Assignment Brief 2.5

Unit Name: Analysis at Work	**Unit Number:** Unit 2
Assignment Title: Power Station Emissions	**Assignment Number:** 2.5
Date Set:	**Due Date:**

Assessment Objective(s): AO3c

Brief:

One the problems with coal burning power stations is that coal contains sulphur and, as a result, sulphur dioxide gas is one of the flue gas products. This gas causes acidic rain. It is important to remove as much sulphur dioxide as possible to prevent this and the flue gases are constantly monitored for their sulphur dioxide content.

One method is to treat a known volume of flue gas with a hydrogen peroxide solution, which converts the sulphur dioxide into sulphuric acid.

The sulphuric acid is then reacted with a standard solution of sodium carbonate in an acid-base titration. Your task is to perform a practical exercise to find % of sulphur dioxide in a given sample.

Finding the percentage of sulphur dioxide in flue gas from power stations.

Task 1:

You are required to:

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

Task 2:

Produce a report which includes:

- a record of your results
- a calculation of the concentration of sulphur dioxide in the flue gas
- an evaluation of your results.

Maximum marks for these tasks: 7

Resources:

Class notes on quantitative inorganic analysis using acid-base titrations.

Note: a flue gas solution can be prepared by acidifying sodium sulphite with hydrochloric acid.

Power Station Emissions
Unit 2: Analysis at Work (AO3c)

Finding the Percentage of sulphur dioxide in flue gas from power stations using an acid-base titration.

CHEMICAL EQUATIONS

$$SO_2 + H_2O_2 \rightarrow H_2SO_4$$

$$Na_2CO_3 + H_2SO_4 \rightarrow Na_2SO_4 + H_2O + CO_2$$

PRACTICAL INSTRUCTIONS

1. Complete an appropriate risk assessment before starting your work
   You should assume that all the sulphur dioxide gas has been absorbed and reacted with dilute hydrogen peroxide solution.
2. 5.0m^3 of flue gas has been bubbled through 250cm^3 of dilute hydrogen peroxide solution. You are provided with this solution.
3. Fill your burette with the sodium carbonate solution of concentration 0.020mol dm^{-3} provided.
4. Pipette 25cm^3 of the 'flue gas' solution into a 250cm^3 conical flask and add a few drops of methyl orange indicator solution.
5. Titrate with the sodium carbonate solution in the usual way until the indicator just turns from pink to orange.
6. Record the volume used in a suitable way and repeat as normal.

CALCULATION

7. Use the equations above to work out the mole ratio of sulphur dioxide to sodium carbonate.
8. Use the mean volume of the sodium carbonate solution used to calculate the number of moles of sodium carbonate used in the titration.
9. State the number of moles of sulphur dioxide present in 25cm^3 of the 'flue gas' solution and hence the number of moles of sulphur dioxide present in the total volume of 'flue gas' solution provided.
10. Find the number of moles of sulphur dioxide present in 1 m^3 of the flue gas.
11. Calculate the concentration of sulphur dioxide in the flue gas in g m^{-3} and then in mg m^{-3}.