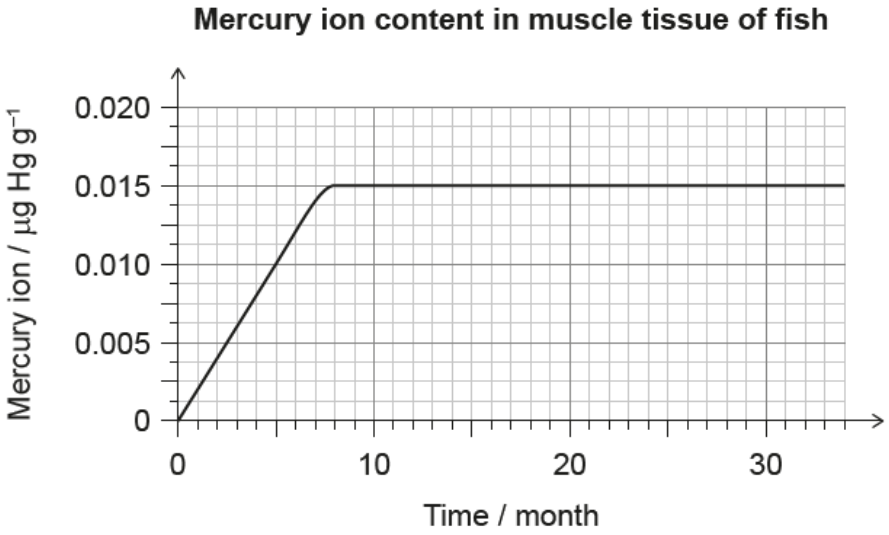
the ionic model [15 marks]

1. [Maximum mark: 8]

Water contaminated with mercury contains methylmercury ions, CH_3Hg^+. These ions are absorbed by living organisms, then slowly metabolized and excreted.

Young fish were taken at regular intervals from a mercury contaminated lake and tested to determine mercury ion content.



(a.i) The mercury ion concentration follows a linear trend during the first five months. Deduce the equation for this part of the graph. [2]

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(a.ii) Suggest why the mercury ion concentrations changed very little after 8 months. [1]

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(a.iii) State why CH_3Hg^+ is more likely to be absorbed by fish than mercury, Hg. [1]

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(b) The concentration of mercury ion in a sample of the fish is 0.0052 ± 0.0001 μg Hg g^{-1}.

(b.i) Calculate the mass of Hg, in μg, in 3.723 g of the sample. [1]

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(b.ii) Calculate the percentage uncertainty of $[CH_3Hg^+]$. [1]

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(c) Suggest **two** variables which should be controlled when sampling the muscle tissues. [2]

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2. [Maximum mark: 1]

What is the correct formula for ammonium phosphate?

A. NH_4PO_4

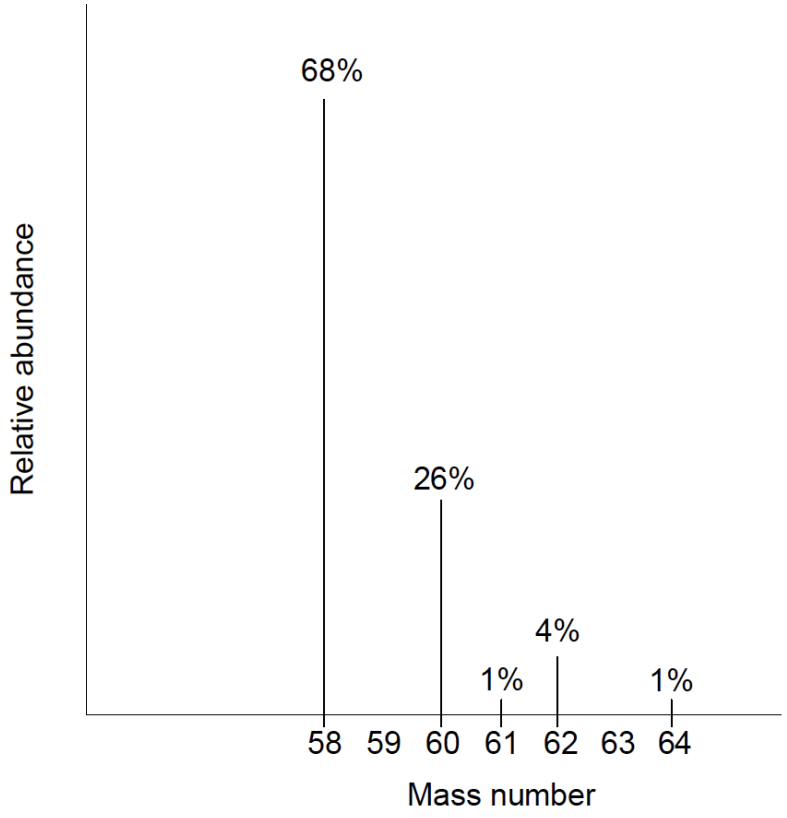
B. $(NH_4)_2PO_4$

C. $(NH_4)_3PO_4$

D. $(NH_3)_3PO_4$ [1]

3. [Maximum mark: 5]

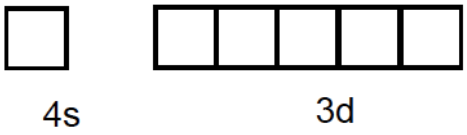
(a) Determine the relative atomic mass of nickel from the mass spectrum shown.



[1]

(b.i) Deduce the nuclear symbol, ${}^{A}_{Z}X$, for an ion of nickel-58 with 26 electrons. [1]

(b.ii) Draw arrows to represent electrons in the orbital diagram for this ion.



[1]

(b.iii) Explain how the ions are held together in nickel chloride, and why it only conducts electricity when molten. [2]

4. [Maximum mark: 1]

Which substance has high volatility in its pure state **and** high electrical conductivity in aqueous solutions?

A. C_6H_5Cl

B. HCl

C. NaCl

D. HCN

[1]