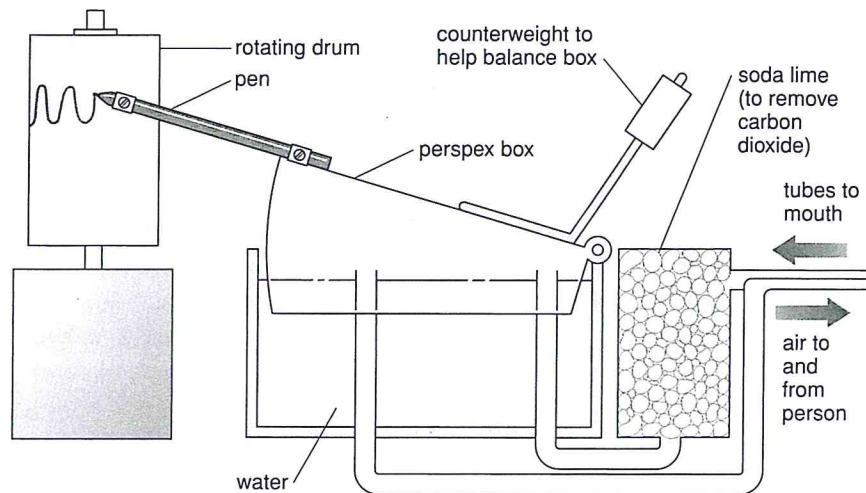


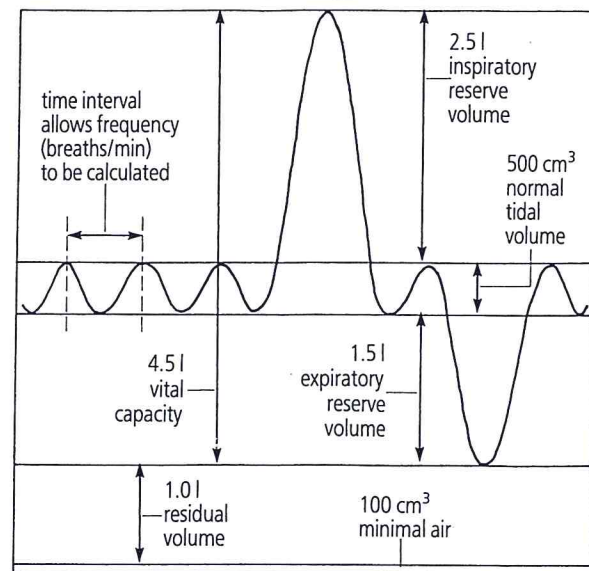
Tidal volume and ventilation rate

A **spirometer** measures the volume of air entering and leaving the lungs:

- Oxygen in the perspex box is breathed in and used in respiration – soda lime absorbs the carbon dioxide released from respiration.
- Movements of the perspex box lid reflect changes in lung volume.
- The pen attached to the lid produces a trace on a rotating drum.
- The trace can be interpreted to show the changes in volume of air over time.



Interpreting a spirometer trace



Tidal volume – the volume of air breathed in and out by an adult during quiet breathing.

= about 500 cm³.

Ventilation rate – the number of breaths taken in one minute.

= 12 – 20 breaths min⁻¹.

Pulmonary ventilation (dm³ min⁻¹) = tidal volume x ventilation rate

The effects of exercise on ventilation

- Muscle cells need more ATP so they need more oxygen for cell respiration and release more carbon dioxide.
- Changes in blood CO₂ levels are detected by **chemosensors** in the walls of the arteries, which send signals to the brainstem with two results:
 - the ventilation rate increases – a greater frequency of breaths allows a more continuous exchange of gases.
 - the tidal volume increases – increasing the volume of air taken in and out per breath allows more air in the lungs to be exchanged.