ATKINSON SCIENCE

THEORY GUIDE

Climate Classes Web Application

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Atkinson Science welcomes your comments on this Theory Guide. Please send an email to keith.atkinson@atkinsonscience.co.uk.

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1 Introduction

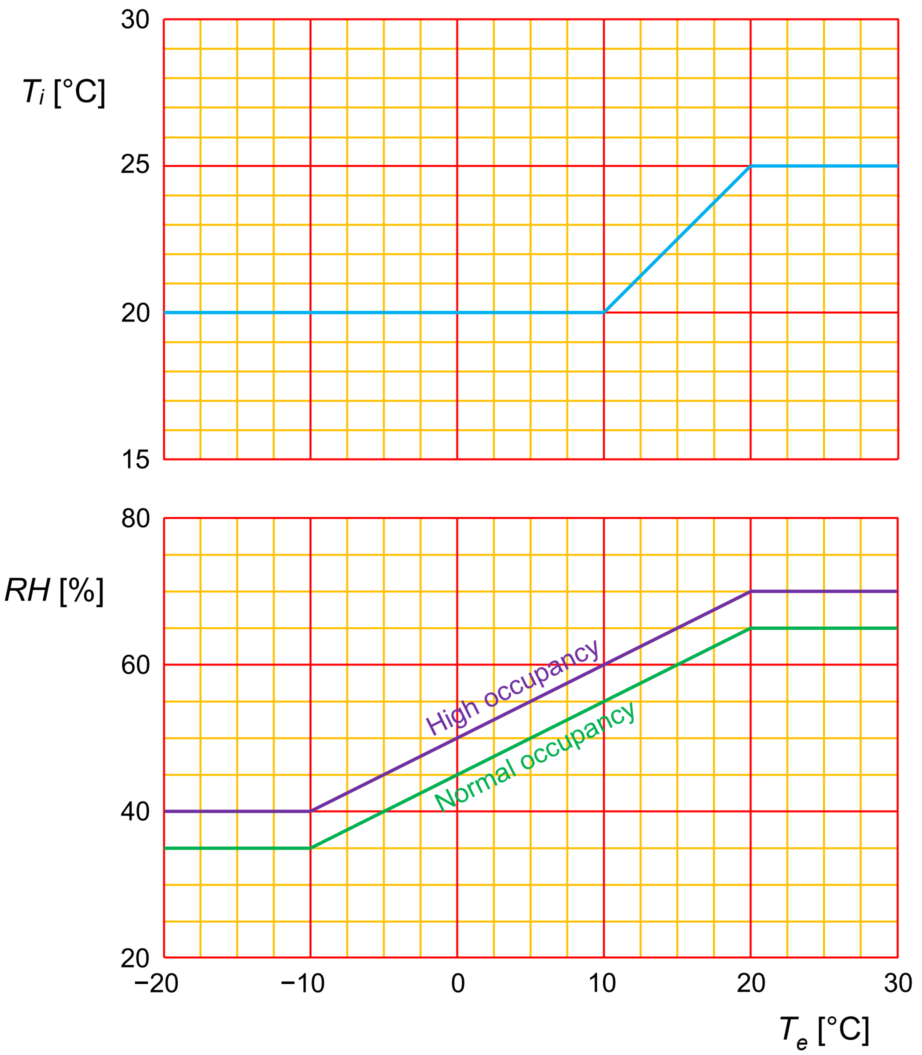
You can find the Atkinson Science Climate Classes web application at the web address https://atkinsonscience.co.uk/WebApps/Construction/ClimateClasses.aspx. There is a user guide that you can download at the same address.

BS EN ISO 13788:2012 provides two simple methods of determining the environmental conditions in a dwelling or office if the conditions are not clearly defined by air conditioning and controls (BS EN ISO 13788:2012, p. 19). The first applies to continental and tropical climates and the second to maritime climates (such as that of the United Kingdom).

2 Continental and tropical climates

In the method for continental and tropical climates, the internal temperature is determined from the external temperature, while the internal humidity is determined from the external temperature and the occupancy of the building. The daily mean temperature is used to locate the internal temperature on the curve in the upper chart of Figure 1. The daily mean temperature and occupancy are used to locate the internal humidity from one of the two curves in the lower chart of Figure 1.

Figure 1 Internal temperature and humidity for continental and tropical climates



3 Maritime climates (including the UK)

BS EN ISO 13788:2012 provides a simple method of calculating the indoor temperature and humidity for maritime climates, such as that of the UK. In maritime climates the internal temperature T_i is assumed to be $20°C$. The living space is assumed to be air-conditioned so that the amount of moisture per unit volume in the space is greater than that outside by $\Delta m_v/V$ [kg m^{-3}], where Δm_v [kg] is the excess mass of moisture in the space and V [m^{-3}] is the volume of the space. The vapour pressure in the space will be greater than that outside by

$$\Delta p_v[\text{Pa}] = p_{v\,i} - p_{v\,e} = \frac{\Delta m_v}{V} R_v T_i$$

where R_v is the specific gas constant for water vapour (= 461.5 J kg^{-1} K^{-1}). Since $T_i = 20°\text{C}$,

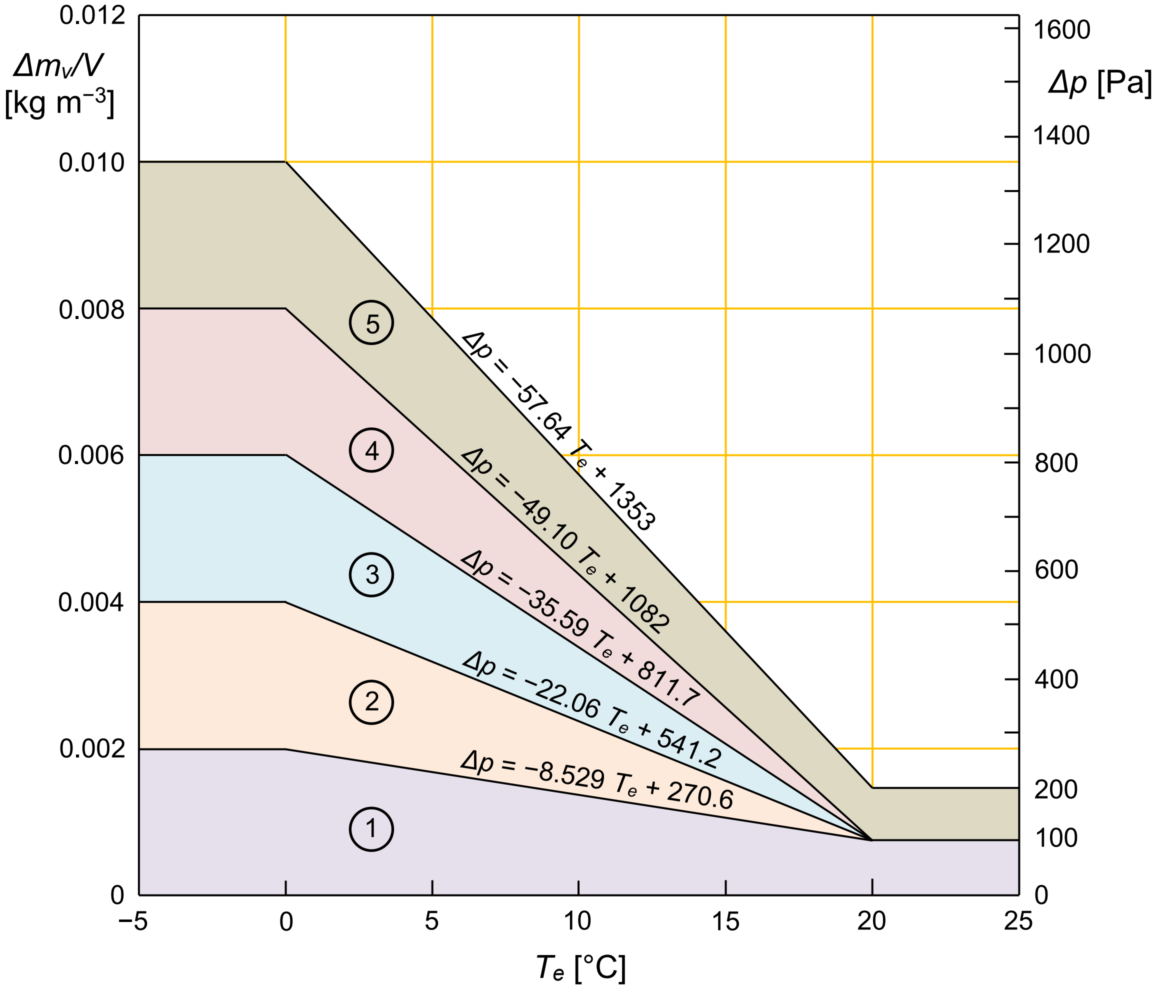
$$\Delta p_v[\text{Pa}] = \frac{\Delta m_v}{V} R_v T_i = 461.5 \times 293.15 \times \frac{\Delta m_v}{V} = 135{,}290 \frac{\Delta m_v}{V}$$

Buildings are divided into five *climate classes* according to occupancy. Unoccupied buildings are in climate class 1, while special building with high humidity, such as breweries and swimming halls, are in climate class 5. It is assumed that $\Delta m_v/V$ and therefore Δp_v will be greater for buildings with high occupancy. However, the calculation method accounts for the likelihood that windows will be opened in summer when the outside and inside temperatures are similar.

For example, for dwellings with low occupancy (climate class 3), $\Delta m_v/V$ is assumed to lie between $0{\cdot}004$ and $0{\cdot}006$ kg m^{-3} (Δp_v between 541 and 812 Pa) when the monthly mean outdoor temperature is $0°\text{C}$ or lower, and to be $0{\cdot}00075$ kg m^{-3} (Δp_v equal to 100 Pa) when the monthly mean outdoor temperature is equal to or higher than the inside temperature of $20°\text{C}$.

Figure 2 shows the divisions in terms of $\Delta m_v/V$ and Δp_v between the five climate classes.

Figure 2 Climate classes



BS EN ISO 13788:2012 gives examples of buildings in each climate class. These are reproduced in Table 1.

Table 1 Typical buildings in each climate class

Climate class	Building
1	Unoccupied buildings, storage of dry goods
2	Offices, dwellings with normal occupancy and ventilation
3	Buildings with unknown occupancy
4	Sports halls, kitchens, canteens
5	Special buildings, e.g. laundry, brewery, swimming pool