

## VIKING RAIDS, WARFARE AND WEAPONS

Vikings used a variety of weapons, mainly depending upon what they could get their hands on. Professional warriors could use all weapons well but had their favourites. Different weapons had different effects depending upon the physics of how they worked.



**Context:** Leif could see the smoke just over the hillside that betrayed the settlement. While Leif donned his chainmail his men readied their weapons and shields. Many carried spears, either to be thrown or to be used in the shieldwall. Leif had his sword, Widowmaker, and most of his other men carried axes. Vandrad, the big Norseman, carried Deathsinger, his long-shafted Dane-axe. The men rowed hard into the shoreline and beached the ship, then jumped into the shallow water and gathered on the beach.





**KEY WORDS:**  
Pressure, force

## Shieldwall formation



**Context:** These Scots, however, were obviously wary and had posted lookouts near the beach. As Leif and his men started up the hill, suddenly a howling mob of clansmen crested the ridge and came hurtling towards them. Leif commanded his men to form the shieldwall. As the Scots approached his men overlapped their shields and braced themselves for the impact. Just as the front line of warriors struck, Leif's men, with their shoulders braced behind their shields, took a half-step forwards. The Scots reeled, and the largest warrior cried out as he rebounded off the solid line of shields and crumpled to the ground, his shoulder shattered.



**Teachers' note:** A shieldwall is a protective formation of interlocking shields. Your shield protects yourself and the man to the right of you. Shieldwall combat was, essentially, a shoving match, with the second rank of your formation trying to kill the front rank of the opposite formation. A gap in the opposing shieldwall would allow your side to break up their formation, giving your side a great advantage in the battle. Normally the side whose shieldwall broke first would lose. Although obsolete as a battle tactic in modern times, riot police still use it effectively today in crowd control situations.



**What can we ask?** How does a shieldwall protect people?



**Equipment list:** Corrugated card, scissors, blu-tack, garden skittles, ball



**Activity instructions:** Cut out squares of corrugated cardboard from a box. Stick the "shields" to the garden skittles, so the ball will hit the "shield". Line up the skittles with the "shields" edge to edge, not overlapping. Bowl the ball just hard enough to knock the middle skittle over. Now place the skittles close together so the "shields" are overlapping. Bowl the ball at the middle skittle again, at the same strength. The skittles should stay up.



**Explanation:** When the ball hits a skittle hard enough to knock it over the skittle is receiving the full force of the strike. When the "shields" overlap each other the force of the impact is spread out, reducing the pressure on the skittle, so it stays up.



**Related activities:** Investigate how the surface area of an applied force affects the pressure exerted by the force, eg add weights to different shoes and measure how far they sink into sand, like stilettos, high heels and ordinary shoes.



**KEY WORDS:**

Pressure, force, length, moment

## Weapons – long vs. short cutting edge



**Context:** Just before the Scots hit Leif's shieldwall some of his men threw their spears at the oncoming warriors. Where they struck, the sharp-tipped weapons sank deep into the bodies of the enemies. Leif had chosen his position well, as his left flank was protected by slippery rocks. On the right, Vandrad swung his long axe in circles about his head, keeping the Scots at a distance, not allowing them to come at the Vikings from behind. In the centre of the line Leif struck low with his spear at the leg of the man facing him. The point sank deep and the warrior fell, dragging the weapon out of Leif's hand. The remaining Scots, meanwhile, had formed their own shieldwall and came forwards slowly. Leif drew his axe and, when the opposite shieldwall came close enough, hooked the top of the shield in front of him, bringing the shield down and allowing the spearman next to him to stab the Scot in the chest.



**Teachers' note:** All cutting or piercing weapons need to be kept sharp, as a sharp edge maximizes the pressure that applies the cutting force. Different weapons are better at different jobs, or handle differently because of their construction. Different weapons work differently because of their physics.



**What can we ask?** Is a long cutting edge better than a short one? Are pointy weapons better? Is a long handle better than a short one?



**Equipment list:** You can buy children's replica wooden weapons on the internet. Alternatively: sword – 1-m ruler with protractor taped to end, spear – 1-m ruler with pencil taped to end. Measuring ruler, slightly damp sand, 1-m long container for sand.



Leif fighting | Hamish Logie

**Activity instructions:**

1. Fill the 1-m long container to just past the brim with slightly damp sand.
2. Hold the "sword" upright and edge on at one end of the container.
3. Allow the "sword" to fall edgewise onto the sand.
4. Measure and record the deepest indentation in the sand made by the "sword". (You could also carefully draw the "sword" along the indentation to simulate a long slicing cut before measuring.)
5. Repeat for the "axe".
6. For the "spear" hold it point down, with the point 1 m above the sand and drop it point first.



**Explanation:** Different weapons cause different types of injury. A sword is a slashing/cutting weapon. Because the longer cutting edge means less pressure overall along the blade, a sword wound might be slightly less bad on the initial strike, but then the blade can be drawn through the wound to inflict even greater damage as it cuts, just like cutting meat with a knife. An axe has a shorter cutting edge, and most of the mass is concentrated at the far end. So the injury is much worse as the pressure from the shorter cutting edge is much greater. The increased momentum of the axe head, due to the concentrated mass, also means the axe acts like a smashing weapon, breaking bones through additional blunt force trauma, so even someone wearing chainmail can be seriously injured. A spear is primarily a thrusting weapon, with a very sharp point. This can penetrate deeply into the body, due to the massive pressure concentrated in its tip. It is very effective against chainmail as it goes through the holes between the links and can burst them apart. A long-handled axe is more effective than a short-handled axe because the longer length results in a greater momentum of the head at the point of impact (due to the greater velocity of the axe head), thus resulting in a much nastier wound.



**Related activities:** Hand axe vs. Dane axe. Use 30-cm ruler for handle of short "axe". Compare to longer "axe".



**KEY WORDS:**

Pressure, force, armour, chainmail

## Armour



**Context:** Then, seemingly out of nowhere, a swordblade swung down and struck Leif on the head. Without his helmet the blade could have cut into Leif's skull and killed him, but instead the sword was deflected from the conical helm and struck him on the shoulder. The wound was painful, several of the metal links being driven into the flesh of his shoulder, but the impact of the blow was spread out and Leif struck back at his attacker.





**Teachers' note:** Most warriors during the time of the Vikings could not afford chainmail armour as it was extremely expensive. Even for those that could afford it, it was of only limited effectiveness. Worn on its own, just over clothing, a hard strike from a weapon could drive the links deep into the flesh, resulting in a very messy wound. Although a strike from a sword or axe could result in broken bones, internal bleeding or severe bruising when wearing mail, this is still much better than having a limb completely chopped off, your chest crushed or your belly opened up. So, wearing mail doesn't prevent injury in battle, but can reduce the severity of injuries so that you have a much better chance of surviving. Its other purpose is to show you are a warrior of very high status. Strangely there is no definitive evidence, either archaeological or in manuscripts, that warriors in Viking times wore any padding under their mail, despite the fact that this would make the armour vastly more effective.



**What can we ask?** How does armour protect you? Does padding make armour better?



**Equipment list:** 30-cm square of chain mail (available on the internet). Alternatively rabbit mesh works well, available from pet or garden centres. Woollen cloth, leather (optional), paper, box of damp sand, ruler, selection of known masses.



**Activity instructions:**

1. Fill the box with damp sand and smooth it out.
2. Drop different masses into the sand. Measure and record the depth of the indentation for each.
3. Cover the sand with the "chainmail" and repeat.
4. Add a layer of cloth, leather or paper underneath the "chainmail" and repeat.



**Explanation:** The chainmail links spread out the impact of the blow, thus reducing the pressure exerted by the weapon. The iron links also act as a physical barrier, preventing the sharp cutting edge from coming into contact with the skin. A layer of padding underneath the mail links, especially leather, will protect against the links being driven into the skin, and further reduce the pressure from the weapon strike by spreading the force of the impact yet again.



**Related activities:** Investigate which material makes the best padding underneath chainmail. Investigate which material (not including mail) makes the best armour. Investigate which weapon (see weapons activity above) is most effective against armour.



**KEY WORDS:**  
Force, angle, deflect

## Helmets

There has only been a single find of a complete Viking helmet in Scandinavia and north-west Europe, the Gjermundbu helmet, which has greatly confused historians and archaeologists alike. What pictorial evidence there is for helmets in manuscripts could often be interpreted as ordinary hats looking a bit like beanie hats today. Alternatively, maybe most helmets were made of leather, so they have rotted in the ground. Sagas rarely mention the wearing of helmets apart from in relation to kings and great chieftains.

### Angled conical vs. flat round helmets



**Teachers' note:** Viking helmets started off as round helmets but evolved into the conical nasal helmet after the 9th century. The more sloping sides help to deflect a blow rather than trying to absorb the whole impact. Padding was usually worn underneath to further absorb the force of a blow.



**What can we ask?** What is the best angle of helmet to deflect a blow to the head?



**Equipment list:** Play dough or salt dough, 2-cm deep tray, 1-cm diameter marble or ball bearing, ruler, protractor



**Activity instructions:** Buy play dough or make salt dough (plenty of recipes on the internet), medium soft. Spread into a 2-cm deep tray. Drop a heavy marble or a 1-cm diameter steel ball bearing into the horizontal tray and measure the depth of hole made. Repeat while holding the tray at an angle. Try at different angles up to about 60° from the horizontal.



**Explanation:** A flat surface will take the full force of a blow, with a sharp cutting edge possibly penetrating the helmet if it is hard enough. As you angle the surface to the incident force some of the force is deflected away from the surface, resulting in less damage. The greater the angle the more force is deflected, although, for a helmet, more than about 45° is impractical as it would get too tall.



**Related activities:** Make a helmet using the dimensions indicated from your experiments.



Gjermundbu helmet | John Erling Blad

**KEY WORDS:**

Padding, force, impact, brain

## Padding under helmets

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**Teachers' note:** Even if a blow didn't penetrate the helmet you could still be killed by the force of the blow injuring the brain in a similar way to whiplash in a car accident. Padding, or a webbing liner, reduces the force of the impact on the skull and brain. Although no evidence has been found for padding or a liner, rivet holes in the helmet have indicated the possible existence of attachment points for some sort of lining.



**What can we ask?** Does padding in a helmet protect the brain?



**Activity instructions:** Put a raw egg into a sealable tin and drop it onto the floor. The egg will be broken inside. Stuff the tin with cotton wool or fabric with the egg in the middle. Drop it onto the floor and the egg should survive.



**Explanation:** When a weapon strikes the side of the helmet without padding the full force is directly transmitted to the skull, due to the very rapid deceleration of the weapon. This results in blunt force trauma to the head and brain. Even if the skull is intact the force of the blow can rupture blood vessels in the brain, causing a haematoma. Padding the inside of the helmet slows the deceleration of the weapon, resulting in much less force reaching the skull. Just like in a car crash, the crumple zones in the car slow down the deceleration of the impact, so the car and passengers receive a much smaller impact force.



**Related activities:** Throw a raw egg at a sheet held vertically by two people. No matter how hard you throw the egg, as long as it is caught in the sheet it will not break.