Oxford Cambridge and RSA

AS Level Chemistry B

H033/01 Foundations of chemistry

Question Set 5

1 The presence of chlorine in organic compounds can be seen from their mass spectra. Chlorinehas two isotopes in the proportions as shown.

^{35}Cl 75.53% ^{37}Cl 24.47%

(a) (i) Give the number of protons, neutrons and electrons in an atom of ^{35}Cl.

protons .....

neutrons .....

electrons .....

[1]

(ii) Give the electron configuration, using sub-shells and atomic orbitals, of an atom of ^{37}Cl.

.....

[1]

(iii) Draw a diagram to show the shape of a p-orbital and indicate how many electrons it canhold.

number of electrons:
……

[1]

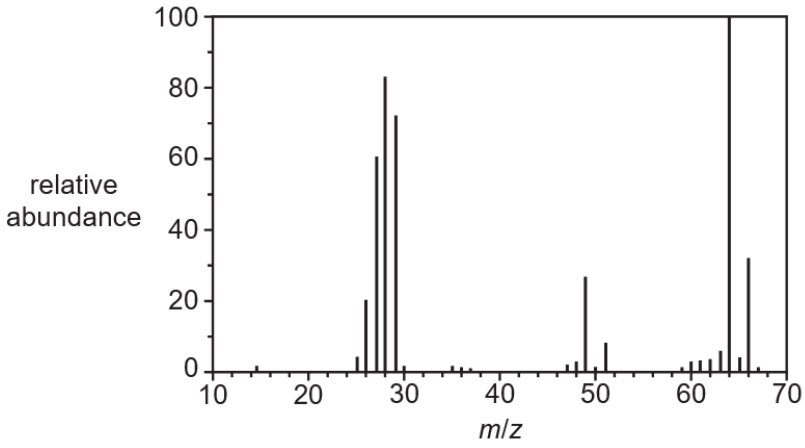
(b) Calculate a value for the A_r of chlorine.

Give your answer to **two** decimal places.

A_r =……

[2]

(c) The mass spectrum of chloroethane, C_2H_5Cl, is shown below.The presence of chlorine isotopes causes two 'mass peaks'.



(i) Give the formula of the ion responsible for the peak at *m*/*z* 64.

[1]

(ii) Explain the ratio of the heights of the peaks at *m*/*z* 64 and *m*/*z* 66.

[2]

(iii) Suggest the formula of the ion that gives the peak at *m*/*z* 65.

[1]

(d) Chloroethane can be converted to ethanol.

The infrared spectrum of ethanol has some absorptions that are not present in the infraredspectrum of chloroethane.

Give the range of **one** of these absorptions and the corresponding bond.

Absorption .....

Bond ……

[1]

2 In 1875 a French chemist saw two violet lines in an emission spectrum that did not correspond toany known element. He isolated the metal responsible and named it gallium, Ga, after his country.

(a) Explain why each element has a characteristic emission spectrum. **[4]**

(b) **(i)** Complete the electron configuration of gallium, Ga.

$1s^2 2s^2 2p^6 3s^2 3p^6$ ……..

[1]

(ii) Describe the shape of an s-orbital.

..... **[1]**

(iii) Give the charge on the cation of gallium predicted by its position in the Periodic Table.

..... **[1]**

(c) Gallium forms an anion with chlorine, $GaCl_4^-$. This is thought to have covalent bonds betweena gallium atom and three chlorine atoms and a dative covalent bond from a chloride ion to thegallium atom.

(i) Draw a '*dot-and-cross*' diagram of $GaCl_4^-$. **[2]**

(ii) Name the shape of $GaCl_4^-$. **[1]**

(d) Gallium has two isotopes, ^{69}Ga and ^{71}Ga.
The A_r of gallium is 69.7.

Calculate the relative abundance of ^{69}Ga as a percentage.

relative abundance of ^{69}Ga =……% **[2]**

Total Marks for Question Set 5: 22