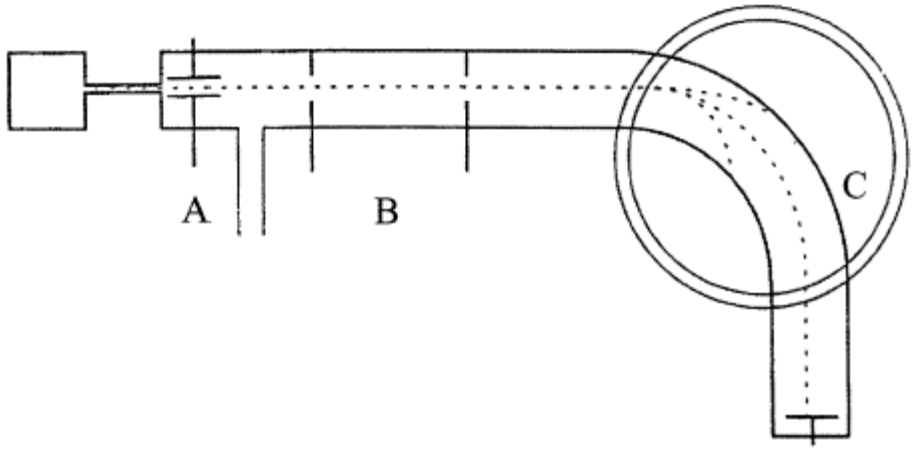
Second Year HL Chemistry

Final review: Atomic Structure

1. N03
2. M03
3. N02/2. The following is a diagram of a mass spectrometer.



(a) Identify the parts labelled A, B, and C. *[3]*

A: .....

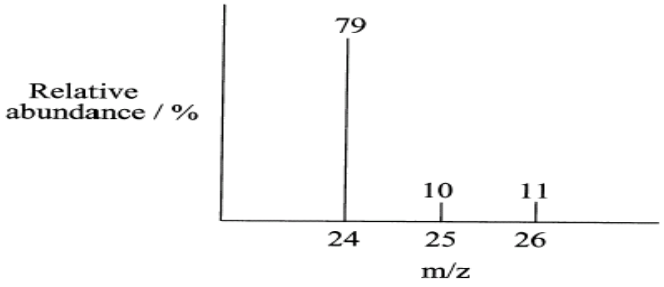
B: .....

C: .....

(b) State and explain which **one** of the following ions will undergo the greatest deflection, under the same conditions, in a mass spectrometer. *[2]*

$^{6}Li^{+}$ $^{6}Li^{2+}$ $^{7}Li^{+}$ $^{7}Li^{2+}$

(c) The mass spectrum for an element is given below.



(i) Explain why there is more than one peak. *[1]*

(ii) Calculate, to two decimal places, the relative atomic mass of the element. *[2]*

4. M02
5. N01/5. (a) The isotopes of sulfur occur naturally in the following percentages:
   32S: 95.0 %, 33S: 0.76 %, 34S: 4.20 %, and 36S: 0.020 %.
   (i) Calculate the relative atomic mass of sulfur to three significant figures. [2]
   (ii) Determine the number of neutrons in the atom of the least abundant sulfur isotope. [1]
   (b) (i) Describe how the first four ionisation energies of aluminium vary. (You may wish to sketch a graph to illustrate your answer.) [2]
   (ii) State the electronic configurations of aluminium, boron and magnesium. Explain how the first ionisation energy of aluminium compares with the first ionisation energies of boron and magnesium. [5]
   (c) When hydrogen gas is placed in an electric discharge tube, an emission spectrum is obtained. Sketch the spectrum, labelling its high energy end. Explain why such a spectrum is obtained. [3]
   (d) (i) Explain why lithium, sodium, and potassium are placed in the same group of the periodic table. Your answer should refer to their melting points, ionisation energies and electronic arrangements. [4]
   (ii) State and explain the trend in the chemical reactivity down group 1. Describe, with the aid of balanced equations, the chemical reactions of sodium metal with water and with chlorine gas. [8]
6. May 01/1 (a) Using the Periodic Table (Table 5) in the Data Booklet, give the symbol(s) of:
   (i) an element with a ground state electronic configuration of [Xe]6s24f145d106p1. [1]
   (ii) an ion with a double positive charge (2+) with an electronic configuration of [Ar]3d5. [1]
   (iii) two elements with a ground state configuration of ns2np3 . [1]

(b) Describe the emission spectrum of hydrogen. Explain how this spectrum is related to the energy levels in hydrogen. [3]

(c) Give **two** reasons why the lithium ion, Li+, has a smaller radius than the lithium atom. [2]

(d) Give **two** reasons why noble gases are not assigned electronegativity values. [2]

1. 98/2. In December 1994 a team of European scientists synthesised element 111 by bombarding a bismuth target for several days with a beam of nickel atoms. $^{209}_{83}Bi + ^{64}_{28}Ni \rightarrow ^{271}_{111}X$ + particles

   [*1 mark*] Identify the particle(s) emitted during this synthesis.

   [*2 marks*] Specify the number of protons and neutrons which would be present in one atom of element 111.

   [*2 marks*] If element 111 forms ions with a +1 charge, determine the number of electrons present in one mole of these ions.

   (i)[*1 mark*] Write the electron configuration for a nickel atom, in the standard form (eg $1s^2$ etc). (ii) [*2 marks*] Give a possible charge for a stable nickel ion and outline your reasoning.

   [*1 mark*] In February 1996 the same group of scientists reported the synthesis of element 112. The chemical properties of element 112 have not been established. Which element (1 - 110) is element 112 most likely to resemble?