lung volumes & capacities
• Lung volumes and lung capacities refer to the volume of air associated with different phases of the respiratory cycle (inspiration & expiration).

The average total lung capacity of an adult human male is about 6 litres of air, but only a small amount of this capacity is used during normal breathing. An average human breathes (respiratory rate) some 12-20 times per minute.

The lung volumes depend on age, body size, gender, position and physical fitness. They are about 20 – 25 % less in women than men. They decrease with age.
Lung volumes:
- **tidal volume (TV)**
  It is the volume of air inspired or expired with each normal breath. It is about 500 ml. in the normal young adult subject.
- **inspiratory reserve volume (IRV)**
  It is extra lung volume that can be inspired over the normal tidal volume. **It is about 3000 ml.**
- **expiratory reserve volume (ERV)**
  It is the amount of air that can still be expired by forceful expiration after the end of a normal tidal expiration. **It is about 1100 ml.**
- **residual volume (RV)**
  It is the volume of air still remaining in the lung after the most forceful expiration. **It is about 1200 ml.** This volume can not be measured by spirometer.
- Lung capacities
  There are four different capacities. The lung capacity includes two or more lung volumes. They are:

- **inspiratory capacity**
  It equals the TV plus the IRV (about 3500 ml).

- **Functional residual capacity (FRC)**
  It equals the ERV plus RV (2300 ml).

- **vital capacity (VC)**
  It equals the IRV plus the TV plus the ERV (4600 ml).

- **Total lung capacity**
  It is equal to the vital capacity plus the residual volume. (5800 ml). It is the maximum volume to which the lung can be expanded with greatest possible inspiratory effort.
The vital capacity is the amount of air that can be expired after a maximal inspiratory effort. It refers to pulmonary function and gives information about strength of respiratory muscles. Any factor reduces the ability of lung to expand, reduces the vital capacity. Thus, tuberculosis, chronic asthma, lung cancer, chronic bronchitis and fibrotic pleurisy can all reduce the pulmonary compliance and thereby decrease the vital capacity.
The lung volumes are used to assess the functional impairment, monitor and diagnosis of respiratory diseases. The maximum expiratory flow is limited in airway narrowing diseases such as asthma. While all lung volumes are limited in lung inflammation and fibrosis. The amount breathed out in the first second (forced expiratory volume in 1st second, FEV1) FEV should be at least 80% to fully forced expiration in normal person. In asthma (obstruction of air flow), the time taken to expire fully is prolonged and the ratio is reduced.
• **Spirometer:-**

Is an instrument used to measure, assess & monitor lung volumes & capacities. It measure many variables of lung volume & capacities like VC, IRC, ERC, TV, FVC, FEV1, FEV ... & others.

Spirometer can be used to diagnose lung diseases & to differentiate between obstructive & restrictive lung diseases.

Spirometer cannot measure residual capacity RV & dead space (air in areas of lung don’t share in gas exchange).

Its measured by whole body plethysmography & Helium dilution method & many other methods.
Spirometry measures the amount and rate of air a person breathes in order to diagnose illness or determine progress in treatment.