**CHEM210 – Analytical Chemistry**

**Mass Spectrometry Worksheet**

**1.** (a) Draw a simple diagram of a mass spectrometer. State briefly how its use could show the

existence of isotopes in a gaseous sample of an element. **(6 Marks)**

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(b) Chlorine exists as a mixture of two stable isotopes 35Cl and 37Cl , present in the approximate

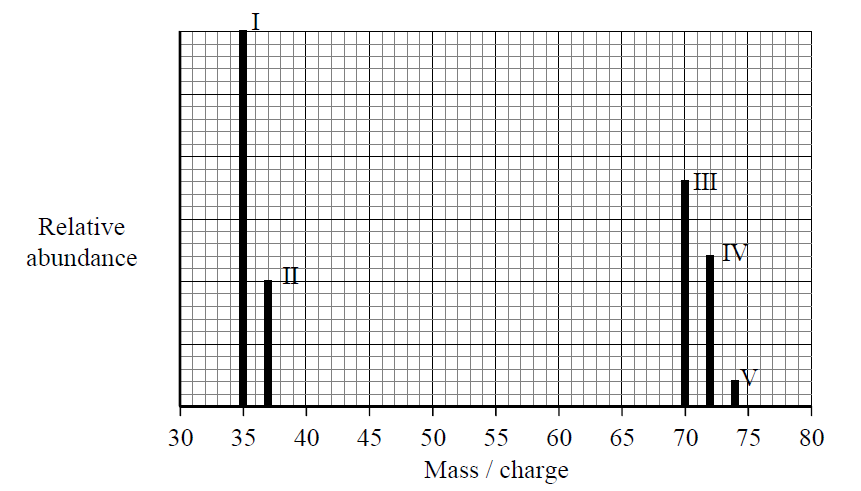
ratio 3:1.

(i) Calculate the relative atomic mass of chlorine. **(2 Marks)**

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(ii) Sketch and label a diagram of the mass spectrum of **molecular** chlorine. **(3 Marks)**

2. The diagram below represents the spectrum of chlorine, consisting of five peaks, labelled I, II, III, IV and V respectively. **Peak I is due to the 35Cl**+ **ion.**



(a) What analytical technique would give a spectrum like that shown above? **(1 Mark)**

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(d) Using the spectrum above, find the isotopic composition of chlorine and justify your answer.

**(2 Marks)**

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(e) (i) How is a molecular ion formed? **(1 Mark)**

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(ii) What information could be obtained from the mass/charge value of the molecular ion?

**(1 Mark)**

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3. Mass spectrometry is a powerful analytical technique used in the identification of

organic compounds. The mass spectrum of a compound with empirical formula CH2O displays

peaks at *m/z* 15, 45 and 60.

(a) Determine the molecular formula of the compound. **(2 Marks)**

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(b) Identify the fragments responsible for the peaks at the m/z values below. **(2 Marks)**

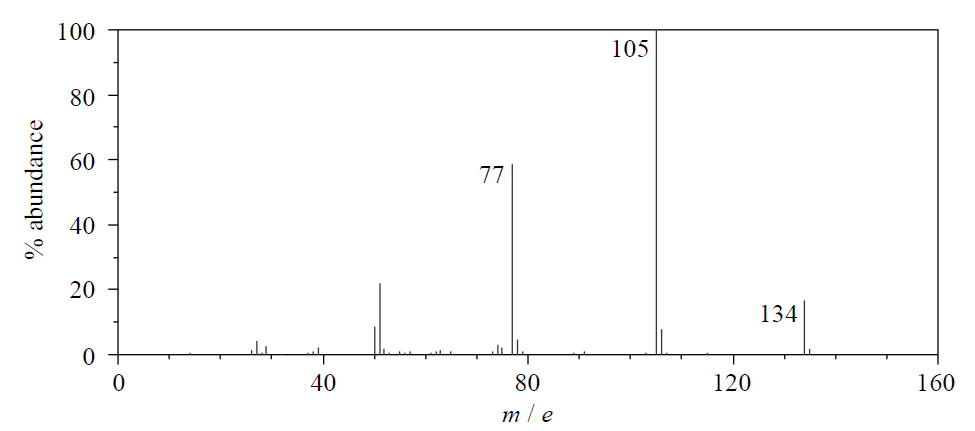
*m/z* = 15 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ *m/z* = 45 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(c) Identify a compound that could produce this spectrum. **(1 Mark)**

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4. An organic compound **A** was found by analysis to have the empirical formula C9H10 O

(a) The mass spectrum of compound **A** is given below:



(i) What does the peak at 134 represent and what information about compound **A** can be

deduced from it? **(2 Marks)**

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(ii) There is a small peak at 135. Explain what causes this peak. **(1 Mark)**

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(iii) Suggest which fragments are responsible for the peaks at 105 and 77. **(2 Marks)**

105\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

77\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_