Technical Help
Light

Light Sensor Reading Conversions Between watts/m² and micromoles/m²/sec

The relationship between the energy and frequency of a quantum (or photon) of radiation is described by the equation

$$E = h . \nu \qquad \text{Joules (or watt seconds)}$$

Where h is Planck's constant (6.63×10^{-34} watt/sec^2) and ν is the frequency of radiation in Hz.
Frequency $\nu = c/\lambda$ where c is the speed of light in m/sec and λ is wavelength in metres

So $$E = h . c / \lambda$$

One mole of photons = N where N is Avogadro's constant (6.022×10^{23})
So a micromole of photons = N / 10^6

So, energy of a micromole of photons $E = N . h . c / \lambda . 10^6$ watt seconds

To convert a radiation measurement R in micromoles/m^2/sec, to a measurement W in watts/m^2

$$W = R . N.h .c / \lambda . 10^6$$

This equation applies for a given wavelength λ in metres.
For calculations with wavelengths in nanometres (10^{-9} metre)

$$W = R . N . h . c / \lambda.10^{-9} . 10^6 \qquad \text{watt/m}^2$$

So $$W = R . (6.022 \times 10^{23} . 6.63 \times 10^{-34} . 3 \times 10^8) / \lambda.10^{-9} . 10^6$$

$$\mathbf{W = R . 119.78 / \lambda \ (watt/m^2)}$$

For conversions in the PAR 400-700 nm or UV wavebands, this calculation must be done for each individual wavelength and summed. As spectral distribution curves for different light sources vary, the overall conversion factor also varies for each source.

(continued overleaf)

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The following examples are for natural daylight conditions:

A) PAR Range

For an approximate value over the waveband 400-700 nm (PAR)

$$119.78 / \lambda_{400-700} = 1 / 4.6 \qquad \text{(approximately)}$$

** So to convert a reading of **X** μmol/m^2/sec to W/m^2 simply divide by 4.6
** Or to convert a reading of **Y** W/m^2 to μmol/m^2/sec simply multiply by 4.6

B) UV-A Range

For an approximate value for the Skye SKU 420 UV-A waveband 315-380 nm

$$119.78 / \lambda_{315-380} = 1 / 2.87 \qquad \text{(approximately)}$$

** So to convert a reading of **X** μmol/m^2/sec to W/m^2 simply divide by 2.87
** Or to convert a reading of **Y** W/m^2 to μmol/m^2/sec simply multiply by 2.87

C) UV-B Range

For an approximate value for the Skye SKU 430 UV-B waveband 280-315 nm

$$119.78 / \lambda_{280-315} = 1 / 2.47 \qquad \text{(approximately)}$$

** So to convert a reading of **X** μmol/m^2/sec to W/m^2 simply divide by 2.47
** Or to convert a reading of **Y** W/m^2 to μmol/m^2/sec simply multiply by 2.47

For details of conversion factors for other light sources please see:

1981 KJ McCree. Photosynthetically Active Radiation. Physiological Plant Ecology I. Edited by OL Lange, PS Nobel, CB Osmond, H Ziegler. Encyclopaedia of Plant Physiology. New Series. Volume 12A. Springer-Verlag Berlin, Heidelberg, New York.

Skye's Light Measurement Guidance Notes booklet

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