Time-of-flight mass spectrometry triominoes

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There are four stages in TOF-MS:

* ionisation (either electron impact or electrospray);
* acceleration;
* flight tube;
* detection.

Students sort the information about each of the four stages by arranging the triominoes.

Photocopy sets of triominoes and cut them up. Give small groups of students the central black triangles and the outer triangles separately, and ask them to match three outer triangles to each of the relevant central triangles.

✂

**Electrospray ionisation**

The

particles gain a proton from the solvent

X(g) + H+ → XH+(g)

Used for substances with higher molecular mass

✂

✂

✂

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Used for elements / substances with low molecular mass

X(g) + e-

X+(g) + 2 e-

One

electron

is knocked off each particle by a high energy ‘electron gun’

**Electron impact ionisation**

**Detection**

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**Flight tube**

Lighter ions have a shorter time of flight

The positive

ions travel

through a hole in

the negatively charged plate

t = d

✂

✂

✂

✂

**Acceleration**

The velocity

of each particle depends on its mass

KE = ½ mv2

Positive ions are accelerated using an electric field

X+(g) + e- → X(g)

Positive

ions are

discharged

by gaining electrons from a negatively charged electric plate

The

number of

particles hitting

the plate determines the size of the current produced