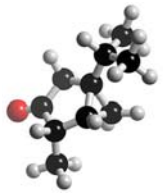
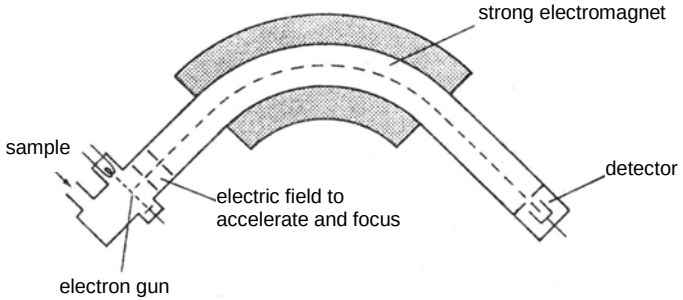
AS.CHEM1.1.002

MASS SPECTROSCOPY



Name ……

Mass spectroscopy provides an accurate way of measuring the mass of atoms and molecules.



1) Ionisation

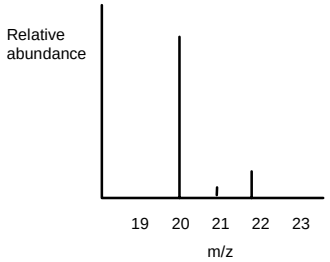
2) Acceleration

3) Deflection

4) Detection

Mass spectra of elements

For an element, the mass spectrum shows the mass of all the isotopes and the relative amount of each. For example, here is the mass spectrum of neon.



^{20}Ne 90.9 %

^{21}Ne 0.26 %

^{22}Ne 8.8 %

$$A_r = \frac{[\,(90.9 \times 20) + (0.26 \times 21) + (8.8 \times 22)\,]}{(90.9 + 0.26 + 8.8)} = 20.17$$

lithium ^{6}Li (7.4%) ^{7}Li (92.6%)

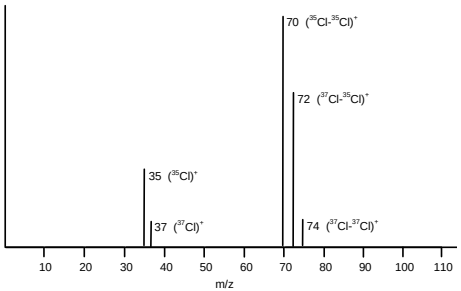
gallium ^{69}Ga (1.00) ^{71}Ga (0.66)

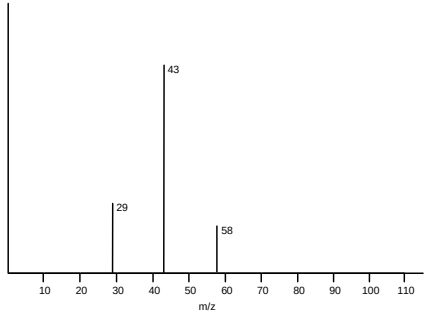
iron ^{54}Fe (5.8%) ^{56}Fe (91.6%) ^{57}Fe (2.2%) ^{58}Fe (0.3%)

Mass spectra of molecules

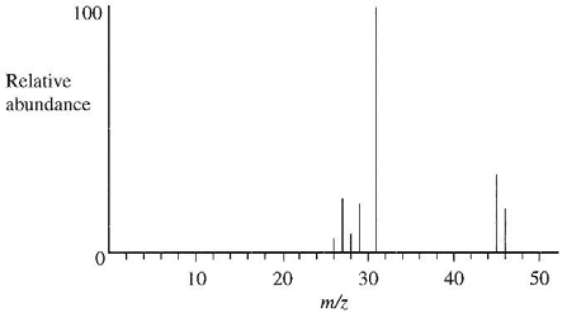
For elements that are made of molecules, peaks will be seen for the molecules as well as the atoms, e.g. Cl_2.

Mass spectra can be used to find the M_r of molecules. The peak with the greatest m/z corresponds to the M_r, but beware of isotopes.

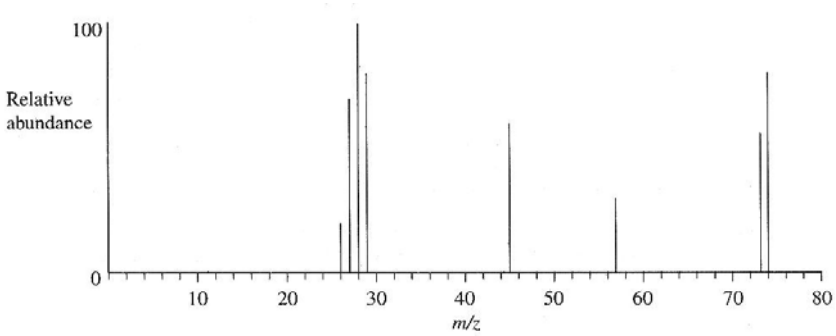




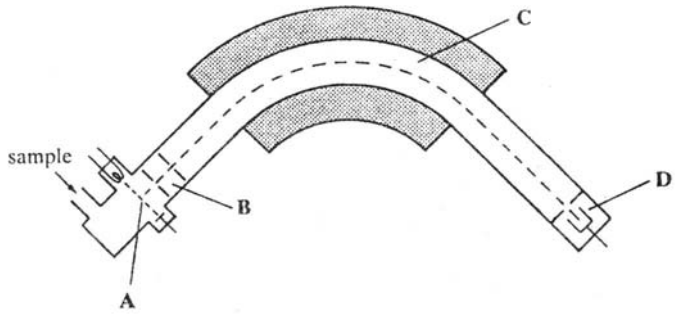
1) The mass spectrum of a compound is shown. What is the relative molecular mass of the compound?



2) The mass spectrum of a compound is shown. What is the relative molecular mass of the compound?



3) a) The diagram shows the path of a $^{25}Mg^{+}$ ion through a mass spectrometer. Name the processes taking place at A, B, C and D.



b) On the diagram, sketch the path of the following ions under the same conditions:

i) $^{24}Mg^{+}$ ion labelled **P**
ii) $^{26}Mg^{+}$ ion labelled **Q**
iii) $^{25}Mg^{2+}$ ion labelled **R**

4) a) Calculate the relative atomic mass of lead given the mass spectroscopy data below.

b) Identify the species responsible for the peak at *m/z* 208.

m/z	204	206	207	208
relative intensity	0.287	4.51	4.32	10.00

5) Calculate the relative atomic mass of chromium given the mass spectroscopy data below.

m/z	50	52	53	54
relative abundance (%)	4.3	83.8	9.5	2.4

6) Calculate the relative atomic mass of krypton given the mass spectroscopy data below.

m/z	78	80	82	83	84	86
relative abundance (%)	0.3	2.3	11.6	11.5	56.9	17.4

7) Calculate the relative atomic mass of strontium given the mass spectroscopy data below.

m/z	84	86	87	88
relative intensity	0.00678	0.120	0.085	1.000