Biomedical Instrumentation

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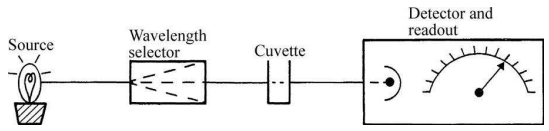
Clinical Laboratory Instrumentation



$$P = P_0 10^{-aLC}$$

$$\%T = 100P/P_0 = (100)10^{-aLC}$$

$$A = aLC$$

$$A = \log\left(\frac{P_0}{P}\right) = \log\left(\frac{100}{\%T}\right) = 2 - \log(\%T)$$

$$C_u = C_s\left(\frac{A_u}{A_s}\right)$$

Figure 11.1 Block diagram of a spectrophotometer (Based on R. J. Henry, D. C. Cannon, and J. W. Winkelman, eds., *Clinical Chemistry,* 2nd ed. Hagerstown, MD: Harper & Row, 1974.)

Standards	% Transmittance	Calcium Concentration, mg/dl
1	79.4	2
2	39.8	8
3	31.6	10
4	20.0	14

Example 11.2 Does this determination follow Beer's law? If a patient sample was processed and a percentage of 35 were obtained, what would the calcium concentration be?
ANSWER *A*1 = 2 – log 79.4 = 2 – 1.90 = 0.10
A2 = 2 – log 39.8 = 2 – 1.60 = 0.40
A3 = 2 – log 31.6 = 2 – 1.50 = 0.50
A4 = 2 – log 20 = 2 – 1.30 = 0.70
For all the 4 samples ratio of concentration to Absorbance is given as:
2/0.1 = 8/0.4 = 10/0.5 = 14/0.7 = 20
So the samples follow Beer's law
For %*T* = 35,
Absorbance = 2 – log (%*T*) = 2 – log 35 = 0.46
Concentration is given as: *C*u = *C*s(*A*u/*A*s) =2(0.46/0.1) = 9.1 mg/dl.

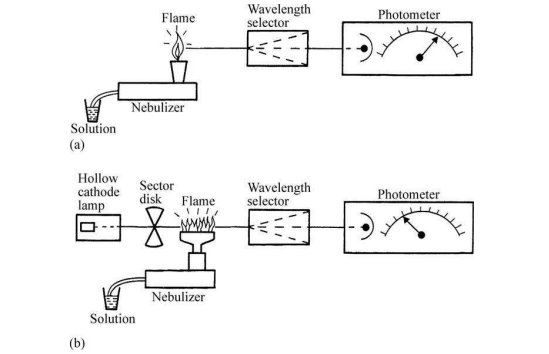


Figure 11.2 Block diagrams of instruments for (a) flame emission and (b) flame absorption. (Based on R. J. Henry, D. C. Cannon, and J. W. Winkelman, eds., *Clinical Chemistry,* 2nd ed. Hagerstown, MD: Harper & Row, 1974.)

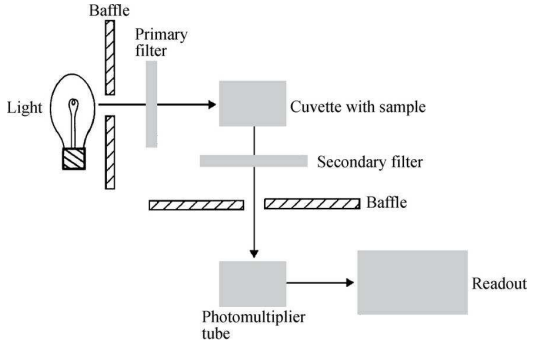


Figure 11.3 Block diagram of a fluorometer (From R. Hicks, J. R. Schenken, and M. A. Steinrauf, *Laboratory Instrumentation.* Hagerstown, MD: Harper & Row, 1974. Used with permission of C. A. McWhorter.)

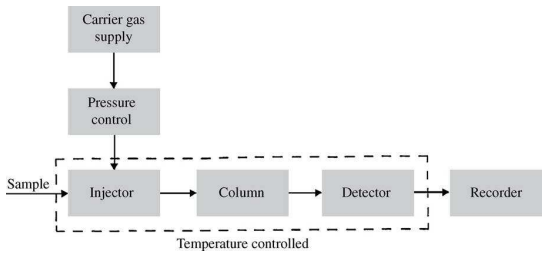


Figure 11.4 Block diagram of a gas–liquid chromatograph (GLC)

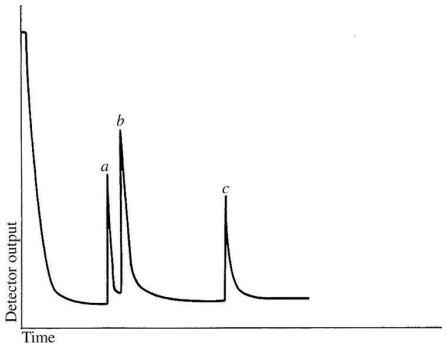


Figure 11.5 Example of a GLC recording for the analysis of blood levels of phenobarbital (peak *a*) and phenytoin (peak *c*). Peak *b* corresponds to the level of heptabarbital (the internal standard).

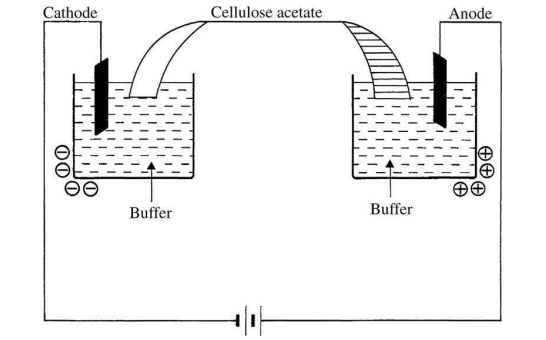


Figure 11.6 Cellulose acetate electrophoresis (From R. Hicks, J. R. Schenken, and M. A. Steinrauf, *Laboratory Instrumentation.* Hagerstown, MD: Harper & Row, 1974. Used with permission of C. A. McWhorter.)

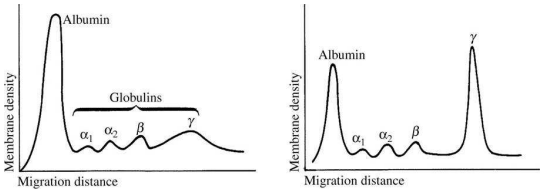


Figure 11.7 Examples of patterns of serum protein electrophoresis The left-hand pattern is normal; the right-hand pattern is seen when there is an overproduction of a single type of gamma globulin.

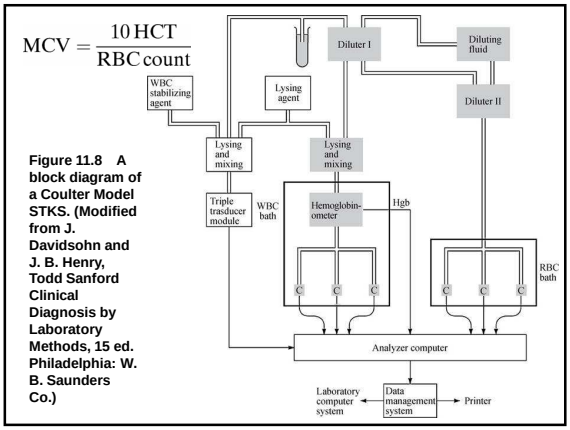


Figure 11.8 A block diagram of a Coulter Model STKS. (Modified from J. Davidsohn and J. B. Henry, Todd Sanford Clinical Diagnosis by Laboratory Methods, 15 ed. Philadelphia: W. B. Saunders Co.)

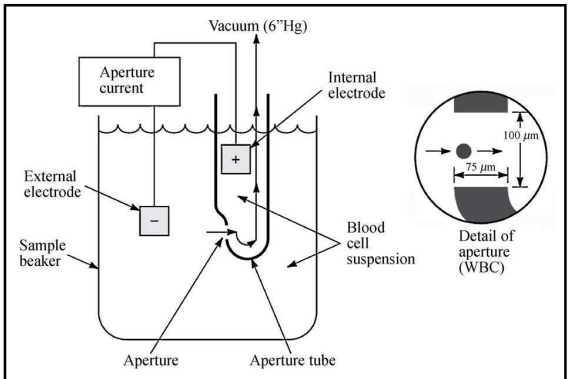


Figure 11.9 Coulter STKS aperture bath

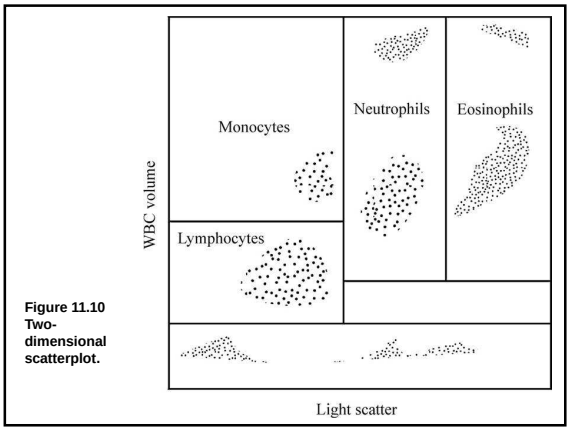


Figure 11.10 Two-dimensional scatterplot.