# Assignment brief 2.3

| **Unit Name:** Analysis at Work | | **Unit Number:** Unit 2 |
|---|---|---|
| **Assignment Title:** Finding the Percentage of Copper in a Brass Alloy | | **Assignment Number:** 2.3 |
| **Date Set:** | **Due date:** | |
| **Assessment Objective(s): AO3a** | | |

**Brief:**

Brass is an alloy of copper and zinc. This alloy has many uses ranging from coinage to non-ferrous fittings on ships. Many domestic taps use brass where contact with water occurs.

You are provided with a sample of brass which is about 150 years old and you are asked to quantitatively analyse it, using colorimetry, to find the percentage of copper present.

Your results will be used to compare the composition of antique brass with modern brass.

**The analysis of a piece of antique brass for its copper content.**

**Task 1:**

You are required to:

- Identify hazards and carry out a risk assessment
- Follow set procedures.

**Task 2:**

Produce a report which shows:

- A table of your readings
- A graph of your results.

**Task 3:**

Use your results to:

- Find the concentration of copper in your 'brass' solution
- Calculate the percentage of copper, by mass, in the antique brass sample.

**Task 4:**

- Comment on the safety and the accuracy of the method
- Evaluate your method and results.

**Maximum marks possible for this task: 8**

**(2 physical analyses are required for AO3a – each analysis can be marked out of 8 and the total halved.)**

**Resources:**

Class notes on colorimetric procedures and the instruction manual for the colorimeter used. You will also need to use 'Hazcards' or similar materials.

# Finding the Percentage of Copper in a Brass Alloy
# Unit 2: Analysis at Work (AO3a)

The analysis of a piece of antique brass for its copper content.

## PRACTICAL INSTRUCTIONS

1. Read through the instructions below and complete a risk assessment for the procedure outlined.
2. You are provided with a sample of brass that has been filed from a piece of antique brass.
3. Using a fume cupboard, place 30 $cm^3$ of distilled water into a 250$cm^3$ conical flask and slowly add 15$cm^3$ of concentrated nitric acid to it. Stir the mixture using a glass rod.
4. Weigh out, accurately known to 2 decimal places, about 1.5g of the antique brass filings.
5. Add these slowly to the diluted nitric acid in the fume cupboard.
6. Leave the mixture for some minutes until all the brass has 'dissolved'. During this procedure poisonous nitrogen dioxide gas is given off and a blue solution containing copper ($Cu^{2+}$) and zinc ($Zn^{2+}$) ions is produced.
7. Remove the solution from the flask and quantitatively add it to some distilled water in a 250$cm^3$ volumetric flask. Make the flask up to the mark using distilled water and mix well.
8. You are provided with around 100$cm^3$ of a copper sulphate solution. This solution contains 1.6g of copper (as $Cu^{2+}$ ions) in 250$cm^3$ of solution.
9. Dilute this copper sulphate solution with distilled water to make the solutions labelled **a** to **f** in the table below. This dilution is to be done accurately using appropriate apparatus, with mixing.

| Solution | Copper sulphate (aq) / $cm^3$ | Water / $cm^3$ | Concentration of solution g Cu / 250 $cm^3$ |
|---|---|---|---|
| a | 10 | 0 | 1.60 |
| b | 8 | 2 | 1.28 |
| c | 6 | 4 | 0.96 |
| d | 4 | 6 | 0.64 |
| e | 2 | 8 | 0.32 |
| f | 1 | 9 | 0.16 |

10. Switch on your colorimeter and allow it warm up for five minutes.
11. Place a 700nm filter in the colorimeter and zero the instrument using a cuvette filled with distilled water.

12. Fill six cuvettes with solutions **a** to **f** and find the absorption values for each of them in turn; record your results in a suitable way.
13. Fill another cuvette with the 'brass' solution and measure the absorption of this solution too.
14. Plot a graph of absorption (y axis) against concentration of copper ions (x axis). Your graph should be a straight line which passes through the origin (0,0).
15. Use your graph to measure the concentration of copper ions in your 'brass' solution. The value that you obtain will give you the mass of copper in your 'brass' solution'.
16. Use this value to calculate the percentage of copper in your antique brass sample.
17. Write a detailed report of your analysis, with comments about its safety and its accuracy together with an evaluation.