MASS SPECTROMETRY

1 Copper contains two isotopes, $^{63}_{29}Cu$ and $^{65}_{29}Cu$. Give the formula of the species that reaches the detector first when a sample of copper is analysed by time of flight mass spectrometry.

$^{63}_{29}Cu^{+}$

2 Mass spectrometry showed an element to contain the following isotopes. Find the relative atomic mass of this element. Give your answer to 1 decimal place.

m/z	10	11
abundance / %	19.9	80.1

$A_r = \frac{[10 \times 19.9]+[11 \times 80.1]}{19.9+80.1} = 10.8$

3 Lithium contains the isotopes $^{6}_{3}Li$ and $^{7}_{3}Li$. It has a relative atomic mass of 6.94. Find the percentage abundance of $^{7}_{3}Li$ in lithium.

let % of $^{7}_{3}Li$ = a

$\frac{[6(100-a)]+[7a]}{100} = 6.94$

$600 - 6a + 7a = 694$

$a = 94$

4 Beryllium contains one isotope only, $^{9}_{4}Be$. Calculate the time of flight of $^{9}_{4}Be^{+}$ of this isotope. Give your answer to the appropriate number of significant figures.

$$t = d\sqrt{\frac{m}{2KE}}$$

t = time of flight (s)
m = mass of particle (kg)
KE = kinetic energy (J)
d = length of flight tube (m)

kinetic energy	3.65×10^{-14} J
length of flight tube	85 cm
mass of electron	9.1094×10^{-31} kg
mass of proton	1.6726×10^{-27} kg
mass of neutron	1.6749×10^{-27} kg

$m = [3 \times 9.1094 \times 10^{-31}] + [4 \times 1.6726 \times 10^{-27}] + [5 \times 1.6749 \times 10^{-27}] = 1.5068 \times 10^{-26}$ kg

$t = d\sqrt{\frac{m}{2KE}} = 0.85\sqrt{\frac{1.5068 \times 10^{-26}}{2 \times 3.65 \times 10^{-14}}} = 3.9 \times 10^{-7}\ s$