A6 - Determination of Total Suspended Particulates in ATMOSPHERIC GASES by High Volume Sampler (AS 2724.3 - Method) and PM$_{10}$ High Volume Sampler with Size Selective Inlet – Gravimetric Method (AS 3580.9.6 – Method)

Prework
2. Outline the procedures for setting up and calibrating the sampler prior to measurement. Point form is acceptable.

6.1 Introduction
There are several accepted methods for the determination of the levels of particulate matter in the atmosphere. The simplest and least expensive of these is the deposit gauge (see A1), but it has many limitations. A more convenient method which provides data much more rapidly (typically one point every 24 hours) is the high volume sampler – which measures suspended particles (not settleable particles as for the deposit gauge).

In order to provide reliable and reproducible data these devices must be very carefully set up and calibrated before use, and the filters treated by strict handling procedures before and after use.

In this exercise you will set up and calibrate a high volume sampler and set it to sample the atmospheric particles in the local area for 24 hours on the prescribed day of the NSW 6-day sampling cycle.

Some suspended particles are far more dangerous to human health than others. One of the key factors in determining the hazard posed by atmospheric particles is their size. Those with equivalent aerodynamic diameters (EAD) of less than 10 µm may be carried into the lungs as they are not filtered out in the nose and throat. This means that they are respirable, and may lodge in the lower lungs to cause respiratory disease.

In order to measure the amount of these respirable particles in the atmosphere a high volume sampler fitted with a size selective inlet (PM$_{10}$ head) is used. This size selective inlet only allows those particles with EAD’s of 10 µm or less to be carried onto the filter and their mass evaluated.

You will set up and calibrate the PM$_{10}$ head and use it to assess the amount of respirable particles in ambient air in Tighes Hill.

Finally you will compare the amount of respirable and non-respirable particles in ambient air through difference calculations.
6.2 Calibration of Air Samplers

The high volume sampler comes Factory Calibrated. It is necessary however to regularly check the accuracy of the system. This is done using the procedure below.

1. Placing 'Calibration Flow Head' (see Figure 6.2.1) squarely on top of the Filter Paper Cassette, with a clean Filter Paper in it.

2. Connect a manometer that reads in either inches or millimetres of water to the Calibration Flow Head.

3. Place the machine in constant speed mode and adjust speed of motor until desired flow rate is achieved according to Manometer reading. See Flow Rate Vs Manometer Chart that is supplied with the Calibration Flow Head.

4. Use the 'Calibration Adjust' Screw (see Figure 6.2.2) to adjust the Flow Rate reading until it is correct, wait 30 seconds between each turn of the screw for reading to settle down.

![Figure 6.2.1](image1)

![Figure 6.2.2](image2)
6.3 Determination of Total Suspended Particulates  
**Note:** You must not attempt this step without approval from the teacher.

1. Using the method outlined in your pre-work set up the filter in the filter cassette. Make sure that you have pre-weighed your paper before placing it on the cassette.
2. Set the timer for the appropriate day of the state wide six day cycle as instructed by the teacher.
3. In the next practical session - or after the sampling has been completed, retrieve your paper, allow it to equilibrate in the laboratory (as per pre-work) then weigh it to the nearest milligram on the same balance used to obtain the initial paper weight.
4. Determine the mass of particles by difference between the initial and final weights.

6.4 Determination of PM$_{10}$ Suspended Particulate Matter  
**Note:** You must not attempt this step without approval from the teacher.

1. Using the method outlined in your pre-work set up the filter in the filter cassette. Make sure that you have pre-weighed your paper before placing it on the cassette.
2. Set the timer for the appropriate day of the state wide six day cycle as instructed by the teacher.
3. In the next practical session - or after the sampling has been completed, retrieve your paper, allow it to equilibrate in the laboratory (as per pre-work) then weigh it to the nearest milligram on the same balance used to obtain the initial paper weight.
4. Determine the mass of particles by difference between the initial and final weights.

6.5 CALCULATIONS.

Volume of air sampled. Calculate the volume of air sampled from the following expression:

$$V = \frac{(Q_i + Q_f) t}{2} \times \frac{273}{T} \times \frac{P_1}{101.3}$$

where

- $V$ = air volume sampled, in cubic metres corrected to 0°C and 101.3 kPa
- $Q_i$ = initial flow rate, in cubic metres per minute
- $Q_f$ = final flow rate, in cubic metres per minute
- $T$ = sampling time, in minutes
- $T$ = estimated mean, ambient temperature, in kelvins
- $P_1$ = estimated mean, ambient barometric pressure, in kilopascals.
Calculate the TSP concentration for each sample from the mass of particles collected on the filter and the respective volume of air sampled, from the following expression:

\[
C = \frac{(W_f - W_i) \times 10^3}{V}
\]

where

- \( C \) = mass concentration of total suspended particulates, in micrograms per cubic metre
- \( W_i \) = initial mass of filter, in milligrams
- \( W_f \) = final mass of filter, in milligrams.

### 6.6 Report

The following information should be reported:

- Reference to the Australian standard, i.e. AS 2724.3.
- Reporting authority (Hunter Institute of Technology CFET)
- The concentration of TSP in air in micrograms per cubic metre at 0°C and 101.3 kPa and the related time averaging periods.
- Location of the sample—all relevant details, e.g. location on Australian Map Grid* or GPS, height above ground level, classification of area (industrial, residential, agricultural, urban etc).
- The dates and time of day (state whether local or standard time).
- Any other relevant data, e.g. meteorological conditions.

### 6.7 References