LEAVING CERT CONSTRUCTION STUDIES

U value practice sheet

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The method (learn this): for each layer, **R = thickness (m) ÷ thermal conductivity λ (W/mK)**. Add every layer's R plus the surface resistances to get R_{total}. Then **$U = 1 \div R_{total}$**, in W/m²K. Lower U means less heat lost. Always change mm to metres first (150 mm = 0.150 m). Try all three before looking at the answers, and show every line: examiners give marks for method.

Question 1: external wall insulation

A solid concrete block wall is insulated on the outside. Use the data below.

Layer (outside to inside)	Thickness	λ (W/mK)
External render	10 mm	0.50
EPS insulation	150 mm	0.031
Concrete block	215 mm	1.33
Plaster	13 mm	0.57

External surface resistance R_{se} = 0.04 m²K/W. Internal surface resistance R_{si} = 0.13 m²K/W.

(a) Calculate the U value of the wall.
(b) Does it meet a maximum of **0.18 W/m²K** for walls? If not, what is the smallest standard EPS board (available in 10 mm steps) that would?

Question 2: roof insulated at ceiling level

A pitched roof is insulated at ceiling level. Ignore the timber joists for this question.

Layer (inside to outside)	Thickness	λ (W/mK)
Plasterboard	12.5 mm	0.19
Mineral wool	300 mm	0.040

R_{si} (heat flowing upwards) = 0.10 m²K/W. Roof space R = 0.20 m²K/W. R_{se} = 0.04 m²K/W.

(a) Calculate the U value. (b) Compare it with a maximum of **0.16 W/m²K** for this type of roof.

Question 3: heat loss

The wall from Question 1 has an area of 40 m². Inside is 21°C and outside is 1°C.
(a) Using heat loss = U × A × ΔT, find the heat lost through the wall in watts with 150 mm EPS.
(b) Repeat with the board you chose in 1(b). How many watts are saved?

WORKED ANSWERS

Answers

Question 1

Render 0.010 ÷ 0.50 = 0.0200
EPS 0.150 ÷ 0.031 = 4.8387
Block 0.215 ÷ 1.33 = 0.1617
Plaster 0.013 ÷ 0.57 = 0.0228
Surfaces 0.04 + 0.13 = 0.1700
R_{total} = **5.2132 m²K/W**
(a) U = 1 ÷ 5.2132 = **0.19 W/m²K** (0.1918)
(b) 0.19 is above 0.18, so it does not meet it.
Needed R_{total} = 1 ÷ 0.18 = 5.5556
Everything except the EPS = 5.2132 - 4.8387 = 0.3745
EPS must give R = 5.5556 - 0.3745 = 5.1811
Thickness = 5.1811 × 0.031 = 0.1606 m = 161 mm
160 mm is not quite enough (U = 0.181), so choose **170 mm**: U = 1 ÷ (5.4839 + 0.3745) = **0.17 W/m²K**

Question 2

Plasterboard 0.0125 ÷ 0.19 = 0.0658
Mineral wool 0.300 ÷ 0.040 = 7.5000
R_{si} 0.10 + roof space 0.20 + R_{se} 0.04 = 0.3400
R_{total} = **7.9058 m²K/W**
(a) U = 1 ÷ 7.9058 = **0.13 W/m²K** (0.1265)
(b) 0.13 is below 0.16, so it meets it with room to spare.

Question 3

ΔT = 21 - 1 = 20°C
(a) 0.19 × 40 × 20 = **152 W**
(b) 0.17 × 40 × 20 = **136 W**
Saving = 152 - 136 = **16 W** through this one wall, all day, every day of the heating season.

> Exam habit: round U values to 2 decimal places at the end, not in the middle. Write the units every time (W/m²K, m²K/W, W).

The 0.18 (walls) and 0.16 (roof insulated at ceiling) figures are the maximum elemental U values for new dwellings in Technical Guidance Document L (Dwellings). Exam questions give you the data to use, so always use the figures in the question. Want help with the rest of the course? WhatsApp 083 003 2914 for a free 15 minute chat. © Raheem Ahmed, Dublin.