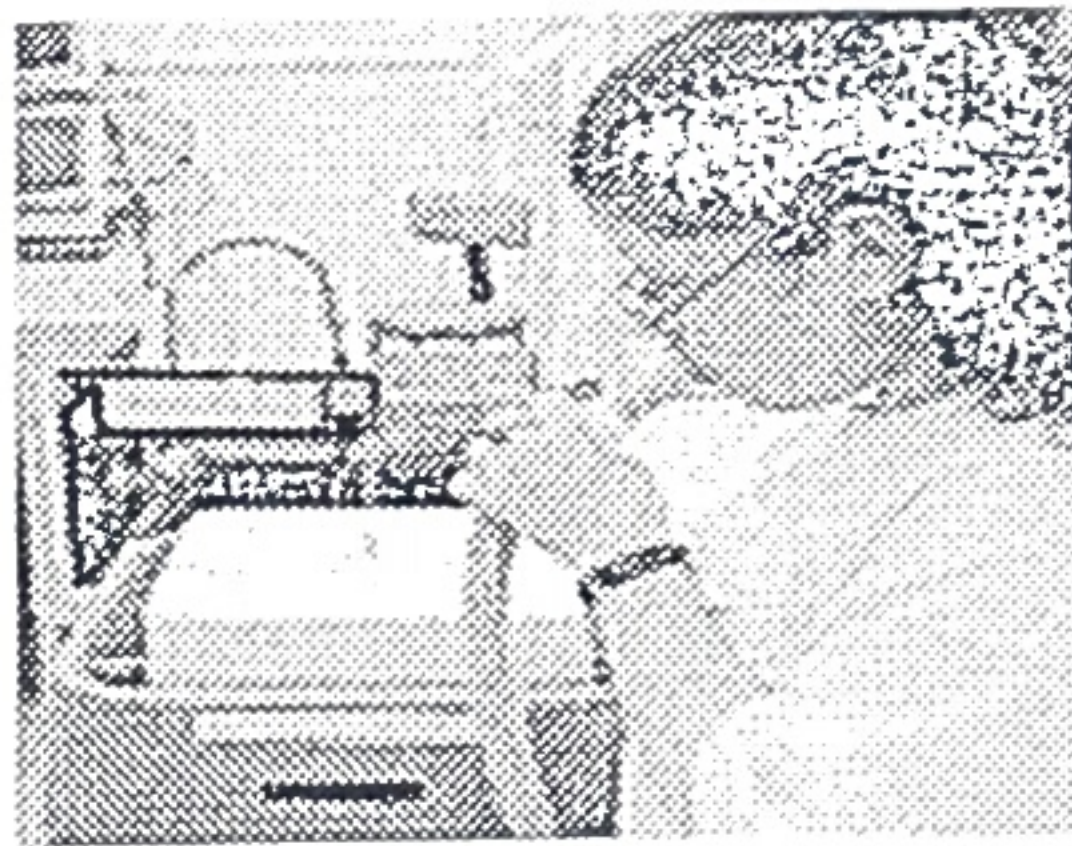


# Student Spirometry



## **OBJECTIVES:**

### **To be able to:**

- a. use a spirometer and determine lung volumes and capacities,**
- b. define and provide normal values for the various lung volumes and capacities and**
- c. recognize the physiological and some pathological factors that modify lung volumes and capacities.**



## **What is *spirometry*?**

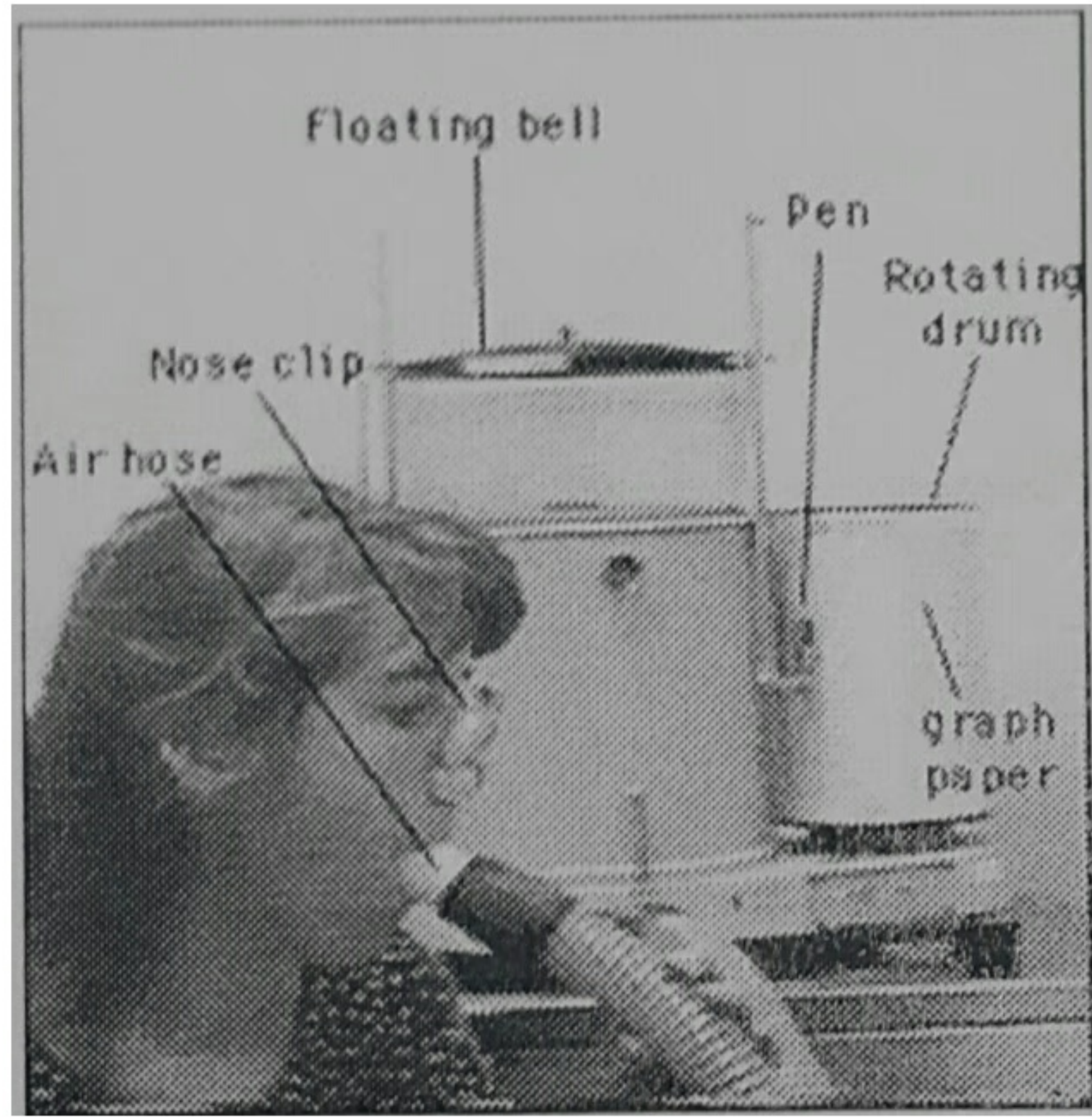
- means the measuring of breath.
- It is the most common of the Pulmonary Function Tests (PFTs), measuring lung function, specifically the measurement of the amount (volume) and/or speed (flow) of air that can be inhaled and exhaled.
- It is helpful in assessing conditions such as asthma and COPD.

## **METHOD:**

**Insert a sterilized mouthpiece in such a way that the edges of it are between the subject's lips and gums.**

- 1. Close the nose with the nose clip. Ask the subject to take normal breaths through the mouthpiece for a short time, then take a deep forceful inspiration to fill the lungs completely, then breath normally for a short time.**



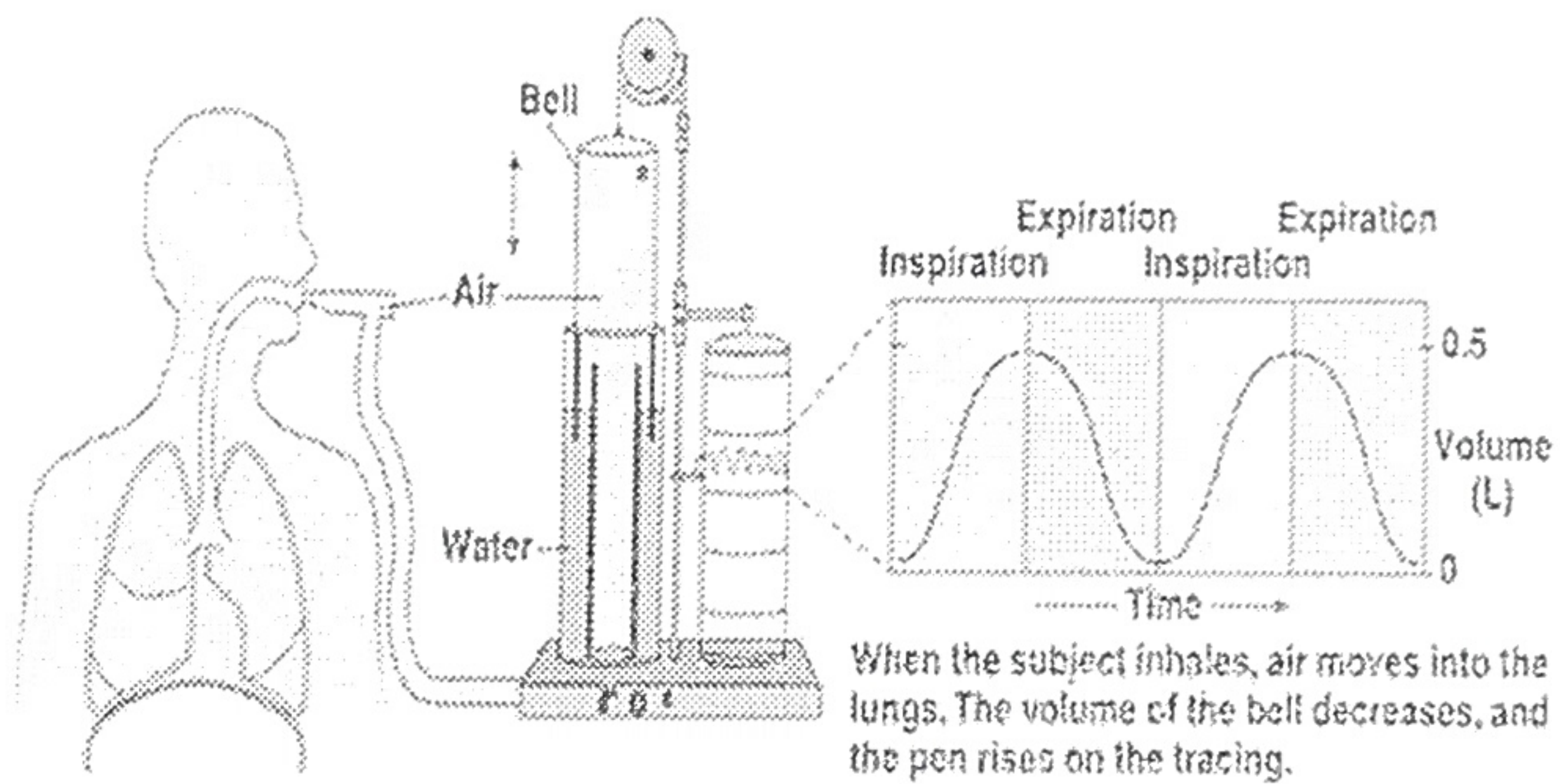


**2. Ask the subject to expire quickly, forcibly and as completely as possible, then ask the subject to breath normally for a short time.**

- 3. Ask the subject to take a deep forceful inspiration and immediately to expire quickly, forcibly and as completely as possible, then ask the subject to breath normally for a short time.**

**The spirogram is recorded on a moving drum.**

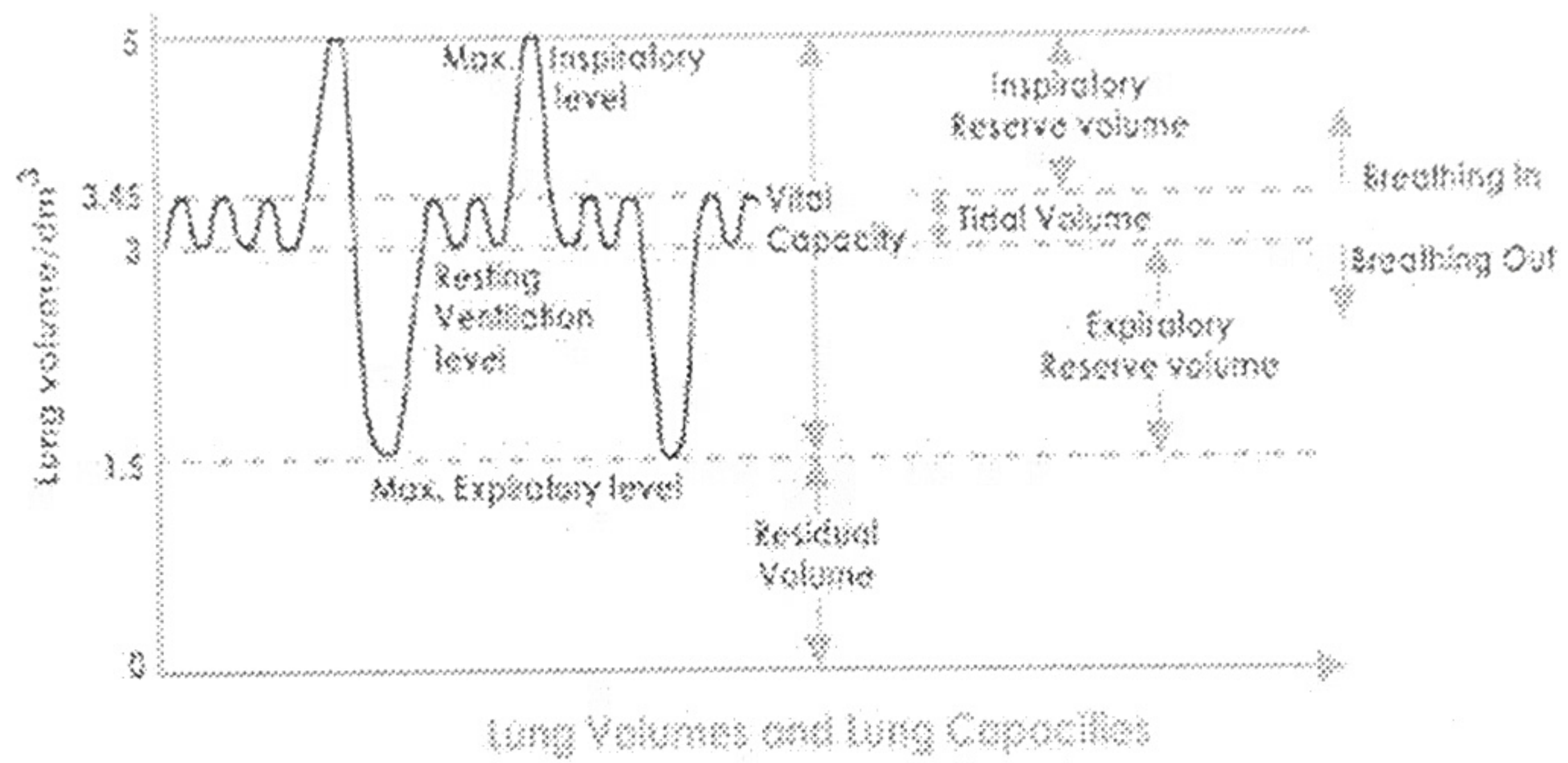




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Fig. 17-6





## **LUNG VOLUMES AND CAPACITIES:**

### **1. TIDAL VOLUME (TV)**

- volume of air inspired or expired with each normal breath.
- N = 500 ml (male and female)

### **2. INSPIRATORY RESERVE VOLUME (IRV)**

- the extra volume of air that can be inspired by a maximal inspiratory effort after normal inspiration.
- N = 3.3 L (male)  
1.9 L (female)

**3. EXPIRATORY RESERVE VOLUME (ERV)**

- the extra volume of air that can be expired by forceful expiration after the end of a normal tidal expiration.
- N = 1 L (male)  
700 ml (female)

**4. VITAL CAPACITY (VC)**

- maximum amount of air a person can expel from the lungs after first filling the lungs to their maximum extent and then expiring to the maximum extent.  
= TV + IRV + ERV
- N = 4.8 L (male)  
3.1 L (female)



**5. INSPIRATORY CAPACITY (IC)**

- volume of air inspired by a maximal inspiratory effort after normal expiration.
- $TV + IRV$
- $N = 3.8 \text{ L (male)}$   
 $2.4 \text{ L (female)}$

**6. FUNCTIONAL RESIDUAL CAPACITY (FRC)**

- the amount of air that remains in the lungs at the end of normal expiration.
- $ERV + RV$
- $N (\text{average}) = 2.3 \text{ L}$

**7. RESIDUAL VOLUME (RV)**

- the volume of air remaining in the lungs after the most forceful expiration.
- $N (\text{average}) = 1.2 \text{ L}$

## **Physiological factors that influence lung volumes and capacities:**

### **1. Age**

- **↑ RV, ↑ FRC with ↑ age**
- **↓ VC with age**

### **2. Sex**

- **females have 20 – 25% less values in all pulmonary volume and capacities than males.**

### **3. Body size**

- **obese – ↓ FRC because there's ↑ elastic recoil of the lungs**

## **Pathological conditions that alter lung volumes and capacities:**

### **a. Restrictive Lung diseases ( e.g. Alveolar Fibrosis)**

- **reduce the compliance of the lungs --- compressed lung volumes**
  
- **↑ elastic recoil of the lungs**
  - **↓ VC, ↓ IRV, ↓ ERV, ↓ RV, ↓ TV**
  - **↑ breathing frequency**



**b. Obstructive Lung diseases  
(e.g. Emphysema)**

- **↑ resistance to airflow**
  - **↑ TLC, ↑ FRC, ↑ RV, ↑ TV**
  - **↓ VC, ↓ ERV**
  
- **↓ elastic recoil of the alveoli**