Teacher’s notes

51 Peak Flow

Read
A spirometer is a device that measures breathing patterns, lung capacities and function. The Smart Q Spirometer measures accurately the flow of air through the device. This investigation will allow you to calculate the various lung capacities that can be measured.

The spirometer flowhead contains a sheet of resistance material that restricts the flow of air; the resistance to the air flow creates an increase in pressure across it. The increase in air pressure is measured via two air lines, one inside the flowhead and one inside the instrument body. An air pressure sensor is used to measure the changes in air pressure.

In the diagnosis of asthma and other lung complaints a measurement of the lung function is made and compared to a database of normal values. The percentage you deviate from normal values in the test is used to determine the degree of problem and the type of problem, appropriate treatment can then be decided upon.

Peak flow rates are also used in sports training either to indicate the improvement in total body fitness during the training period or to watch for the onset of exercise induced asthma. Peak flow is also considered to be an indicator of potential.

In this exercise the subject will try to create lung function data for analysis. The Smart Q Spirometer has not been calibrated for medical / diagnostic use and the instructor is not normally trained in fully interpreting the results. Any results should be regarded as demonstration of a principle and not to have any clinical significance.

The test will require you to take a very deep breath in followed by a very rapid forced expiration. This manoeuvre can cause some individuals discomfort and should not be undertaken by chronic asthmatics, individuals with bronchitis, lung infection or diagnosed lung disease.

Apparatus
1. An EASYSENSE logger.
2. A Smart Q Spirometer with one flow head fitted with a circular guard.
3. A flow head and nose clip for each user.

Measurement procedure
The procedure to record lung volumes / efficiencies is not instinctive and may require practice by the test subject. It is recommended that they try a few sample logs before attempting to collect “real” data. Breathing through the apparatus is unnatural and takes adjustment. Don’t snatch at the breathing or rush to complete.

It may take a few attempts before successfully collecting data; do not over practice the manoeuvre can be quite stressful.
Hazard information
Be careful that breathing investigations do not become competitions. Investigations on lung ventilation can be potentially distressing / dangerous to students with asthma or bronchitis.

Set up of the software and logger
Use setup file 51 Peak Flow.

<table>
<thead>
<tr>
<th>Recording method</th>
<th>Time</th>
<th>Intersample time</th>
<th>Pre-log Function</th>
<th>Trigger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graph</td>
<td>20 s</td>
<td>50 ms or less</td>
<td>Spirometer, Air Flow to Volume</td>
<td>When Air flow rises above 0.2 L/s</td>
</tr>
</tbody>
</table>

You may need to apply a tare / constant to the final data to give a true zero for the volume

Notes
The blue flowheads contain a bacterial and viral filter to prevent cross contamination. It is recommended that each user has their own flowhead and they should be marked to identify them. They are not washable; the filter material will felt and clog if immersed in water. One of the flowheads is “semi permanent” it is to be used many times and it provides the resistance that creates the pressure change in the device. The fixed flowhead should have the circular guard fitted to make a strong visual reminder that it is not to be used for breathing into.

Constants

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Defined</th>
<th>How measured</th>
<th>Typical values</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEV1</td>
<td>Forced expiration volume after 1 second.</td>
<td>Volume of air expired after 1 second</td>
<td>83% of FVC</td>
</tr>
<tr>
<td>FEV2</td>
<td>Forced expiration volume after 2 seconds.</td>
<td>Volume of air expired after 2 seconds</td>
<td>91% of FVC</td>
</tr>
<tr>
<td>FEV3</td>
<td>Forced expiration volume after 3 seconds.</td>
<td>Volume of air expired after 3 seconds</td>
<td>97% of FVC</td>
</tr>
<tr>
<td>FEV6</td>
<td>Forced expiration volume after 6 seconds.</td>
<td>Volume of air expired after 6 seconds</td>
<td>100% of FVC</td>
</tr>
<tr>
<td>FVC</td>
<td>Forced Vital Capacity.</td>
<td>Volume of air expired out from the beginning of the manoeuvre to the FEV6 volume plateau</td>
<td></td>
</tr>
<tr>
<td>FET</td>
<td>Forced Expiration Volume.</td>
<td>Time taken to reach FVC from start of expiration</td>
<td></td>
</tr>
<tr>
<td>FEV1/FVC</td>
<td>Forced Expiratory Volume divided by the Forced Vital Capacity</td>
<td></td>
<td>80-85%</td>
</tr>
</tbody>
</table>

Note: Values quoted have been reproduced from published and freely available literature. They represent values found in normal patients, i.e. patients with no breathing problems. Most people (normal) have some form of diagnosable breathing problem, they simply have not reached a point that they consider it is worth visiting a medical practitioner.
As a rough guide, a fully fit athlete would approach normal values (assuming they were not exercising to correct a health problem). A smoker would fall below the normal values.

**Results and analysis**

Typical results using the breathing method outlined above.

*Post-log Function to convert Air Flow to Volume has been used. Original air flow data had a Tare applied to remove any offset.*

*Volume against time graph ready for analysis (Auto scale used). Original and tared Air flow data have been hidden from view (Show or Hide Channels).*