



## C3.3.2 PHOTOMETRY

### C3.3.2.1 The Beer-Lambert law

The Beer-Lambert law (C3.3.2.1)

Cat. No.	Description	C3.3.2.1
524 005W	Mobile-CASSY 2 WiFi	1
524 220	CASSY Lab 2	1
524 069	Immersion photometer S	1
666 2605	Holder for immersion photometer S	1
665 793	Volumetric flask, Boro 3.3, 100 ml	1
665 792	Volumetric flask, Boro 3.3, 50 ml	1
664 045	Test tubes, Fiolax, 30 x 200 mm, set of 10	1
665 997	Graduated pipette 10 ml	3
666 003	Pipetting ball (Peleus ball)	1
667 054	Test tube rack, for 12 tubes, 32 mm diam.	1
667 7977	Electronic Balance 440-3N, 200 g : 0.01 g	1
672 9600	Copper(II) sulfate-5-hydrate, 100 g	1
670 3600	Ammonia solution, 25 %, 250 ml	1
675 3400	Water, pure, 1 l	1
	additionally required: PC with Windows 7 or higher with WIFI or USB connection	1

The intensity of light diminishes when it passes through a coloured solution. Photometric measurements make use of this fact to determine the concentration of such a solution. For this purpose, the transmittance  $T$  of the solution is measured, i.e. the ratio of the intensity of the transmitted light  $I$  to the intensity of light exposure  $I_0$ .

$$T = \frac{I}{I_0}$$

The extinction or absorption of the solution, i.e. the number of light quanta absorbed, is proportional to the concentration. Transmission and extinction have the following relationship:

$$E = \log_{10} \left( \frac{I_0}{I} \right) = -\log_{10} \left( \frac{I}{I_0} \right) = -\log_{10}(T)$$

If the extinction of a solution is measured, its concentration can be calculated from the result. That relationship is expressed by the Beer-Lambert law. Along with the concentration  $c$  of a solution, the extinction also depends on the thickness  $d$  of the layer and on the substance-specific extinction coefficient  $\varepsilon$ .

$$E = \log_{10} \left( \frac{I_0}{I} \right) = \varepsilon \cdot c \cdot d$$

In experiment C3.3.2.1, a dilution series is used to study the proportional relationship between extinction and concentration and to determine the extinction coefficient of blue copper tetraammine.