Breathing patterns

Apparatus

- A =/- 25 kPa Wireless Pressure sensor.
- A breathing rate belt.
- Space for light exercise.

Data recording setup.

Use the default settings, select start to record, select stop to end recording.

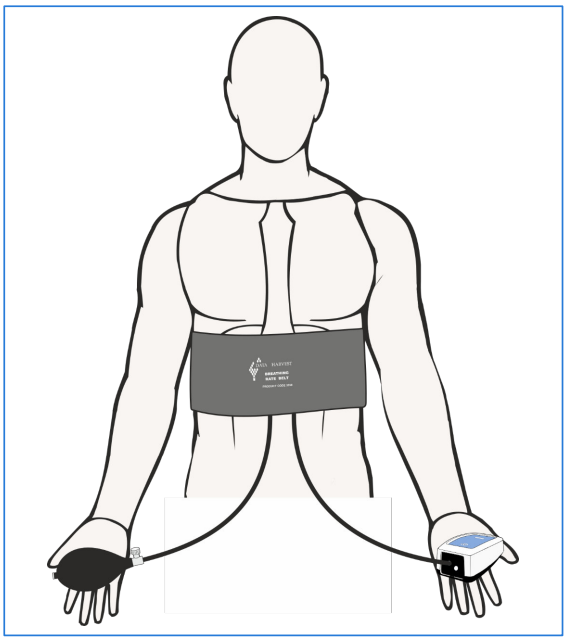
Allow about 30 seconds per recording

This activity is to see how breathing patterns change from rest to exercise.

You will, from you own observations of yourself, have noticed that breathing can change:

1. Frequency of breathing - breaths per minute.
2. Depth of breathing - the amplitude of the breathing will increase.

In this activity a belt containing a pressure bladder is placed around the thorax (chest). The bladder is then lightly pressurised and connected to a Gas Pressure sensor. As you breathe changes in chest size due to breathing will create a change in pressure in the bladder, which in turn will be recorded by the Sensor.



IMPORTANT.

With any work that involves people due care needs to be given to the individuals. You need to be aware of any discomfort and or stress your work is creating.

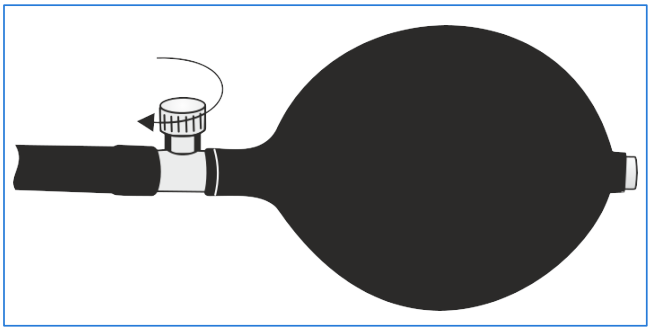
If you have any asthma or other breathing problems you must let your instructor know before attempting the activity.

Do not be tempted to turn this activity into a competition about who can breathe fastest, deepest, longest etc.

Method

1. Record a normal breathing pattern. Like all good science investigations you need to know what normal is.
2. Fit the breathing belt as shown in the diagram above. Your teacher may give additional advice. Fit the belt when you are standing or sitting upright. Make sure the belt is snug, it should feel tight without constricting movement or breathing.
3. Connect the tube that does not have the pump attached to the pressure sensor, again you teacher or demonstrator will have additional instructions about which adaptors etc. to use. Make sure the tubing is connected to Port1 on the sensor.
4. Open the software and link the sensor to it.

5. Once the link has been made, look at the live data and pump the belt up with the small bulb pump. You will need to reach a pressure of about 12 kPa. If the pump does not seem to work check the thumb screw valve is open.
6. Once the pressure is reached, close the thumbscrew valve and sit for a few moments to get used to the feel of the belt, during this time check that the pressure is not decreasing, if it is check for leaks and correct as necessary.
7. Ask the person with the belt to breath out to there normal limit, click on the live data box and select Tare. This will set their lowest "exhale" to zero (note, due to movement and variations in breathing this may never be truly zero, but very close).
8. Let the subject breath in and out to get used to the extra "tightness" around their chest, no more than 1 -2 minutes.
9. Select Start (ideally without the subject knowing when the recording has started. Stop after 30 seconds to a maximum of 1 minute.



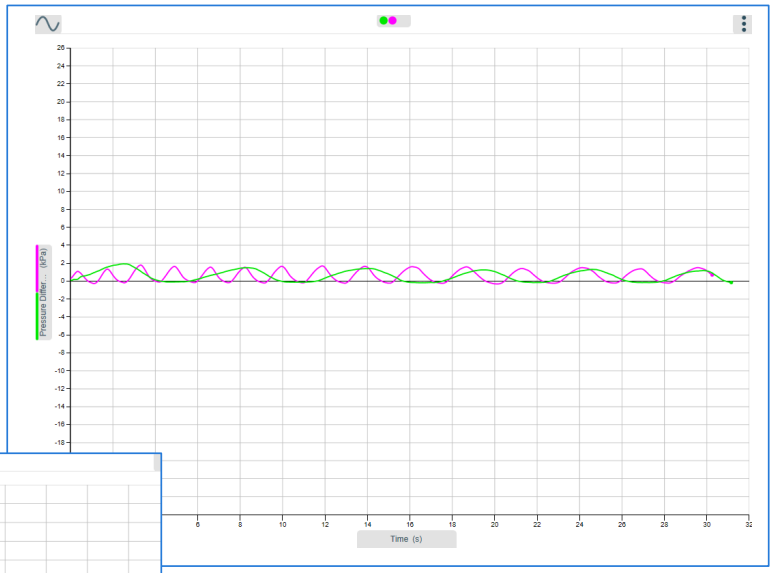
10. Now get them to a little light activity, walk round the room for example. Select overlay and record another 30 second to 1 minute sample.
11. Save the results, let the air out and release your volunteer form the belt.

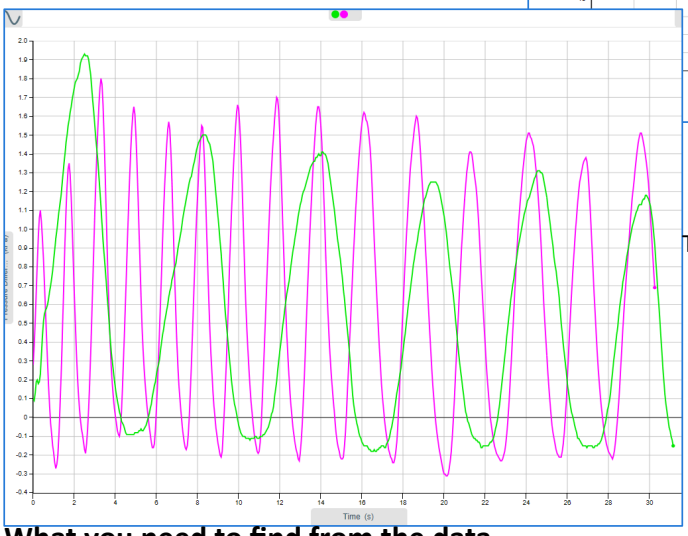
Sample results.

The sample results show the data for an individuals resting breathing pattern and the pattern for post exercise.

The data was collected using Overlay so that both patterns could be displayed on the same graph.

No scaling has been done. A tare has been applied to give the low pressure point as zero (in reality due to movement of the individual this was not exact as the activity continued)





The same data with scaling (max to min) applied.

What you need to find from the data.

1. Frequency of breathing as breaths per minute.
2. Amplitude of breathing in kPa
3. Average time between breaths.

Activity / breathing type	Frequency (rate)	Average interval	Average amplitude
Resting breathing			
Active breathing			

Extension.

As long as the person wearing the belt is in direct line of sight and no more than 25 metres away you can catch data from them.

For example.

1. How does breathing change as you walk around - long recording.
2. How does breathing change as you walk up the stairs to your class.
3. How does breathing change just as you sit in the room - long recording.
4. Follow the breathing pattern to help relax and or control breathing (create a nice regular breathing pattern)
5. As a pre - spirometer drill look at the trace from a spirometer and practice the breathing actions to get the same trace.

Questions

1. At what rate, in breaths per minute, did the test subject breathe on average whilst
    - at initial rest,
    - exercising
    - during recovery?
2. What is the average volume of breath, (i.e. the depth of breathing)
    - at initial rest,
    - exercise
    - during recovery?
3. Which altered most with exercise the frequency of breathing or the depth of each breath?
4. Compare your results with another test subject. Are the results different, if so why?
5. Could you calibrate this experiment to give volume of air in each breath? Describe the method you would use.
6. How do you think carbon dioxide controls breathing?