Rewarding Learning

A2 LEVEL

FACT FILE

Environmental Technology

For first teaching from September 2014

For first award in Summer 2015

U Values

environmental technology

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U Values

Specification Content

Students should be able to:

- define what is meant by 'U value' and understand that different construction materials have different U values;
- recall, understand and use the equation: rate of heat flow = U value × area × temperature difference;

Course Content

The **U value** or **thermal transmittance**, is a measure of the rate at which heat passes through (or is lost through a material in W/m2K) in other words, the U value of a material, is the rate at which heat is conducted away through 1m2 of the material, for each 1 degree difference in temperature between the outside and the inside of the material. It is sometimes formally referred to as being the ***"overall heat transfer co-efficient of the material".*** The lower the U value the less heat will be lost through a section of the material. This makes consideration of the U values of building and construction materials an important factor in the energy performance of a building. It is for this reason that loft insulation and double glazing are two of the more obvious means of reducing heat loss in a building.

Placing layers of insulation in the cavities of a wall greatly reduces the amount of heat lost from the building Installing loft insulation reduces heat loss because of the

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U value of the insulating material. Using loft insulation can result in a reduction of 50% in the amount of heat lost through the roof of a house

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Double glazing has a lower U value than single glazed windows hence its extensive use in housing.

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The rate of heat loss through a material depends upon several factors e.g.

- The nature and type of material. All materials have different U-values
- The area (m2) of the material through which heat is being transferred.
- The temperature difference between the two sides of the material through which heat is being transferred.

The U value of a material can be measured and as mentioned in the introduction has the SI unit: **Watt per square meter per Kelvin** or in abbreviated form $Wm^{-2}K^{-1}$

Some examples of U values for different material types:

Material	U value $Wm^{-2}K^{-1}$
20mm thick outer wall made from solid brick	2.2
25mm thick outer wall made from brick with a cavity - unfilled	1.0
25mm thick outer wall made from brick with a cavity - insulated	0.6
Pitched roof with felt under the tiles, 50mm insulation	0.6
Pitched with felt under the tiles, 100mm insulation	0.3
Wooden/uvpc frame window, single glazed	5.0
Wooden/uvpc frame window, double glazed	2.9

Knowing the U value of the material being used, the area of the surface and the temperature difference between the two ends of the material, the following equation can be used to calculate the rate of heat flow:

Rate of Heat flow =U value X area X temperature difference

Activity

Using the **U values** given in the table above, attempt the following questions:
Question one has been done for you:

1. Calculate the rate of heat flow through a 22mm thick cavity wall in a house if the area of the wall is 12m2 and the temperature difference between the inside and outside of the house is 100C.
   Rate of heat loss = 1.0 X 12 X 10 = 120W

2. Calculate the rate of heat flow through the same size of wall with the same temperature difference if the wall itself is made from 25mm thick brick, with the cavity being insulated.

3. Calculate the total rate of heat loss through the wall in number 2 above if 20% of the wall area is occupied by a double glazed window under the same temperature conditions.