

5 Field athletics

Field athletics includes some of the oldest sports in the world. Through their wide variety of events, field athletics demonstrates the extraordinary range of skills and movements of the human body. Athletics is one of the sports that most clearly demonstrates how humans are fearfully and wonderfully made.



Field athletics includes a diverse set of track and field events based on running, jumping or throwing as well as road running and race-walking events. There are up to around 50 events in total, meaning there are plenty of options to choose from when it comes to spectating and participating.

Field athletics is a popular participant sport around the world. Most events are easy to learn and do not require a lot of specialized equipment, making them easily accessible to people of all abilities. Many of the events take less than a few minutes to complete, making them quite adrenaline-inducing!

Events

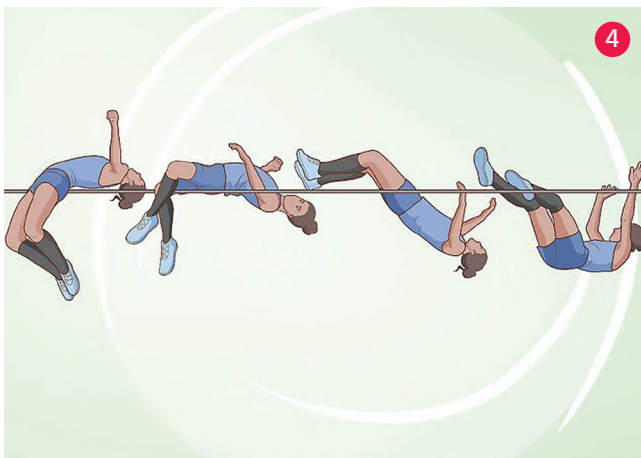
1. Running events: These range from 60 m (indoors) or 100m (outdoors) to a full marathon (26.2 miles or 42.195 km) and include sprints, hurdles, steeplechase and relays. The most popular events of field athletics are the sprints and middle-distance races. The hurdles, steeplechase and relay events require skill and

tactics, with competitors penalized for minute errors such as handing over the baton in the relay outside their allocated zone.

2. Walking events: Men can compete in 20 km or 50 km races, whilst women normally only compete in a 20 km event. At the same time as walking as fast as they possibly can, competitors are expected to maintain a true walking technique and are penalized for any technical errors such as bending their knee as it goes under their body or for any loss of foot-to-ground contact, as this would mean they are running not walking.

3. Jumping events: These include the long jump, triple jump, high jump and pole vault.

In the long jump the athlete must see how far they can jump after a sprint run-up and single-footed take-off. In the case of the triple jump, there is a hop, skip and jump which means the athlete must be good at leaping from both feet.



Wrongly timed run-ups can end in overstepping the launch pad, so competitors must judge their runs precisely. It is also necessary to maintain the right body shape (Fig. 3) whilst in the air to travel as far as possible before landing.

In the high jump the athlete must attempt to jump over a bar without knocking it over. A soft mattress waits for them once they have made it over! The current most popular jumping technique is the Fosbury Flop (Fig. 4) which involves a curved run-up, followed by a head-first jump, together with a twisting motion so that the athlete faces upwards as they go over the bar.

The pole vault event is the only jumping event involving a prop. The pole used is around 5 m long and is carried vertically by the pole vaulter during a sprint run-up, before being

planted into a metal box in the ground to propel the athlete upwards and over the bar (Fig. 5). Occasionally disasters happen during training and competitions, such as the pole snapping!

4. Throwing events: The discus, shot put, hammer throw and javelin involve an athlete throwing the object as far as possible. Each event requires a different set of techniques.

- 1 Field athletics depicted in Ancient Greece
- 2 Most events take place on or near the athletics track
- 3 The long jump
- 4 The Fosbury Flop high jump technique
- 5 The pole vault
- 6 The discus



In the discus event, the competitor must throw a round disc weighing 2 kg for men and 1 kg for women from a concrete circle around 2.5 m in diameter. To propel the discus as far as possible, the competitor spins around in the circle (Fig. 6) without their feet leaving the circle, before releasing the discus.

In the shot put and hammer throws, the athlete cannot leave the 2.5 m concrete circle while performing their throw.

The shot put (Fig. 7) involves the athlete throwing a metal ball (just over 7 kg for men and 4 kg for women) as far as they can.



Surprisingly, the hammer throw does not involve a hammer at all. Instead, the athlete must throw a metal ball attached to a wire and a handle. Much like the discus, the athlete spins to gain momentum (Fig. 8) before releasing the hammer. It requires great balance and skill to maintain balance due to the weight of the hammer!



The javelin event involves throwing a spear-like object as far as possible, after a relatively slow run-up. The athlete must throw the javelin without stepping over a marker line or else they are disqualified. It is important to always take care when doing the javelin event, as the javelin, at over 2.5 m long for the men and over 2 m long for the women, can be dangerous!

Multi-event competitions

There are also competitions involving multiple events such as the heptathlon which is a combination of running, throwing and jumping events. The modern pentathlon (Figs. 9 & 10) includes fencing, swimming, horse riding, shooting and running and was created in order to demonstrate the skills required of 19th century soldiers.



7 The shot put

8 The hammer throw

9 Horse riding in the modern pentathlon

10 Pistol shooting in the modern pentathlon

History of field athletics

The Olympics

Some of the events in field athletics are amongst the oldest sports in history. The origin of field athletics is closely linked to the Olympic games which started in Ancient Greece around 776 B.C. The original Olympic games involved a series of athletic competitions in honour of the Greek mythical god Zeus. Running, long jump, discus, javelin as separate events and pentathlon (running, long jump, discus, javelin and wrestling) all featured in the Ancient Olympics.

The history of the Olympics is split into two parts: the ancient Olympics and the modern Olympics. The Ancient Olympics ran from 776 B.C. to 394 A.D., at which point they were banned under Roman rule. The modern Olympics began in 1896 and continues to this day. However, various competitions such as the Cotswold Olympic Games in 17th-century England and L'Olympiade de la République in 18th-century France served as forerunners to the modern Olympics with events such as running and hammer throwing. Gradually more and more sports have been added to the Olympics, including different sports in field athletics.

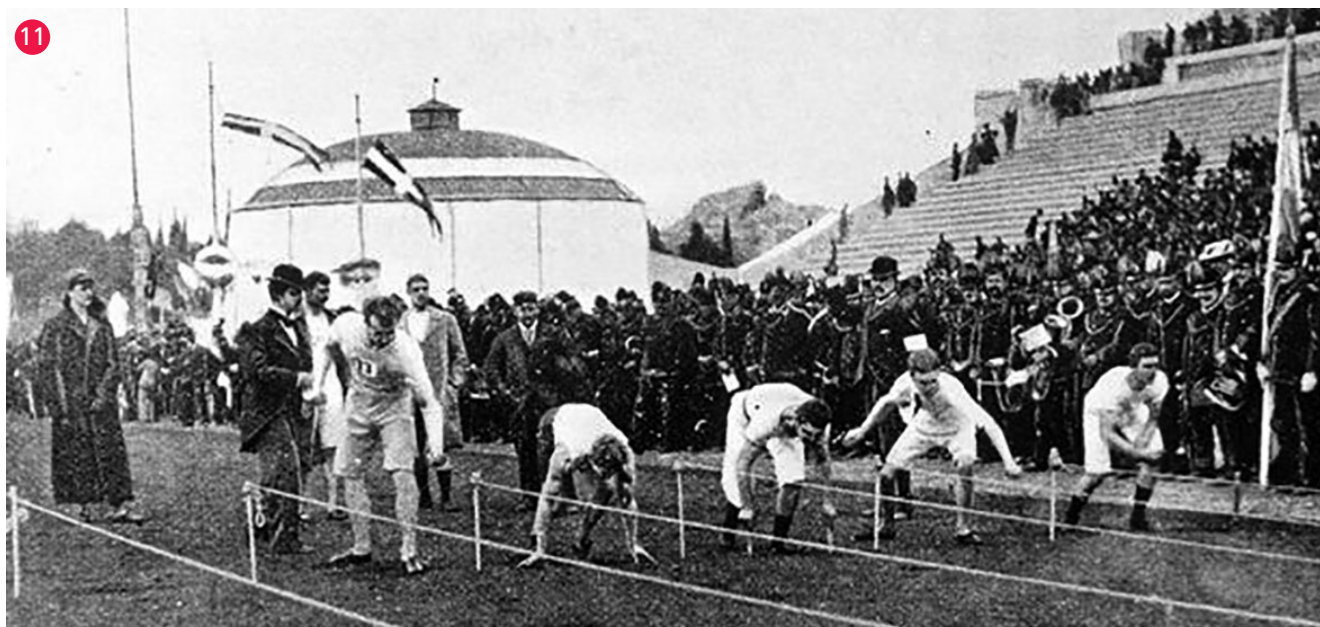
Technology: clothing

At the first modern Olympics in 1896 athletes wore long baggy shorts and tops with varying sleeve lengths for the 100m sprint. Regulations regarding sprinters' apparel were brought in with the 1912 Olympics, when competitors were to wear a short sleeve top, shorts and their race number on their front and back.

Synthetic materials began to be used in the 1970s, creating a big difference between short-distance and long-distance running attire. Sprinters preferred aerodynamic tight suits, whereas long-distance runners opted for lightweight clothing.

The 1984 U.S. Olympic uniforms were designed with the help of a NASA scientist whose expertise led to the creation of an aluminium-coated fabric that could deflect the sun's rays and wick sweat away from the athlete's body.

Some of the latest designs for sprinting attire include patterned patches covered in dimples to reduce the aerodynamic drag of the runner. An advantage of a fraction of a second can sometimes be the difference between a gold and a silver medal!



11 Athletes ready for the 100m sprint, 1896 Olympics, Athens

Science of field athletics

Energy transfers and forces in javelin, pole vault and hammer throw

Javelin

The most important aspects to the javelin throw are release speed and release angle.

The release speed is the speed at which the competitor releases the javelin. To create a high release speed, the competitor takes a run-up of between six and ten steps, before completing two or three cross-over steps, followed by the throw (Fig. 15). The first six to ten steps build speed and rhythm, whereas the cross-over steps enable the thrower to be facing at the right angle to be in the right throwing position.

Elite throwers have an average run-up of 12 mph but the javelin is released at around 60 mph. It is the energy transfer in the release of the javelin that creates this huge increase in speed. There are kinetic energy transfers between the competitor's body segments with peak kinetic energy occurring for the lower body first, followed by the torso, upper arm and lower arm. Finally, kinetic energy is transferred from the lower arm to the javelin. The thrower reduces their speed dramatically at the point of delivery, transferring momentum from the lower body to the upper body and the javelin.

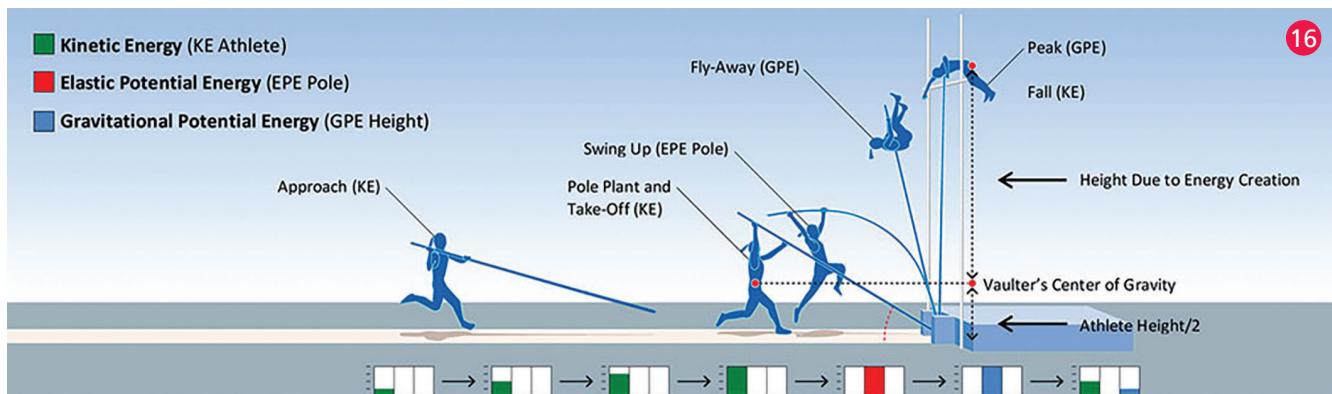
The release angle is the angle of the javelin at the point at which it is released. The best angle is between 32 and 36 degrees because this gives the javelin the best parabolic trajectory for achieving the furthest horizontal distance. The pointed tip and slim design,



along with the smooth surface of the javelin, all help improve the aerodynamics.

Pole vault

The pole vault also involves several energy transfers (Fig. 16). The competitor tries to build up as much speed as possible during the run-up to achieve the maximum kinetic energy at take-off. As the pole is placed into the metal box, the competitor's velocity decreases and the pole bends, converting kinetic energy into elastic potential energy in the pole. When the pole straightens out, the elastic energy is converted into gravitational potential energy and the athlete is projected upwards. At the top of the jump, the athlete can gain a little more height by pressing downwards on the pole. The athlete must also retain a little forward momentum in order to get over the bar. The final energy transfer involves potential energy being converted to kinetic energy as the competitor falls down on the mat.



Techniques: high jump and pole vault

The high jump's first recorded event took place in Scotland in the 1800s and since then various jumping techniques have been used.

The first techniques were either straight-on approaches or a scissors technique. The scissors technique in its most basic form involves a straight run-up followed by the jumper splitting their legs as they jump over the bar and ending with the jumper landing on their feet. The lead leg is the first to cross the bar, propelled by the launch leg which follows behind.

As previously stated, today the dominant technique is the Fosbury Flop, invented by Dick Fosbury and used to win gold at the 1968 Olympics. Fosbury took advantage of the soft landing mat that had come into use in his time to jump over the bar head-first and facing upwards. This technique has the advantage of keeping the centre of gravity of the jumper as low as

possible over the bar (compare Figs. 12 & 13). Within 20 years the technique had completely taken over the high jump event.

The pole vault originated in 16th-century Netherlands as a means of getting across bodies of water with a pole. In the 18th century this leaping method became an organised sport known as 'Fierljeppen', translated 'far-leaping'. Instead of a metal box, the competitor jams the pole into water and then climbs up the pole, before jumping the furthest distance possible (Fig. 14).

Fierljeppen still exists today but modern pole vaulting came about as a branch of the Dutch sport when it was adopted by a gymnastics club in Germany in the mid 1800s. The sport is now about height and not distance. Current poles are made from super lightweight fibreglass or carbon fibre instead of the heavier bamboo and aluminum used in the past.



12 A variation of the scissors technique



13 Dick Fosbury using the Fosbury Flop



14 The Dutch sport of Fierljeppen

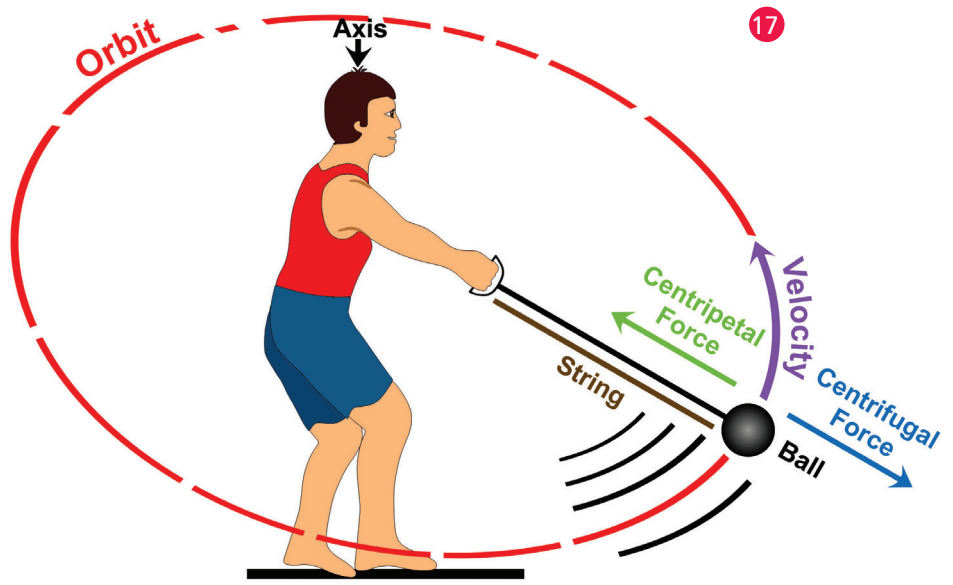
15 Throwing the javelin

16 Energy transfers in pole vault

Hammer throw

The hammer throw is the most complex throwing sport. The hammer thrower attempts to reach the highest rotational speed by turning on the spot as fast as possible before releasing the hammer.

Centrifugal force is a very important factor in achieving the highest velocity before the hammer is released because the more force the thrower builds, the further the hammer flies. The centrifugal force is an outward force to do with rotation and pushes objects away from the centre around which they are rotating. Before release, the centrifugal force is exactly countered by the centripetal force pulling the object inwards (Fig. 17). As soon as the hammer is released, the centripetal force becomes zero and the hammer is accelerated outwards by the centrifugal force. The rotational speed is so high for hammer



throwing that the athlete must time the release of the hammer with precision in order to produce the right launch direction.

10 fun facts about field athletics!

1. The word 'athlete' comes from the Greek word for 'contest' or 'competition'.
2. The steeplechase was inspired by the horse steeplechase which originated in Ireland.
3. In the first horse steeplechases, riders navigated using church steeples.
4. In pole vaulting, each competitor has their own design of pole, so success is partly determined by how well the pole is designed.
5. The modern heptathlon was created to demonstrate the required skills of 19th century soldiers.
6. Sprinters sometimes run in a swimming pool for greater resistance and to help prevent injury.
7. The first Olympic race in 776 B.C. had a track 600ft (182.88m) long.
8. The first modern college track competition was held in 1864 between Oxford and Cambridge Universities.
9. The highest pole vault is 6.22m for men and 5.06m for women. (guinnessworldrecord.com)
10. In the 100m sprint, if any athlete goes off within 100 milliseconds of the gun being fired, then it is a false start.