

More examples with units and dimensions

1. According to Holligan et al 1984 (*Marine Ecology Progress Series* 17:201) the vertical flux of nutrients through the ocean's thermocline is:

$$F_N = K_V \Delta N / \Delta Z$$

where F_N is the vertical flux of nutrients (milligram-atoms $\text{m}^{-2} \text{s}^{-1}$)

K_V is the vertical eddy diffusivity ($10^{-4} \text{m}^{-2} \text{s}^{-1}$)

ΔN is the nitrate difference across the thermocline (mg-atoms)

ΔZ is the thickness of the thermocline (metres)

Write the equation, then write out dimensions beneath each symbol

Is this equation dimensionally homogeneous ? _____

Write the equation again, with dimensions, but this time assume that ΔN is the vertical nitrate gradient (mg-atoms/metre).

Is the equation dimensionally homogeneous ? _____

2. A series of experimental measurements suggest that the vertical flux of nutrients through the thermocline follows an exponential relation:

$$F_N = \alpha (K_V \Delta N / \Delta Z)^{3/4}$$

What units does α have ? _____

What dimensions does α have ? _____

3. Another series of experiments suggest that nutrient flux depends upon the temperature gradient across the thermocline.

$$F_N = \beta (\Delta T / \Delta Z)^{-1/3}$$

$\Delta T / \Delta Z = \text{°C/metre}$

What units does β have ? _____

What dimensions does β have ? _____