Exemplar exam question – Chapter 2

1 A mass spectrometer may be used to determine the relative atomic mass of an atom.

    a Explain the basic operating principles of a mass spectrometer. [7]

    b Explain what is meant by the word **isotopes**. [2]

Commentary

It is important, when answering this sort of question, to pay attention to the number of marks available and to give at least the appropriate number of points.

a Model answer:

Vaporisation	The sample is converted to gaseous atoms.
Ionisation	The gaseous atoms are bombarded with high energy electrons to form positive ions.
Acceleration	The positive ions are accelerated in an electric field.
Deflection	The positive ions are deflected in a magnetic field according to their mass : charge ratio.
	Ions with a smaller mass : charge ratio are deflected more.
	The magnetic field is changed to bring ions of each mass to the detector in turn.
Detection	The ions hit a detector and an electric current is produced proportional to the number of ions hitting the detector.

All stages are included in the correct order and sufficient detail is given for each one: seven points are covered.

b It is important to be clear when answering this question. Possible answers include:

- The same element with different number of neutrons.

- An element which has more than one form/different numbers of protons/neutrons whilst being the same element.

The first answer is probably worthy of only 1 mark as it does not make clear that isotopes are different **atoms** of the same element.

The second answer would probably score 0. Although the idea of the same element and different number of neutrons is mentioned, the student has not mentioned different atoms of the same element. However, they have mentioned different number of **protons**, which contradicts the idea of the same element. It is not clear that the student understands that isotopes have different numbers of neutrons.

Model answer:

    Different atoms of the same element with different numbers of neutrons in the nucleus.