# EVERYDAY VIKING LIFE

**Context:** Leif bought some land in the Copeland area of Cumberland and, with the help of his crew, built a farmstead for himself and his men. Soon afterwards he married an Anglian woman from the local area named Cuthswith. Together they had five children, three of them, two sons and a daughter, surviving into adulthood. In the spring and autumn Leif busied himself on the farm, planting and harvesting the crops. In the summer he went Viking, finishing the season with trade in Dublin. Winter time was always hard, but Leif was very successful and was able to feed his household, and even help neighbours when they fell on hard times. When Cuthswith wasn't preparing or preserving food or brewing beer, she and the other women spent most of their time spinning wool or flax into thread. This would be used to make fabric for clothing for the entire household.

Leif and family | Terry Harvey-Chadwick

KEY WORDS:
Fire, fuel, energy, evaporation

# FIRE AND WARMTH

## Starting fires

**Teachers' note:** One of the main requirements for survival in Viking times was fire. Without fire you cannot get warm in winter or cook your food. One of the main problems was keeping fuel dry enough to burn properly. Without dry tinder it is extremely difficult to start a fire. This activity should only be done as a demonstration.

**What can we ask?** How can we set fire to paper without it burning?

**Equipment list:** £5 note or similar sized piece of paper, lighter, kitchen tongs, 100-ml beaker of 50/50 mix of isopropyl alcohol (rubbing alcohol) and water.

**Activity instructions:** Soak your £5 note in the alcohol/water mixture so it is completely wet. Carefully, using tongs, remove it and spread it out, gently shaking any drips off the note. Quickly light the bottom edge with the lighter and watch it become enveloped in flames. The flames will go out leaving the £5 note intact. (Occasionally an edge or corner can ignite. Just blow it out.)

**Explanation:** A common misconception is that water puts out fire by smothering it, blocking the oxygen. With a large amount of water thrown on a fire that certainly occurs, but the main way it puts out fire is by removing the heat energy from the fuel. When you ignite the alcohol/water mixture the alcohol burns away. It also heats the water and the £5 note. As the water is heated it evaporates, removing the heat energy from the note, so it stays too cool to ignite. As long as the alcohol burns off before all the water evaporates the £5 note will remain unburnt as it doesn't get hot enough to ignite.

**Health and safety:** Wear eye protection. Always use the tongs to hold the £5 note, as isopropyl alcohol is a skin irritant and flammable. Never light the £5 note over the beaker of alcohol. Make sure no flammable materials are within 1 m of the burning £5 note. Always do as a demonstration only.

KEY WORDS:
Vinegar, sodium bicarbonate, acid, alkali, oxygen, carbon dioxide

## Putting fires out

**Teachers' note:** With wooden buildings and thatched roofs fire was an ever-present danger in Viking times, especially as the hearth in the centre of the main room is where the open fire would be lit. Sparks from the fire could easily set fire to the thatch without proper precautions. In case of fire, buckets of water could be thrown onto the blaze to extinguish it, or cloaks thrown over smaller fires to smother them.

**What can we ask?** How can we use vinegar and sodium bicarbonate to make a fire extinguisher?

**Equipment list:** Vinegar, baking soda (sodium bicarbonate), 1-litre jug, spoon, tea light candles, lighter

**Activity instructions:** Light a tea light candle with the lighter. Measure approximately 100 ml of vinegar into the jug. Add a couple of teaspoons of sodium bicarbonate and wait until the fizzing stops. Carefully tip the jug over the candle, but don't let any liquid come out. The candle should go out.

**Explanation:** The vinegar and sodium bicarbonate react to produce carbon dioxide, an invisible gas which is heavier than air. When you tip the jug you pour the carbon dioxide over the flame, cutting off the oxygen and smothering the flame.

**Health and safety:** Wear safety glasses. Ensure no flammable materials are within 1 m of the candle flame.

KEY WORDS:
Convection, conductor, heat, energy

## Cooking on fire

**Teachers' note:** Only quite wealthy people in Viking times could afford metal pots to cook in. Most people used pottery or pots carved from soapstone, a soft rock.

**What can we ask?** Can pots and pans be made of other things than metal?

**Equipment list:** Paper cup, tea light, tripod, lighter

**Activity instructions:** Fill the paper cup about a third to half full with water and place it on a tripod or similar holder. Light the tea light and place it so its flame is touching the base of the paper cup. The paper will blacken but probably not burn through and, eventually, the water will boil.

**Explanation:** As the candle flame heats the paper the heat energy is removed on the other side by the water. A convection current is set up, constantly replacing the heated water with cooler water and carrying the heat energy away from the paper. Even when the water is boiling, the paper does not get hot enough to ignite as the heat energy is constantly removed by convection.

**Health and safety:** Wear eye protection. Ensure no flammable materials are within 1 m of the candle flame. Make sure there is plenty of space between the audience and the cup when it is boiling to ensure nobody is scalded if the cup is tipped over or the paper does burn through. Do as a demonstration if you are not confident the children can do this activity themselves.

**Related activities:** Try a similar demonstration using a balloon with about 2 cm of water in the bottom. As long as you keep the candle flame under the water-filled part of the balloon it probably won't pop. For extra fun do it with the balloon over someone's head. An umbrella is recommended, just in case.

KEY WORDS:
Micro-organism, yeast, fermentation, carbon dioxide

# FOOD AND COOKING

**Context:** Leif could cook; he had to when his was out on a Viking expedition. At home, however, cooking was the work of Cuthswith and the other women. As well as the usual flatbread, Cuthswith loved making risen bread in her oven, which used the yeast from brewing to make it rise into loaves. She had a slave to grind the rye into flour, although it was often the task of the youngest daughter in some other households. Sometimes, when there were visitors, Cuthswith would make loaves from wheat, to show her high status. While most food was cooked in soapstone and pottery vessels on the fire, when she had guests Cuthswith would cook using her expensive iron cauldron.

## Making bread

**Teachers' note:** Strangely, bread wasn't a staple food in many areas due to the amount of work involved in making it. Flour needed to be made afresh every day, a task that could take between two and five hours using a simple hand quern, depending on the amount of bread needed. This job was usually given to a young girl, or a slave in wealthier households. Many houses did not have an oven, with cooking mostly being done over an open fire, so it would not be possible to bake bread. If an oven was available it could have taken up to a couple of hours to prepare, as the fire was lit inside and the whole oven heated. This means that it could take up to eight man-hours just to make a few loaves of bread, a significant investment in time and energy.

**What can we ask?** How do you make bread? Why do we use yeast to make bread?

**Equipment list:** Mixing bowl, wooden spoon, measuring jug, greased baking tray

**Ingredients List:**

- 225 g plain wholemeal flour
- 1/2 teaspoon salt
- 1 level dessert spoon sugar
- 1 desert spoon vegetable oil
- 1 sachet (6 g) dried yeast
- 150 ml warm (hand-hot) water

**Activity instructions:** Wash your hands before starting. Mix the dry ingredients together in the mixing bowl then add the water. Stir until the mixture becomes too thick. Sprinkle flour on a clean dry surface and knead the dough until it becomes smooth (at least 15 minutes). Add extra flour if it becomes too sticky. Divide into six rolls and place on the baking tray in a warm place for 15 minutes to rise. Cook in a preheated oven at 170 °C (gas mark 3) for about 15 minutes, or until golden brown on top.

**Explanation:** Yeast is a micro-organism used in bread to make it rise. The yeast ferments the sugar and converts it to alcohol and carbon dioxide. The alcohol evaporates during cooking, while the carbon dioxide gas makes bubbles in the dough, causing the bread to rise. People in Viking times would use the same yeast for baking as they used in brewing beer.

**Health and safety:** If the bread made is to be eaten make sure all school hygiene procedures are followed.

**Related activities:** People in Viking times often made unleavened (flat) bread as a fast alternative or when yeast was not available. Follow the recipe above but leave out the yeast to see how the bread is different, or halve the ingredients to bake leavened and unleavened bread side by side.

KEY WORDS:
Micro-organism, yeast, preserve, drying

# PRESERVING FOOD

Food was preserved in Viking times by drying, pickling in whey or lactic acid (from milk) or by salting or smoking. Preserving food stops micro-organisms from growing and spoiling the food.

## Growing yeast

**Teachers' note:** Drying food stops it spoiling because micro-organisms need water to live. Fish and meat would be left outside in the wind to dry on racks, then stored in a cool dry place.

**What can we ask?** How does drying food stop it from going off?

**Equipment list:** Two balloons, dried yeast, sugar, teaspoon

**Activity instructions:** Put a teaspoon of dried yeast and two teaspoons of sugar into two balloons. Add water to one balloon and tie the end of both. The one with water will blow up as carbon dioxide is produced by the yeast.

**Explanation:** Living things need water to live, grow and reproduce. The balloon containing water blows up as the yeast activates, starts fermenting the sugar and produces carbon dioxide gas. The yeast in the balloon without water remains dormant and does not start the fermentation process. By drying out food you remove the water so any micro-organisms cannot grow, so the food lasts much longer without spoiling.

**Related activities:** See the bread-making activity.

KEY WORDS:
Dissolve, evaporate, crystallise, solution

# SALTING

Salt can be used to preserve food by drawing the water out of it, also dehydrating any micro-organisms that try to grow in it. Salt was quite hard to come by in Viking times, so was unavailable to poorer households. It can be obtained by mining from salt mines, or extracting from sea water.

## Extraction of salt from sea water

**Teachers' note:** You can easily make "sea water" by dissolving sodium chloride (common or table salt) in water. For best results make a saturated solution, ie keep adding salt until no more will dissolve. It can be very good to start the activity by dissolving the salt and asking the children where the salt has gone. Put the beaker of water on some electronic scales and ask what will happen to the reading on the scales when you add the salt. Many children will say the weight will stay the same because the salt disappears. Show how the weight increases as you add salt, despite it apparently disappearing as you dissolve it.

**What can we ask?** What happens to salt when you dissolve it? How can you get the salt out of salty water? Is dissolving salt a physical or a chemical change?

**Equipment list:** Bowl, electronic scales (optional), spirit burner or candle (optional), ceramic dish or saucer

**Activity instructions:** Dissolve the salt in water to make brine (saturated salt solution), stirring until all the salt has dissolved. Evaporate the water using a spirit burner or candle, or leave in a sunny place on a windowsill or on a heater (if safe to do so).

**Explanation:** When salt is added to water the ions that make up the crystals come apart from each other and are surrounded by the water molecules. If you measure the mass of the salt and water separately the mass of the solution will be the same as the combined mass of the salt and water. The salt appears to disappear when added to the water as it forms a colourless solution. When you heat the solution, or leave it in a warm place, the water evaporates much more easily than the salt, so the water evaporates and leaves the salt behind as new crystals.

**Related activities:** Compare the crystals produced when you boil the salt solution in one dish and leave it to evaporate slowly in another dish. Make a crystal garden.

KEY WORDS:
Dissolve, evaporate, crystallise, solution, soluble, insoluble, filter

## Extraction of salt from rock salt

**Teachers' note:** Rock salt is a mixture of sand, gravel and salt. It can be bought from garden centres or online, or easily mimicked by mixing sand gravel and salt. This activity introduces an additional separation step to the previous activity, as the salt is mixed up with insoluble substances.

**What can we ask?** How can you separate a mixture of sand, gravel and salt so you end up with pure salt?

**Equipment list:** Rock salt, sieve (optional), filter paper (the filters from a coffee maker work well), funnel, ceramic dish, spirit burner or candle (optional), spoon

**Activity instructions:** Add the rock salt to water and stir until the salt has dissolved. Use the sieve to separate the sand from the gravel (optional). Put the filter paper in the funnel and filter the sand/gravel from the water. Pour the water (salt solution) into a dish and evaporate the water, either by heating it with a spirit burner or candle, or leaving it in a warm spot to evaporate overnight.

**Explanation:** The sand and gravel is insoluble, while the salt dissolves in the water. You can physically separate the sand from the gravel by size using the sieve. Larger fragments are caught in the sieve, while the smaller fragments pass through back into the water. You can physically separate the smaller fragments by filtering them with the filter paper. Finally, reclaim the salt by evaporating the water, leaving pure salt crystals in the dish. All of these separation methods are physical, based upon grain size (sand/gravel) and solubility (salt).

**Related activities:** Try using different physical properties to separate mixtures of substances, eg by using magnets to separate magnetic from non-magnetic materials, by whether things float or sink, etc.

KEY WORDS:
Salt, preserve, food, hygroscopic

## Preserving cucumber with salt

**Teachers' note:** Preserving food using salt works because the salt draws water out of the food, dehydrating the food and any micro-organisms on it so they cannot spoil the food. Cucumber contains a lot of water so this activity shows the process very well. However, salt was quite expensive during Viking times, and it is unclear from the archaeological record how many people used this method to preserve food.

**What can we ask?** How does covering food in salt prevent it from spoiling?

**Equipment list:** Fresh cucumber, sharp knife, bowl or plate, table salt

**Activity instructions:** Cut a cucumber into thin slices and thickly cover with the salt. After an hour or so you can see the water has started to come out of the cucumber into the salt.

**Explanation:** Salt is hydroscopic; it attracts water. Covering fresh food, such as meat or fish, with salt extracts the water from it and prevents micro-organisms from growing on it and spoiling it.

**Health and safety:** If the cucumber is to be eaten afterwards follow all school hygiene procedures during the activity. Take care when using a sharp knife.

**Related activities:** To finish the preservation process, try pickling the cucumber in vinegar for a couple of weeks to make yummy pickled cucumber. The vinegar is too acidic for most micro-organisms to grow and spoil the food.

KEY WORDS:
Preserve, fat, lipid, emulsion

# DAIRY PRODUCTS

Milk from cows, sheep, horses or goats can be preserved by making it into butter, cheese or skyr, a product similar to yoghurt. In Viking times animals would not be milked until they had weaned their young, then it became an important source of nutrition for people. Raw milk was not often drunk unless there was a large surplus, as the valuable calories and nutrients needed to be preserved for when the animals no longer produced milk.

## Making butter

**Teachers' note:** Butter preserves cow's milk so it does not need to be drunk on the same day. It can go rancid after a few days, so butter can be preserved by salting or smoking it so it lasts even longer. For even greater preservation, butter can be wrapped in a cloth and buried in waterlogged peat to last for years. The buttermilk that remains can be drunk, as it is a very good source of calcium, or used in cooking or to preserve other foodstuffs.

**What can we ask?** How is butter made?

**Equipment list:** Double cream, jars with lids

**Activity instructions:** Add about 100 ml of cream to each jar and close the lid tightly. Shake hard until a solid lump of butter is formed, after about 10–20 minutes. Remove from the remaining buttermilk, add a pinch of salt to taste. Spread immediately on bread or a cracker.

**Explanation:** Milk is basically an emulsion of water and tiny globs of fat (lipids). As you shake the jar, churning the milk, the lipid globs stick together, getting larger and larger until, eventually, they quickly coalesce into a single lump of butter in the thin buttermilk. Normally you would use wooden paddles to squeeze the remaining buttermilk out and shape the butter into a block, but it is fine to spread on crackers or bread immediately, adding a pinch of salt to taste.

**Health and safety:** Before starting make sure you have washed your hands and all the jars and lids are sterile. Follow all the school's hygiene procedures if the butter is to be eaten.

KEY WORDS:
Coagulation, lactic acid, bacteria, rennet, acidic, curds, whey

## Making cheese

**Teachers' note:** Cheese can be made from any type of milk, even buttermilk, and is an excellent way of preserving milk for a long time. Cheese is a very good source of fat, protein, calcium and phosphorus. Raw milk is acidified, usually through bacterial action that produces lactic acid, then curdled, or coagulated, using rennet, an enzyme extracted from the lining of a cow's stomach. This results in a solid rubbery gel, the curd. For a soft cheese the curds can now be cut up, salted and moulded into shape. Harder cheeses can be cut up into smaller pieces, so more of the whey can drain, and salted, so more of the whey will drain and to preserve it. It can then be processed further and moulded into shape. The whey contains lactic acid, so it can be used to preserve food by pickling, which prevents the growth of many micro-organisms due to the acidic environment.

Below is a quick recipe that acidifies the milk using lemon juice and causes the milk to curdle. Vinegar can also be used if preferred.

**What can we ask?** How is cheese made?

**Equipment list:** Pint of fresh full-fat milk, saucepan, lemon juice, sieve or colander, clean cheesecloth or tea towel, mixing bowl, salt

**Activity instructions:**

1. Heat the milk until just before it boils.
2. Take the milk off the heat and add the juice of two lemons.
3. Cover the milk and let it stand for 10 minutes.
4. Set up a strainer lined with a cloth (eg cheesecloth or a tea towel) over a mixing bowl and pour the contents of the saucepan into the cloth.
5. The curds will collect in the cloth and the yellow, watery whey will collect in the bowl.
6. Squeeze the curds gently in the cloth to remove any excess whey.
7. Open the cheese cloth and sprinkle a quarter of a teaspoon of salt over the curds.
8. Eat the curds as they are or press them into shape in a mould.

**Explanation:** The action of bacteria on lactose milk sugars is a type of fermentation, producing lactic acid. This produces the acidic environment for the enzyme rennet to denature the casein protein in milk and coagulate it to form curds. If lemon juice or vinegar is used the milk becomes acidic enough for it to curdle without rennet. Adding salt helps preserve the cheese by drawing more water out of it.

**Health and safety:** Make sure all school hygiene procedures are followed when making cheese, especially if it is going to be eaten.

**Related activities:** After the curds have been separated from whey add some sodium bicarbonate to the curds and mix well into a paste. This can be used as glue, and was used by people in Viking times. Use immediately.

Make yoghurt, similar to Skyr in Iceland, where the recipe has existed since Viking times.

KEY WORDS:
Spinning, thread, plaiting, twisting

# TEXTILES

**Context:** Throughout the year the children would collect tufts of wool shed from Leif's herd of sheep. The women would spin it into thread, and this was one of the first tasks a girl learned from her mother, as miles of thread were needed every year. One year Leif informed his wife that he needed a new sail for his longship. That year even some of the young boys on the farmstead learned how to spin.

Vikings mostly wore clothes made from wool and linen. Wool is the hair from sheep and was mainly collected from natural shedding caught on twigs and fences throughout the year. Linen is made from flax fibres or, sometimes, fibres from the stems of nettles. Wool was worn by people of all statuses, while linen was worn more by high-status people.

## Spinning

**Teachers' note:** Spinning with a drop spindle was a vital skill for women in Viking times, as this is how you make thread to use for weaving and sewing. Spinning fibres together makes a long thread and it also makes it much stronger. Each year every woman, from slaves to noblewomen, would need to make miles of thread.

**What can we ask?** How does spinning make thread stronger?

**Equipment list:** Long grass leaves or thin ribbon

**Activity instructions:** Take three leaves of grass or lengths of thin ribbon and try and snap all of them together. Take three more and plait them into a single piece. Try to snap it.

**Explanation:** Even if you cut three threads together with scissors they will still have very slight differences in their length. This means when they are placed under a load together, the shortest one will have slightly more tension placed on it and will snap first. When you twist or plait the threads together, you distribute the load evenly between the individual threads, so it is stronger overall.

**Related activities:** Suspend weights from a single cotton thread and record the mass at which it snaps. Tie three separate threads to a weight, and record the mass at which they all snap. Twist or plait three threads together. Record the mass needed to make it snap.

Spinning with a drop spindle | Mark Thornton-Bryar

KEY WORDS:
Natural fibre, synthetic fibre, insulator, conductor

## Which fabric keeps you warmest?

**Teachers' note:** Natural fibres tend to keep you warmer in the winter than synthetic fibres. Modern explorers who have visited native peoples in Alaska or Siberia often swap their modern warm clothing for the traditional clothing because it keeps them warmer, being made from natural fibres.

**What can we ask?** Which is the best fabric at keeping you warm? Are natural fibres better insulators than synthetic fibres?

**Equipment list:** Thermometers, kettle, plastic, glass or ceramic beakers, lids from disposable coffee cups, selection of cloths made from natural or synthetic fibres, eg wool, linen, cotton, rayon, nylon, polyester, etc.

**Activity instructions:**

1. Boil a kettle full of water.
2. Wrap each beaker in a different fabric, ensuring that the same amount of fabric is used on each one.
3. Fill each beaker with the same amount of hot water.
4. Put the disposable lid on the beaker and put the thermometer in the water through the lid.
5. Finish wrapping the beaker so it is completely covered.
6. Measure the drop in temperature in each beaker every 30 s or minute for 10 minutes.
7. Optional – Draw a graph of drop in temperature against time for each beaker.
8. Determine which fabric kept the water the warmest, and which temperature dropped most slowly.

**Explanation:** Natural fabrics, especially wool, trap a lot of air in the spaces between the fibres. Air is a poor conductor of heat; therefore it is a good insulator as it only allows heat energy to transmit through it slowly. Synthetic fibres tend to be much smoother and can be woven more tightly, so there are fewer air pockets, and heat escapes more quickly. Synthetic fibres, like polyester, also conduct heat themselves better than natural fibres like wool, leading to further heat lost by conduction through the material.

**Health and safety:** Take care when pouring hot water, and that the beakers are not knocked over when full.

**Related activities:** Try using other materials like bubble wrap, cotton wool, kapok, paper, aluminium foil, etc to find the best heat insulator.

KEY WORDS:
Natural fibre, synthetic fibre, evaporation, absorb

## Which clothes keep you coolest?

**Teachers' note:** Not only can clothes made from natural fibres keep you warm in winter, but they can help keep you cooler in summer as well, and are often more comfortable to wear as they breathe when you sweat.

**What can we ask?** Do clothes made from natural or synthetic fibres keep you cooler in summer? Which clothes are more comfortable to wear when you are sweaty?

**Equipment list:** Thermometers, kettle, plastic, glass or ceramic beakers, lids from disposable coffee cups, selection of cloths made from natural or synthetic fibres, eg wool, linen, cotton, rayon, nylon, polyester, etc.

**Activity instructions:**

1. Boil a kettle full of water.
2. Soak each piece of fabric in lukewarm water and wring it dry.
3. Wrap each beaker in a different fabric, ensuring that the same amount of fabric is used on each one.
4. Fill each beaker with the same amount of hot water.
5. Put the disposable lid on the beaker and put the thermometer in the water through the lid.
6. Finish wrapping the beaker so it is completely covered.
7. Measure the drop in temperature in each beaker every 30 s or minute for 10 minutes.
8. Optional – Draw a graph of drop in temperature against time for each beaker.
9. Determine which fabric allowed the water to cool quickest, and which dropped to the lowest temperature.

**Explanation:** Natural fibres absorb water more easily than synthetic fibres, so when you sweat they soak it up. This means that you don't feel so sticky when you are hot, as more sweat is absorbed from the surface of your skin, so you feel more comfortable. As your body heats the air trapped between the fibres, so that heats the water and it evaporates, taking the heat energy away from your body and cooling your skin more rapidly.

**Health and safety:** Take care when pouring hot water, and that the beakers are not knocked over when full.

**Related activities:** Take your temperature using a strip thermometer on the forehead. Spray hand-hot water onto your forehead and try taking your temperature again.

KEY WORDS:
Hygiene, absorbent

## Viking nappies

**Teachers' note:** How to keep babies bottoms clean and dry has been a problem as long as there have been babies. Nature, however, does provide several different absorbent materials.

**What can we ask?** How did mothers in Viking times make nappies?

**Equipment list:** Cloths or paper towels to use as "nappies", Komodo Reptile Habitat Sphagnum Moss (available on the internet or from pet shops), disposable nappies or water-absorbing crystals (from garden centres), measuring jug, digital scales

**Activity instructions:**

1. If you have bought some disposable nappies, cut open the water absorbent lining and remove the crystals that are inside.
2. If the sphagnum moss is damp, dry it out in an oven set to low.
3. Lay out two cloths or paper towels to use as "nappies".
4. Measure equal weights of moss and crystals and put one in the centre of each "nappy". These are your absorbent materials.
5. Slowly add measured amounts of water, about 10–20 ml at a time, to the absorbent material and carefully lift up each "nappy".
6. Record the total amount of water used for each absorbent material when the water starts to drip through.

**Explanation:** Sphagnum moss is a very common plant in Scandinavia and parts of the British Isles and is well known for its water-absorbing properties, which made it ideal for use in nappies. Mosses tend to lack a waxy cuticle on their leaves and so are prone to drying out so, for many, being able to absorb more water than they need is an advantage. Sphagnum moss also helps keep faeces away from the baby's skin, as it surrounds it and absorbs the water from it, drying it out and preventing bad smells. Modern nappies contain super-absorbent polymer crystals made from sodium polyacrylate. These can absorb between 90 and 500 times their mass in water, depending on the polymer used. The crystals can be reused either through gentle drying in an oven, or leaving in a warm place while the water evaporates, as can the moss.

**Health and safety:** Do not dispose of superabsorbent polymer crystals down the toilet or sink. Always dispose of in the rubbish bin. Do not eat the crystals.

**Related activities:** Investigate the absorbing powers of other materials, like different brands of paper towels, silica gel, table salt, etc.

Will the polymer crystals absorb anything other than water? Try other liquids, for example tomato juice, orange juice, vegetable oil, milk, rainwater, hot water, salt water, etc.

KEY WORDS:
Sag, weight, absorbent

## Longship sails

**Teachers' note:** Longship sails were made of wool and, later, linen. Woollen sails absorb lots of water and tend to stretch and lose their shape over time, so Vikings strengthened the sails with walrus-hide leather strips.

**What can we ask?** Which material is best for making a sail? Is wet material stronger than dry material? How much water do different fabrics absorb?

**Equipment list:** Ruler, weights, 30-cm squares of different materials, eg wool, linen, cotton, polyester, nylon

**Activity instructions:**

1. Suspend the material horizontally tied at the four corners.
2. Add weights to the middle of the square. Measure and record the amount the material sags in the middle as each weight is added.
3. Soak each fabric in water, gently wring dry and repeat the experiment.
4. Compare the amount of sag between wet and dry materials.

**Explanation:** Wool should sag a lot, especially when it is wet. Most of the synthetic fibres will hardly stretch at all, even when wet, as they do not absorb much water. The main indicator of whether a fabric will stretch and sag a lot is the length of the fibres that make up the thread. A long thread of wool is made of many much shorter hair fibres twisted together. These threads can stretch when put under a load, like the wind in the sails. Linen is made from much longer fibres so, when twisted together, it is stronger, although it can still stretch. Synthetic threads tend to be made of single fibres, so the strength of the thread depends upon the material it is made from. When wool is wetted this reduces the friction holding the fibres in the threads together, so they slide past each other, lengthening and weakening the threads. This is why a woollen jumper that has stretched will not go back into shape again. Longer natural fibres, like linen, also suffer this effect, but not anywhere near as bad. Synthetic threads, being often made of just a single long fibre, do not tend to suffer from this effect.

**Health and safety:** Follow school health and safety procedures when doing practical activities. Be careful that weights do not fall onto children's toes.

**Related activities:** Sew strips of leather or a synthetic, non-stretchy fabric to the woollen fabric in a criss-cross pattern and repeat the experiment.

KEY WORDS:
Dye, colourfast

# DYEING CLOTH

**Context:** One of the women on Leif's farmstead was skilled at dyeing. She dyed the cloth used to make Leif's new sail red and yellow. Cuthswith had a beautiful dress of the darkest blue, and Leif wore red and green that didn't fade over time, showing the high status of him and his family.

Many people think clothing in Viking times was all drab colours like various shades of brown. People have always loved wearing bright colours and that was no different in Viking times. Many people wore red, yellow, green, blue, even purple, and all the shades in between. The brighter the colours you wore the wealthier you were, as they took longer to dye and often used more expensive materials. Also, even if a poorer person and a wealthy person started out with new clothes the same shade of red, for example, the poorer person's colour would fade quite quickly, while the wealthier person's clothes would stay bright for much longer.

## Dyeing with onion skins

**Teachers' note:** Many different plants can be used to dye with. This activity introduces children to the basic dyeing process.

**What can we ask?** How can you use plants to colour material? How long will the colour stay in a material when it is washed?

**Equipment list:** Three large stainless steel saucepans, ball of white 100% pure wool, tongs, colander or sieve, dried cooking onion skins, hob

**Activity instructions:**

1. Weigh out approximately 20 g of wool and 20 g of onion skins.
2. Put the wool and skins in separate saucepans, fill with water so there is about three times as much water as the materials and bring to the boil.
3. Simmer both for about 30 minutes. If not much colour has come out of the onion skins simmer for up to an hour.
4. Strain the onion skins into the third saucepan using the colander and bring the liquid back to the boil.
5. Use the tongs to transfer the wool into the dye-bath (coloured water).
6. Simmer the wool in the dye-bath for a further hour.
7. Remove the wool from the dye-bath and allow to cool.
8. Rinse the wool in lukewarm fresh water.
9. The wool should have been dyed by the colour from the onion skins. Is it the same colour as the onion skins?

**Explanation:** The coloured chemicals from the onion skins react with the proteins that make the wool. However, many natural dyes do not stick to the wool very well and the colour will fade after a few washes.

**Health and safety:** Follow all school health and safety procedures for practical activities. Wear eye protection. Be aware that natural dyes can stain clothes.

**Related activities:** Investigate how the colour varies with how long the wool is left in the dye-bath. Investigate how many times the wool can be washed before the colour fades. Try using red onion skins, or other dyes such as tea, coffee, turmeric, walnut shells or grass.

KEY WORDS:
Mordant, dye, salt, alum

## Dyeing with mordants

**Teachers' note:** A mordant is a chemical used in dyeing to make the dye more colourfast, ie it doesn't fade as quickly, and also to adjust the colour of the finished material. Most natural dyes require a mordant to remain colourfast, apart from indigo.

**What can we ask?** How does a mordant affect dyeing? What does a mordant do to the colour? How colourfast does a mordant make the dye?

**Equipment list:** Three large stainless steel saucepans, ball of white 100% pure wool, table salt, alum (available from the internet. Search "buy alum".), tongs, colander or sieve, dried onion skins, hob

**Activity instructions:**

1. Weigh out approximately 20 g of wool and onion skins, and 10 g of alum.
2. Put the wool and skins in separate saucepans, fill with water so there is about three times as much water as the materials and bring to the boil.
3. Before heating add the alum to the wool saucepan and stir until dissolved.
4. Simmer both for about 30 minutes. If not much colour has come out of the onion skins simmer for up to an hour.
5. Strain the onion skins into the third saucepan using the colander and bring the liquid back to the boil.
6. Use the tongs to remove the wool from the water and allow it to cool, then rinse it in lukewarm water.
7. Transfer the wool into the dye-bath (coloured water).
8. Simmer the wool in the dye-bath for a further hour.
9. Remove the wool from the dye-bath and allow to cool.
10. Rinse the wool in lukewarm fresh water.
11. The wool should have been dyed by the colour from the onion skins. Is it the same colour as the onion skins? If you dyed without onion skins before is it the same colour as before?

**Explanation:** A mordant is a chemical that makes the dye more colourfast, and it can also change the colour after dyeing. The mordant reacts with the wool and binds more firmly to the protein molecules that make it up. The dye then reacts with the mordant and binds firmly to it. Sometimes the dye changes colour due to the reaction with the mordant. Different mordants often give different colours with the same dyes. For example, an iron mordant will give a green colour from onion skins. Alum (potassium aluminium sulfate) is one of the most common mordants used. Ammonia, from stale urine, was also a common mordant, resulting in dye-works often being on the outskirts of settlements due to the smell.

**Health and safety:** Follow all school health and safety procedures for practical activities. Wear eye protection. Read MSDS for use and disposal of mordants.

**Related activities:** Wash the wool several times and compare how colourfast it is to wool that was dyed without a mordant. Try different mordants, such as ferrous sulfate, copper sulfate or vinegar.

KEY WORDS:
Acid, alkali, neutral, pH

## Dyeing with red cabbage

**Teachers' note:** Not only are some dyes affected by different mordants but the colour you get can also be affected by the pH (how acidic or alkaline it is) of the dye-bath. The turnsole plant, also known as folium, produces a range of reds, purples and blues depending on the pH of the solution, but a much easier to obtain alternative is red cabbage.

**What can we ask?** How does the colour of red cabbage dye change in acid or alkali?

**Equipment list:** Three large stainless steel saucepans, ball of white 100% pure wool, alum (available from the internet. Search "buy alum".), tongs, colander or sieve, a red cabbage, sharp knife, distilled water (optional, available from car autocentres or local garages), teaspoon, white distilled vinegar, baking powder (sodium bicarbonate), hob

**Activity instructions:**

1. Coarsely chop up the red cabbage and heat it without boiling in a saucepan of distilled water for about 30 minutes (you can use tap water, if it is pH 7, or neutral).
2. While the cabbage water is being prepared weigh out approximately 100 g of wool and 10 g of alum.
3. Fill a second saucepan with water, add the alum and stir to dissolve.
4. Add the wool to the alum solution and simmer for about 30 minutes.
5. Use the tongs to remove the wool from the water and allow it to cool, then rinse it in lukewarm water.
6. Strain and collect the coloured water from the red cabbage with the colander.
7. Dispose of the alum solution down the sink and wash the saucepan, making sure it is properly rinsed.
8. Divide the red cabbage water into three equal parts, one-third in each saucepan. Divide the wool into three equal parts with scissors.
9. Into one saucepan pour in two teaspoons of vinegar and stir well. The water should turn a reddish pink colour.
10. Into another saucepan pour a heaped teaspoon of baking powder and stir until dissolved. The water should turn a bluey green colour.
11. Transfer a hank of wool into each dye-bath.
12. Simmer the wool in the dye-baths for a further hour.
13. Remove the wool from the dye-baths and allow to cool.
14. Rinse the wool in lukewarm fresh water.
15. You should now have three hanks of wool all dyed different colours by the same red cabbage dyestuff.

**Explanation:** Red cabbage, as well as other plants, contains a type of coloured compound known as anthocyanins. These change colour depending on whether they are in an acidic (red/pink) or an alkaline (blue/green) solution. By changing the pH of the dye-bath it is possible to get more than one colour using the same dyestuff.

**Related activities:** Try using other red dye plants, such as red onion skins or plums, and see whether they are also affected by whether the water is alkaline or acidic.

KEY WORDS:
Domestication, breeding, adaptation

## FARMING AND HUNTING

**Context:** Leif had purchased very good land in Copeland including flat fertile land for growing crops, and into the hills of Wasdale for raising sheep. The rich land, far better than what his family owned in Norway, meant that he was able to produce a surplus almost every year. He would sell some and gift some to poorer neighbours to increase his reputation. The land was also rich in wildlife and sealife. Leif owned two fishing boats and enjoyed hunting in the hills.

Most people were farmers in Viking times, growing crops and raising livestock. Most only produced enough food for their own families, but some farmers grew rich by selling their surplus, enabling them to buy more land and grow even more crops and raise more animals.

### Sheep

**Teachers' note:** Sheep are thought to have been first domesticated between 9,000 and 11,000 years ago. They are important for meat, milk and wool. Old breeds like Faroese sheep or Old Norwegian (Viking) sheep are similar to sheep kept by people in Viking times.

**What can we ask?** What were sheep like in Viking times? How were Viking sheep different from sheep today?

**Equipment list:** Computer with internet access, library books, notebook

**Activity instructions:** Research the characteristics of Faroese sheep and Old Norwegian (Viking) sheep. Explain how they were adapted to living on Viking farms in Scandinavia.

**Explanation:** Sheep have been bred for thousands of years. Farmers select and breed certain sheep with characteristics they think are valuable so more of the offspring have these characteristics. This is called selective breeding, and has resulted in the wide variety of different breeds we have today.

**Related activities:** Compare the old Viking sheep breeds to more modern breeds like Merino sheep.

Leif's land in Cumberland | Terry Harvey-Chadwick

KEY WORDS:
Crops, plants, identification, life cycle

## Identification and life cycles of crops

**Teachers' note:** The main cereals grown in Viking times were barley, rye and oats. Some wheat was grown in southern Denmark, but it was considered a luxury crop. Other important crops grown were beans, peas, cabbage, onions and some other root vegetables.

**What can we ask?** How can we tell cereal crops apart? What is the life cycle of a crop plant? Do different plants have different life cycles?

**Equipment list:** Photographs, pictures or specimens of whole barley, rye, oat and wheat plants. Notebooks, coloured pencils (optional), identification keys

**Activity instructions:** Use or make a key to identify the four cereal crops grown in Viking times. Identify the parts of the plants.

**Related activities:** Research the life cycle of one of the crop plants, including sowing, growing and harvesting times.

KEY WORDS:
Life cycle, animal, domesticated

## Life cycles of domesticated animals

**Teachers' note:** The main domestic animals kept on farms during Viking times were sheep, goats, cattle and, in richer households, horses. Goats and cattle were raised for milk and meat and, in the case of cattle, as beasts of burden. Sheep were raised for wool, meat and milk, and horses mainly as riding animals and meat. Chickens were also often kept for meat, eggs and feathers.

**What can we ask?** What is the life cycle of a farm animal?

**Equipment list:** Computer connected to the internet, notebook, coloured pencils (optional).

**Activity instructions:** Research the life cycle of an animal kept by farmers in Viking times.

KEY WORDS:
Life cycle, fish

## Life cycles of salmon or eels

**Teachers' note:** People living by the coast or by rivers in Viking times ate a lot of fish and shellfish. Common fish were salmon and eels.

**What can we ask?** What is the life cycle of a fish?

**Equipment list:** Computer connected to the internet, notebook

**Activity instructions:** Research the life cycles of salmon and eels, and how they were caught.

KEY WORDS:
Belief, superstition, spell, medicine, fossil

# BELIEFS

**Context:** Although many of the Saxons (called Angles in this area) who lived in the area were Christian, Leif still clung to the old gods: Thor, Odin, Frey and others. In his pouch and around his neck he carried his talismans to protect him from harm and help cure illnesses.

## Protection from snakes and elves

**Teachers' note:** Snake stones were believed to protect people against snake bites and, if actually bitten, help cure them. Although they look like curled up snakes they are actually fossil ammonites, a type of sea creature that lived between 400 million and 65 million years ago.

Belemnites are fossilised parts from extinct squid-like creatures that lived between 175 million and 200 million years ago. They were believed to protect against being elf shot, sharp stabbing pains caused by things like appendicitis, muscle stiches, cramps, arthritis or rheumatism.

**What can we ask?** How are fossils formed?

**Equipment list:** Computer connected to the internet, notebook

**Activity instructions:** Research and write a story describing how an ammonite or belemnite died, was fossilised and then found millions of years later by a person living in Viking times.

Protective charms | Terry Harvey-Chadwick

## TRADE

**Context:** At the end of the Viking season Leif would sail across to the Isle of Man, visible from his farm, and to Dublin in Ireland. Here he would trade slaves captured in raids, and wool from his farm. From Scotland he would also pick up skins and furs. These he would trade for essentials like salt, but also glass beads and jewellery for his wife and daughter.

Scandinavian people in Viking times were great traders. Their ships travelled all over the known world. The people from Sweden headed eastward rather than north and west, like the Norwegians and Danes, down the Volga River, founding the cities of Novgorod and Kiev in Russia and Ukraine. They were known to the people there as the Rus. The Rus controlled the trade routes to the Black Sea and the city of Constantinople, where they brought luxury items back from the Byzantine Empire.

Leif the trader | Terry Harvey-Chadwick

KEY WORDS:
Fossilize, tree resin

## Amber

**Teachers' note:** Amber is fossilised tree resin. The richest sources of amber in Viking times, and even today, are the Baltic coasts. Amber was highly sought after and used to make jewellery. It was highly prized in the Byzantine Empire.

**What can we ask?** What is amber and how is it formed?

**Equipment list:** Computer connected to the internet, notebook

**Activity instructions:** Amber is fossilised tree resin. Research where it comes from and how it is formed.

**Related activities:** Research the properties of amber and how it can be made into jewellery.

KEY WORDS:
Adaptation, environment

## Furs and skins

**Teachers' note:** Many animals were hunted and trapped for their skins, as well as meat. Furs and skins of wolf, fox, reindeer, arctic hare, marten, squirrel, seal, sheep, beaver, boar, bear and deer were used and traded in Viking times. They were highly sought after in the Byzantine Empire, especially furs from arctic animals.

**What can we ask?** How are animals adapted to their environment?

**Equipment list:** Computer connected to the internet, library books, notebook

**Activity instructions:** Choose an animal used by Vikings for its skin or fur and research how it is adapted to its environment.