



TIME OF FLIGHT MASS SPECTROMETRY 2

- 1) a) Calculate the relative atomic mass of lead given the mass spectroscopy data below. Give your answer to 2dp.

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

- b) Identify the species responsible for the peak at m/z 208.
c) Which ion will have the shortest time of flight and reach the detector fastest?
- 2) The mass spectrum of butanone shows its main peak at m/z 72. It also has a small signal at m/z 73.
a) Which ionisation technique is likely to have been used?
b) What is the relative formula mass of this compound?
c) Give two reasons for the peak at m/z 73.
d) There would also be tiny peaks at m/z 74, 75, etc. Explain why some ions with these m/z values may be formed but why their signals may be too small to be seen.
- 3) The mass spectrum of chloromethane (CH_3Cl) shows two main peaks at m/z 50 and m/z 52.
a) Explain why these two peaks are produced.
b) Predict the relative intensity of these two signals. Explain your answer.
- 4) a) 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

- b) Identify the species responsible for the peak at m/z 52.
c) Which ion will have the shortest time of flight and reach the detector fastest?
d) All the particles have the same kinetic energy ($= \frac{1}{2}mv^2$, where m = mass of particle and v = velocity) and the velocity of the particles is given by $v = d/t$ (where d = distance travelled and t = time taken). If the time of flight of a $^{54}\text{Cr}^+$ ion is 1.486×10^{-5} s, calculate the time of flight of a $^{50}\text{Cr}^+$ ion. Give your answer to the appropriate number of significant figures.
- 5) The element bromine is made of diatomic molecules. There are two isotopes of bromine, namely ^{79}Br and ^{81}Br of roughly equal abundance. Sketch what the time of flight mass spectrum of the element bromine will look like.
- 6) The relative atomic mass of gallium is 69.72. It consists of two isotopes, ^{69}Ga and ^{71}Ga . Find the percentage composition by mass of these two isotopes in gallium.
- 7) The relative atomic mass of neon is 20.18. It consists of three isotopes, ^{20}Ne , ^{21}Ne and ^{22}Ne . It contains 90.5% ^{20}Ne . Find the percentage composition by mass of the other two isotopes in neon.
- 8) a) The mass of one mole of $^{18}\text{O}^+$ ions is 18.0 g. The Avogadro constant is $6.022 \times 10^{23} \text{ mol}^{-1}$
Find the mass of a single ion of $^{18}\text{O}^+$ in kg.
b) Find the time it takes an ion of $^{18}\text{O}^+$ to travel along a flight tube of 75.0 cm length if given 2.50×10^{-15} J of energy.
- 9) 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