeared when the solid reacted with vinegar, which means the solid must be magnesium carbonate).

Magnesium carbonate is similar to calcium carbonate, which is the chemical in calcite. Calcite is a mineral found in limestone rock, marble, and sometimes fossils. Fossil shells from Texas in the United States of America are often made of calcite. Like magnesium carbonate, calcium carbonate also bubbles with vinegar.

Experiment Procedure

1. Wear gloves and safety goggles for this experiment.
2. Fill the cup with 250 mL cold water.
3. Use the teaspoon to stir Epsom salts into the water until no more Epsom salts will dissolve.
4. Take the cup containing washing soda mixed with water from the last experiment (either hot water or cold water). Use a pipette to pick up some of the washing soda solution, and put one drop into the cup containing the Epsom salt solution. Observe what happens.
5. Try another drop. Continue dripping washing soda into the Epsom salts. What's happening?
6. Take the sheet of paper towel and spread it over the other empty cup. Push the middle of the paper towel down a bit, so it makes a little funnel.
7. Slowly pour the mixture with the white solid through the paper towel. Take out the paper towel and spread some of the solid onto the plate.
8. Use the pipette to drip vinegar over the solid on the plate. Observe closely for 30 seconds



Notes & Calculations

Dinosaur Discovery: Form a Fossil

Workshop Table Prompts

Dinosaur Discovery: Form a Fossil

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Cut and place these prompts around the tables!

Cold water dissolved ___ teaspoons of washing soda?
Hot water dissolved ___ teaspoons of washing soda?

Washing soda is a salt also called sodium carbonate.

Permineralisation

What is a saturated solution?

Silica, Calcite and Pyrite are often found in fossils, true or false?

Dinosaur Bones from Winton usually contain s_____?

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Bone Template & Labels

Dinosaur Discovery: Form a Fossil

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A) Cut the bone out and use as a template for the sponges.

B) Cut out the boxes below to use as labels.

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