Nadar Saraswathi College of Engineering & Technology

NSCET E-LEARNING PRESENTATION

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Electrical and Electronics engineering

III YEAR/ Vth Semester

OMD551 Basics of Biomedical Instrumentation

M.DIVYABHARATHI , M.E.,
Assistant professor
Nadar Saraswathi College of Engineering & Technology,
Vadapudupatti, Annanji (po), Theni – 625531.

TOPIC NAME

UNIT 05 –BIO CHEMICAL MEASUREMENT

BIO CHEMICAL MEASUREMENT

- Blood gas analyzer and non invasive monitoring
- Colorimeter, sodium potassium analyzer
- Spectrophotometer
- Blood cell counter
- Auto analyzer

BLOOD GAS ANALYZER

Definition:

Blood gas analysis, also called arterial blood gas (ABG) analysis, is a test which measures the amounts of oxygen and carbon dioxide in the blood, as well as the acidity (pH) of the blood.

Purpose:

An ABG analysis evaluates how effectively the lungs are delivering oxygen to the blood and how efficiently they are eliminating carbon dioxide from it. The test also indicates how well the lungs and kidneys are interacting to maintain normal blood pH (acid-base balance). Blood gas studies are usually done to assess respiratory disease and other conditions that may affect the lungs, and to manage patients receiving oxygen therapy (respiratory therapy). In addition, the acid-base component of the test provides information on kidney function.

DESCRIPTION

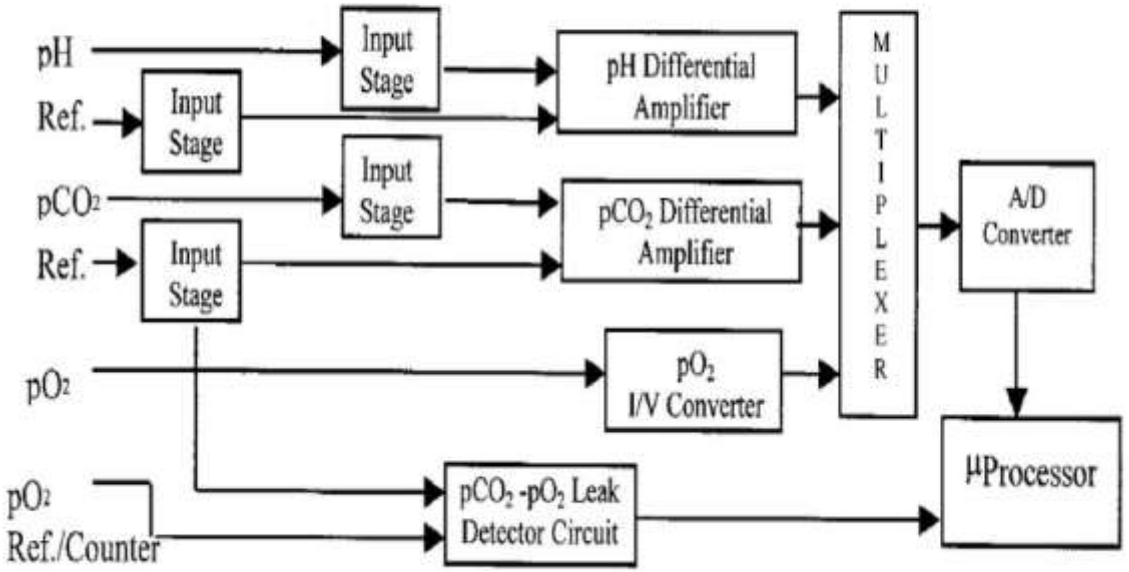
Blood gas analysis is performed on blood from an artery. It measures the partial pressures of oxygen and carbon dioxide in the blood, as well as oxygen content, oxygen saturation, bicarbonate content, and blood pH. Oxygen in the lungs is carried to the tissues through the bloodstream, but only a small amount of this oxygen can actually dissolve in arterial blood. How much dissolves depends on the partial pressure of the oxygen (the pressure that the gas exerts on the walls of the arteries).

Therefore, testing the partial pressure of oxygen is actually measuring how much oxygen the lungs are delivering to the blood. Carbon dioxide is released into the blood as a by-product of cell metabolism. The partial carbon dioxide pressure indicates how well the lungs are eliminating this carbon dioxide.

Acid-base balance — The condition that exists when the body's carbonic acid-bicarbonate buffer system is in equilibrium, helping to maintain the blood pH at a normal level of 7.35-7.45.

Hemoglobin — A protein—iron compound in red blood cells that functions primarily in carrying oxygen from the lungs to the tissues of the body.

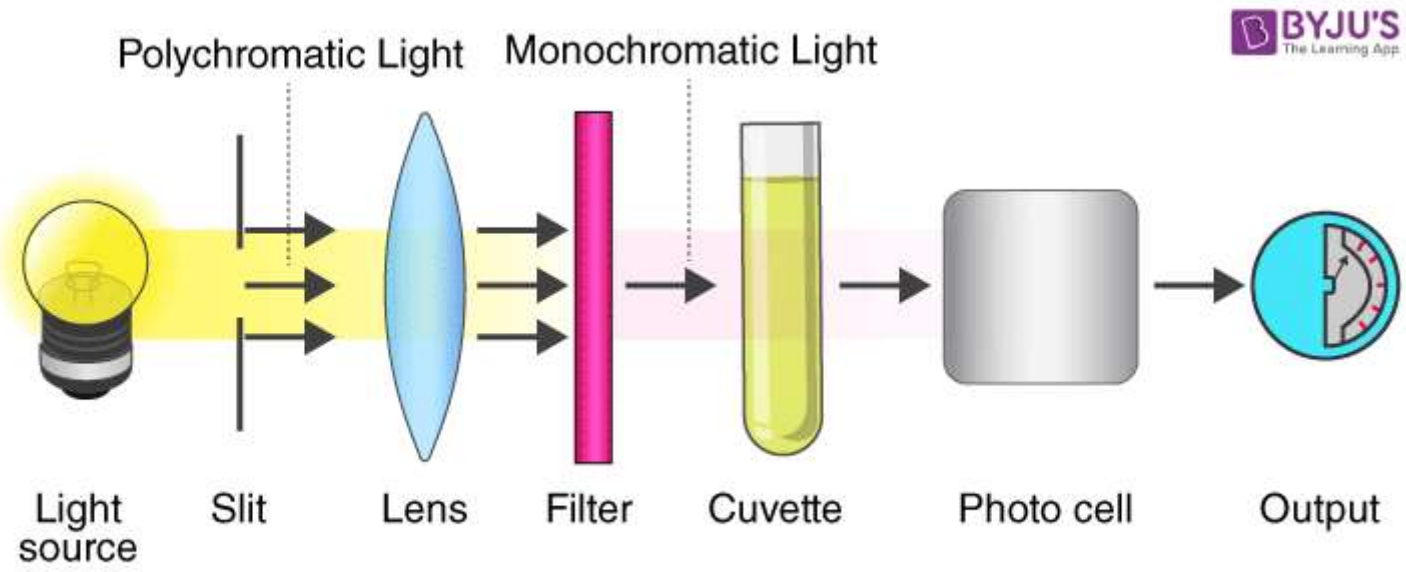
Blood Gas Analyzer Block Diagram



COLORIMETER AND PHOTOMETER

- chemical test plays an major role in identifying the abnormalities in human being
- The blood serum is a complex fluid which contains more substances dissolved in it
- These substances have the property of the property of absorbing and emitting the visible light
- The nature of these biological substances can be determined by analysing their absorbance and transmittance characteristics

Principle used in colorimeter analysis



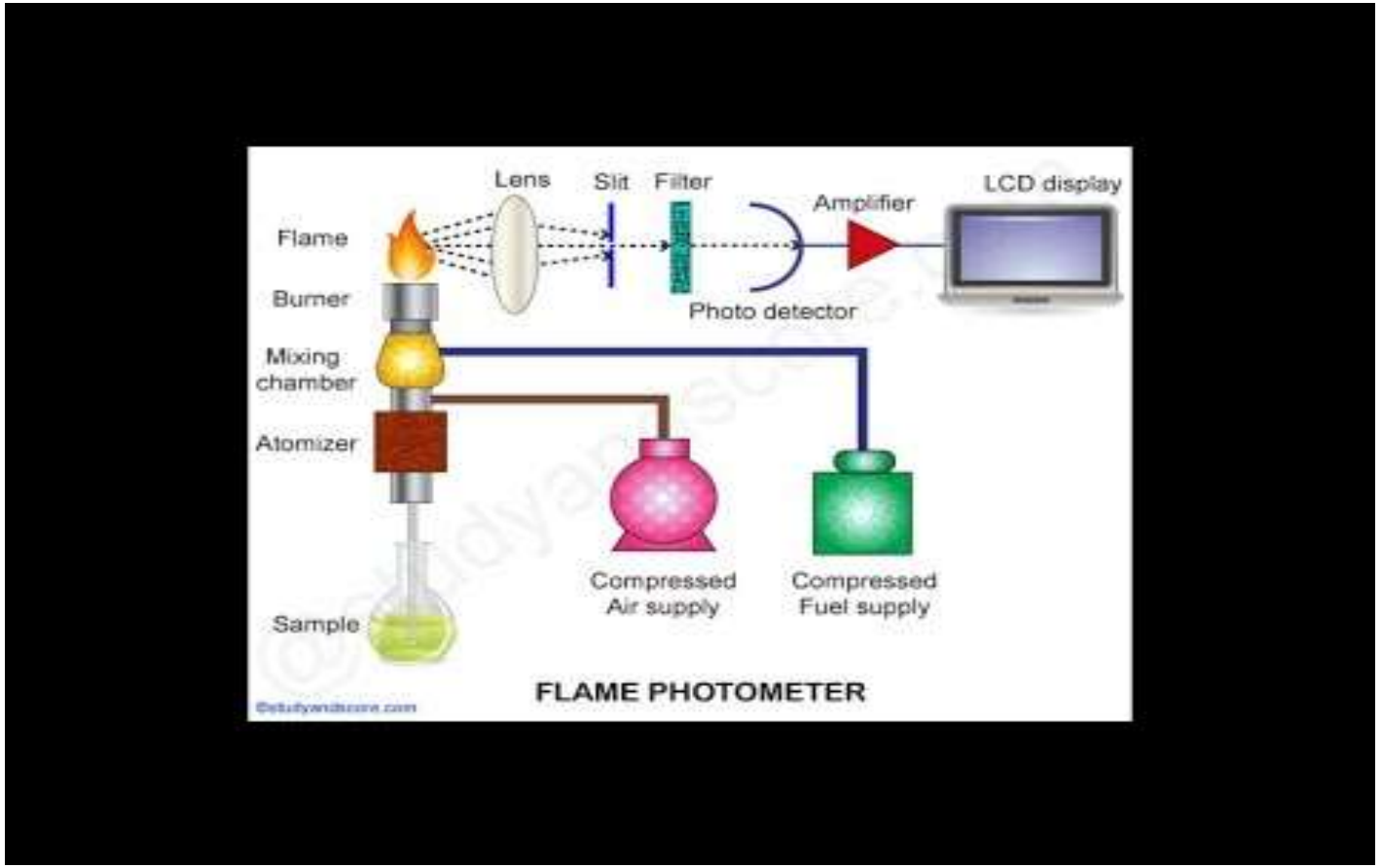
Principle used in colorimeter analysis

- The three main components of a colorimeter are a light source, a cuvette containing the sample solution and a photocell for detecting the light passed through the solution.
- The colorimeter is based on Beer-Lambert's law, according to which the absorption of light transmitted through the medium is directly proportional to the medium concentration.
- In a colorimeter, a beam of light with a specific wavelength is passed through a solution via a series of lenses, which navigate the colored light to the measuring device.

- This analyzes the color compared to an existing standard. A microprocessor then calculates the absorbance or percent transmittance. If the concentration of the solution is greater, more light will be absorbed, which can be identified by measuring the difference between the amount of light at its origin and that after passing the solution.
- To determine the concentration of an unknown sample, several sample solutions of a known concentration are first prepared and tested. The concentrations are then plotted on a graph against absorbance, thereby generating a calibration curve. The results of the unknown sample are compared to that of the known sample on the curve to measure the concentration.

When heart muscle contract blood is ejected from the ventricles and a pulse of pressure is transmitted through the circulatory system .This pulse can be measured at various points.

SODIUM POTASSIUM ANALYSER (or) FLAME PHOTOMETER



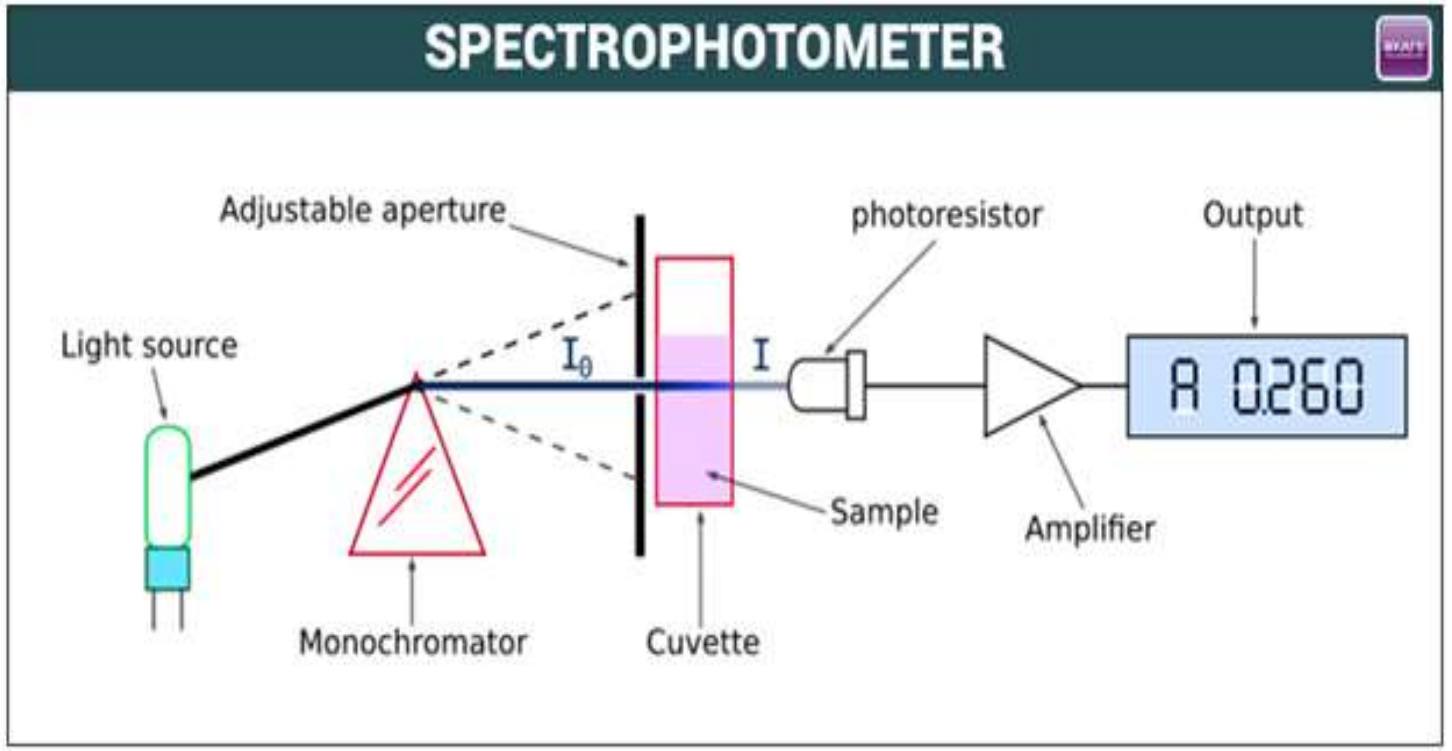
SODIUM POTASSIUM ANALYSER (or) FLAME PHOTOMETER

Flame photometer is an analytical instrument used in clinical laboratories for determining of sodium, potassium, lithium and calcium ions in body fluids. The principle of flame photometry is based on the fact that the compounds of some elements can be thermally dissociated in a flame and that some of the atoms produced in this process can get excited to a higher energy level. A flame photometer has three essential parts.

These are: emission system, fuel gases and their regulation, and atomizer. The advantages of flame photometry are the low cost as compared with atomic absorption or atomic emission spectrophotometry.

It does not suffer from spectral and ionization interferences because ionization becomes a serious problem only at higher temperatures. In the clinical analysis of sodium and potassium, the flame photometer gives, rapidly and accurately, numerous differential data for normal and pathological values.

SPECTRO PHOTOMETER



A spectrophotometer is an instrument that measures the amount of light absorbed by a sample.

Spectrophotometer techniques are mostly used to measure the concentration of solutes in solution by measuring the amount of the light that is absorbed by the solution in a cuvette placed in the spectrophotometer.

The spectrophotometer technique is to measure light intensity as a function of wavelength. It does this by diffracting the light beam into a spectrum of wavelengths, detecting the intensities with a charge-coupled device, and displaying the results as a graph on the detector and then on the display device.

- In the spectrophotometer, a prism (or) grating is used to split the incident beam into different wavelengths.
- By suitable mechanisms, waves of specific wavelengths can be manipulated to fall on the test solution. The range of the wavelengths of the incident light can be as low as 1 to 2nm.
- The spectrophotometer is useful for measuring the absorption spectrum of a compound, that is, the absorption of light by a solution at each wavelength.
- Instrumentation of Spectrophotometer

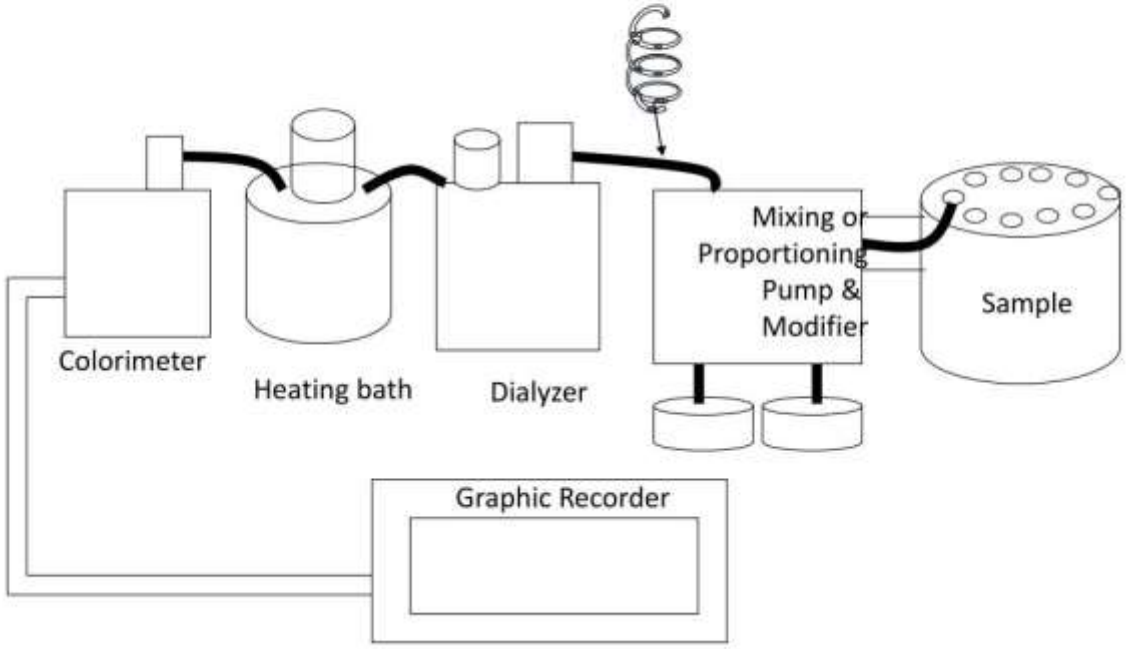
BLOOD CELL COUNTER

A measure of the number of red blood cells, white blood cells, and platelets in the blood. The amount of hemoglobin (substance in the blood that carries oxygen) and the hematocrit (the amount of whole blood that is made up of red blood cells) are also measured. A blood cell count is used to help diagnose and monitor many conditions. Also called CBC, complete blood count, and full blood count.

Different types of blood cells are,

- RBC (Red blood cell)
- WBC (white blood cell)
- Blood platelets (Thrombocytes**)**

AUTO ANALYZER



AUTO ANALYZER

In continuous flow analysis (CFA) a continuous stream of material is divided by air bubbles into discrete segments in which chemical reactions occur,The continuous stream of liquid samples and reagents are combined and transported in tubing and mixing coils, The tubing passes the samples from one apparatus to the other with each apparatus performing different functions, such as distillation,dialysis,extraction,ion exchange,heating,incubation,and subsequent recording of a signal.

Sampler

Samples are feeded into the analyzer by using sampler up to 128 samples can be placed in the sampler samples contains the holes in which the sample tubes can be placed.

Dialyzer

It separates interfacing substances from the sample by permitting selective passage of sample through a semipermeable membrane.

Heating bath

It is used to heat the fluids continuously to exact temperature this module is very important because color development depends on temperature also.

Colorimeter

It is used to monitor the changes in optical density of the fluid which flows through a tubular flow cell. Color intensity is proportional to substance concentrations is converted into corresponding electrical voltage.