1. A student analyses a solution of a salt.

The results are shown below.

Test	Observation
Reaction with NaOH(aq)	Green precipitate
Reaction with $Ba(NO_3)_2(aq)$	White precipitate

What is the formula of the salt?

A $CuCl_2$
B $CuSO_4$
C $FeCl_2$
D $FeSO_4$

Your answer ☐ **[1]**

2. Tutton's salts are 'double salts' with the formula $\mathbf{X}_2\,\mathbf{Y}(\mathbf{Z}O_4)_2 \cdot 6H_2O$.

A Tutton's salt contains two cations: $\mathbf{X}^+$ and $\mathbf{Y}^{2+}$.

- $\mathbf{X}^+$ can be an ion of the Group 1 elements K, Rb, Cs or Fr, or an ammonium ion.
- $\mathbf{Y}^{2+}$ can be a 2+ ion of magnesium or an ion of most of the transition elements in Period 4.
- **Z** can be S or Cr.

$(NH_4)_2Cu(SO_4)_2 \cdot 6H_2O$ is an example of a Tutton's salt.

The student dissolves their Tutton's salt in water. A pale blue solution forms.

The student carries out two tests on this aqueous solution.

i. The student adds an excess of aqueous ammonia to their aqueous solution of Tutton's salt. A deep blue solution forms.

The complex ion responsible for the deep blue solution has a molar mass of 167.5 g mol^{-1}.

Suggest the formula of this complex ion.

_____ **[1]**

ii. The student adds NaOH(aq) to the aqueous solution of Tutton's salt and warms the mixture.

A precipitate and a gas are formed.

Write the formulae of the precipitate and gas and suggest a test that could confirm the identity of the gas.

Formula of precipitate _____

Formula of gas _____

Test to confirm the identity of the gas _____

_____

_____ **[3]**

iii. How could the student carry out a test-tube test to confirm the anion in the Tutton's salt?

_____

_____

_____

_____ **[2]**

END OF QUESTION PAPER