

Tutorial 2b: Thermo-physical properties

Q1. List the thermo-physical properties of building materials that influence dynamic conduction characteristics and give the corresponding thermo-physical unit.

1. conductivity (W/m.K);
2. density (kg/m³); and
3. specific heat capacity (J/kg.K).

Q2. On what parameters do the above properties depend?

1. temperature;
2. moisture content; and
3. internal structure (degree of homogeneity and anisotropy).

Q3. Identify two building materials that have time-dependent thermo-physical properties. Indicate the properties that are not constant and identify the independent parameter on which the change depends.

1. external bricks - conductivity depends on moisture content; and
2. phase change materials - conductivity and specific heat capacity depend on temperature.

Q4. Consider two materials, A and B, described by the following thermal properties. Which material transmits a heat flux fluctuation the fastest and why? Which material absorbs a surface heat flux less readily and why?

	Diffusivity (m ² /s)	Effusivity (J/m ² .C ^{1/2})
A	1.3×10^{-7}	1.5×10^3
B	0.5×10^{-4}	6.5

1. B because the thermal diffusivity is highest.
2. B because the thermal effusivity is lowest.

Q5. Give 3 reasons why two different walls of the same U-value might give rise to substantially different energy requirements.

1. different thermal capacity;
2. different arrangement of layers; and
3. different layer conductivities.