
# Important practical physiology questions.

**When you feel like quitting, think about why you started.**

# Spirometry

**1- Define the following terms:**

- **A) Tidal volume:**

It is the volume of air inspired or expired during (quite) normal breathing. Its normal value is 500 ml or 0.5 Liter.

- **B) Inspiratory reserve volume:**

It is the volume of air that can be maximally inhaled after normal inspiration. Its normal value is 3000 ml or 3 Liters.

- **C) Expiratory reserve volume:**

It is the volume of air that can be maximally exhaled after normal expiration. Its normal value is 1100 ml or 1.1 Liters.

- **D) Vital capacity**

It is the volume of air that can be maximally expired after maximum inspiration. Its normal value is 4600 ml or 4.6 Liters.

- **D) Inspiratory capacity:**

It is the volume of air that can be maximally inhaled after normal expiration. Its normal value is 3500 ml or 3.5 Liters.

**2- A number of physiological factors influence lung volumes and capacities. What are they and how do they exert their effects?**

1. Age
2. Height
3. Weight
4. Gender
5. Posture
6. Pregnancy

**3- Lung volumes and capacities are altered in a variety of pathological conditions. Name a few of them and explain how these changes are produced.**

- Bronchial asthma
- Pulmonary fibrosis
- Chest wall deformities
- Respiratory muscle weakness

These are a few examples of those conditions which can alter the lung volumes and capacities either by decreasing the lung compliance or by narrowing the airways.

# Spirometry



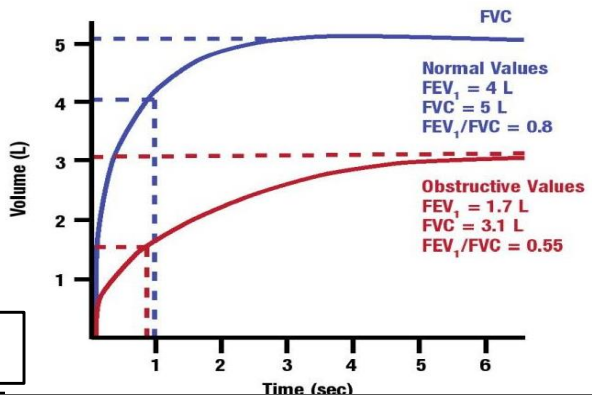
**4- What is the physiological significance of the residual volume and the functional residual capacity?**

1. They prevent the lungs from collapsing .
2. They maintain a continuous gas exchange between the breaths .
3. They make work of breathing easier .

**5- Residual volume cannot be directly measured by spirometry .What is the technique that can be used to measure It ?**

**Helium dilution technique**

# Dynamic Spirometry




**IMPORTANT.**

**1. From the $FEV_1$, curve produced, calculate:**

**a) Forced vital capacity (FVC):** i.e. the volume of air expired with forceful effort after a maximum inspiration.

Look where the curve becomes straight line at the top, then take that straight line left towards the vertical axis where it shows the units in liters and see what value it is leading to and that will be your forced vital capacity (FVC).

**b) Forced expiratory volume in the first second ($FEV_1$):** i.e. the volume of air forcefully expired in the first second after maximum inspiration

x-axis of the $FEV_1$ curve represents the time duration of expiration in seconds. Mark the first second and draw an imaginary horizontal line towards the vertical axis and see the value to which it ends. That will be your $FEV_1$ value.

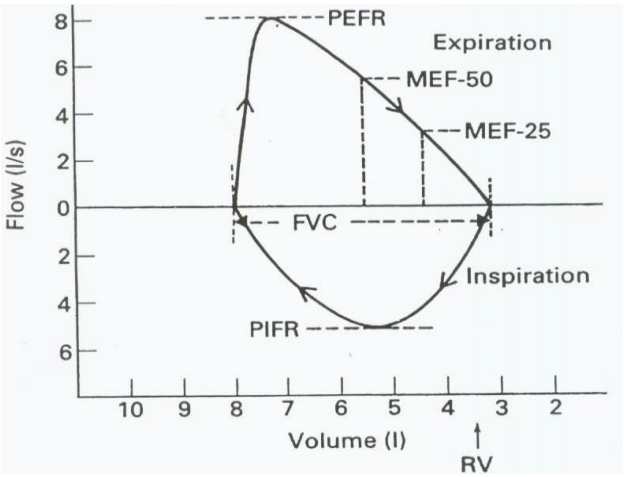
**c) $FEV_{1\ \%} = FEV_1 \times 100 / FVC$**

**2. The $FEV_1$% is a good index of airway resistance while expiring.**

**a) What values would be expected for a normal person? 70-80%**
**b) How long does it take for healthy subjects to expire their vital capacity? 3-5 seconds**
**c) Briefly explain what happens to FVC, $FEV_1$, and $FEV_1$% measurements in patients with obstructive and restrictive lung diseases.**

| | Normal | Obstructive | Restrictive |
|---|---|---|---|
| FVC | >75% predicted | Normal or ↓ | ↓↓↓ |
| $FEV_1$ | >75% predicted | ↓↓↓ | Normal or ↓ |
| $FEV_1$% | 70-80% | <70% | >80% |

# Dynamic Spirometry




## IMPORTANT.

**From the flow volume loop recorded, calculate:**

**Forced vital capacity (FVC):**

is measured over the X-axis of the flow-volume loop.

Its value is determined by the decline of expiratory loop over X-axis. Just look at what value of X-axis, the expiratory loop falls; that will be your forced vital capacity (FVC).

**b) The peak expiratory flow rate (PEFR):**

It is measured over the Y-axis of the flow-volume loop.

It is the maximum flow speed that can be achieved during forceful expiratory effort. Look at the peak of the expiratory loop and draw an imaginary horizontal line towards Y-axis. The value at which this imaginary line crosses the Y-axis, that value will be your peak expiratory flow rate (PEFR).

**c) The peak inspiratory flow rate (PIFR)**

It is measured over the Y-axis of the flow-volume loop.

It is the maximum flows peed that can be achieved during forceful inspiratory effort.

Look at the peak of the inspiratory loop and draw an imaginary horizontal line towards Y-axis. The value at which this imaginary line crosses the Y-axis, that value will be your peak inspiratory flow rate (PIFR).

**d)The MEF50 (maximum expiratory flow at 50% vital capacity):**

It is the flow speed of air during forceful expiration at the 50 % of the vital capacity. First mark the 50% of the vital capacity on the X-axis. Then draw a vertical imaginary line till it meets the declining expiratory loop. From here on, draw a horizontal imaginary line towards left till it reaches the Y-axis. Look at the value of x-axis, at which this line ends; that value will be your MEF50.

# Dynamic Spirometry



**VERY IMPORTANT.**

**4. Briefly describe the important characteristics of the flow-volume curve recorded with a normal healthy person.**

It has an upward expiratory loop and a downward inspiratory loop. The expiratory loop has a rising phase and a falling phase. The rising phase is force-dependent, as the air comes out with force from the larger airways due to the contraction of expiratory muscles. The falling phase is force-independent as the air comes out from the smaller airways without any force due to the elastic recoil of the lungs.

**5. Why is the force-independent part of the expiratory loop curvilinear in obstructive lung disease?**

Because the smaller airways are narrowed due to either spasm or accumulation of secretions, they provide resistance to the airflow during expiration; therefore, the airflow slows down and the force-independent part of the expiratory loop becomes curvilinear.

**6. What is the clinical significance of MEF50 measurements?**

MEF50 becomes greatly reduced in obstructive lung diseases (less than 4 L/sec).

**GOOD LUCK.**

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THANK YOU FOR CHECKING OUR WORK

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