Fairness is crucial to Olympic events, and that means performance-enhancing drugs are banned, and frequent drug testing is essential.

The use of performance-enhancing drugs in sports is not new – Thomas Hicks won the marathon at the 1904 Olympics, thanks to being dosed by his coach with a cocktail of strychnine and brandy (before and during the event!) Following a rise in both drug use and in the awareness of this problem, the International Olympic Committee banned doping in 1967. Today, the World Anti-Doping Agency (WADA) specifies which performance-enhancing drugs are banned.

**Did you know?** Drug testing in the Olympics first took place in the Cycling Team Time Trial race at the 1964 games.

What matters is the number of molecules of the drug in an athlete’s body. The SI unit for the amount of substance is the mole: one mole of a drug molecule is 602,214,179,000,000,000,000,000 identical copies of that molecule.

There are three main ways to test for drugs:

**Mass spectrometry**

Samples are vaporised and then ionised. A magnet sends the ions in different directions depending on their masses, so they are identified by their arrival positions. This is a highly accurate but expensive process.

**Gas chromatography**

Samples are vaporised and passed through a tube filled with a mixture of silicon grains and liquid. Different components of the sample travel at different speeds through the tube and so arrive in turn at a detector to be identified. This is relatively inexpensive, but cannot differentiate components with the same travel speed.

**Immu-no-assays**

Antibodies are introduced to the sample, and react to the presence of the drug. The strength of the response is a measure of the amount of drug present. Immuno-assays are simpler but less accurate than the other tests.

---

**How a mass spectrometer works**

1. **Heater to vaporise sample**
2. **Electron beam ionises sample**
3. **Particles accelerated into magnetic field**
4. **Magnetic field separates particles based on mass charge ratio**
5. **Detector**