**Essential facts**

**A brief history of timekeeping**

**Sundials:** As early as 3500BC, the Ancient Egyptians used the shadows cast by obelisks to separate morning from afternoon and subdivide the day. Over the centuries, sundial measurements improved and were used across the ancient world.

**Water clocks:** Early water clocks measured time by allowing water to drip from one bowl to another at a constant rate, with markings at the receptacle’s side measuring intervals of time. Mechanical versions of these clepsydras were developed by the Ancient Greeks, Romans and Chinese. Water was later replaced with sand as the hourglass became popular.

**Mechanical clocks:** From the 14th century, mechanical clocks started to appear on the scene. They began as large public clocks, but soon the invention of coiled spring power made portable clocks possible. They still lacked accuracy, as they tended to slow down as the spring unwound.

**Pendulum clocks:** In 1656, Dutch scientist, Christiaan Huygens, invented the pendulum clock using springs and a swinging weight, based on a design by Galileo. Accuracy continued to improve over the next two centuries as pendulum clocks were further developed. In 1889, a nearly ‘free pendulum’ clock invented by Siegmund Riefler lost only one hundredth of a second each day.

**Harrison’s clock:** In 1761, John Harrison revolutionised marine navigation by inventing a clock that could keep almost perfect time for weeks aboard a moving ship.

**Quartz clocks:** In the 1920s, time-keeping accuracy made another leap forward with the invention of quartz clocks, which used electronic clock displays controlled by a fairly even electrical signal from quartz crystals. These rapidly became widespread and superseded all other types of clock. Quartz wristwatches, first produced by Seiko in 1967, became popular, as they did not require winding. Digital watch displays followed shortly after, produced in 1972, by Hamilton.

**Atomic clocks:** Today atomic clocks are the most precise time keepers. They were first built in 1949 and utilise electromagnetic oscillations of atoms to create stable signals. Scientists used them as a reference point for all other time keeping. One of the world’s most accurate clocks to date is the NIST-F1 cesium fountain clock, developed in 1999, which is out by one second in every 20 million years, but even more accurate models are in development.