Mass Spectrometry

Question Paper

Level	Pre U
Subject	Chemistry
Exam Board	Cambridge International Examinations
Topic	Mass Spectrometry
Booklet	Question Paper

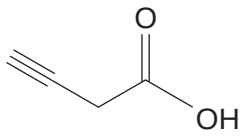
Time Allowed: **12 minutes**

Score: **/10**

Percentage: **/100**

Grade Boundaries:

1. The molecule shown is but-3-ynoic acid.



(a) Give the molecular formula for but-3-ynoic acid.

molecular formula ..... [1]

(b) Draw the structure and name an isomer of but-3-ynoic acid that contains the same functional groups.

structure

name..... [2]

(c) Work out the percentage composition (by mass) of the constituent elements in but-3-ynoic acid.

C ..... % H ..... % O ..... % [2]

(d) Give the m/z value of the molecular ion peak in the mass spectrum of but-3-ynoic acid.

..... [1]

(e) **(i)** But-3-ynoic acid contains a carboxylic acid group with double and single bonds. Write down a value in cm^{-1} that falls in the wavenumber range of each of these types of bonds in an infrared spectrum.

double bonds ..... cm^{-1}

single bonds (not involving hydrogen) ..... cm^{-1}

single bonds to hydrogen ..... cm^{-1}

[2]

(ii) The carboxylic acid O–H stretch has a characteristic appearance in an infrared spectrum. Describe its general appearance. There is no need to give wavenumber values.

.....

..... [1]

(f) Scientists recently isolated a novel, highly toxic and unstable molecule, **T**, from the poisonous Asian mushroom *Russula subnigricans* (reported in *Nature Chemical Biology*, 2009).

T is an isomer of but-3-ynoic acid. Its infrared spectrum indicates that **T** also contains a carboxylic acid group. Its carbon-13 nmr spectrum, however, only contains 3 signals.

Suggest a structure for **T**.

[1]

[Total: 10]