

1.

	Wood	Insulation
Outside Air	0.03	0.03
Wood Bevel	0.14	0.14
Plywood, 13mm	0.11	0.11
Urethane Rigid Foam, 90mm	No	$0.98 \times 90 / 25 = 3.528$
Wood Studs, 90mm	0.63	No
Gypsum Board, 13mm	0.079	0.079
Inside Surface	0.12	0.12

$$R'_{\text{with wood}} = 0.03 + 0.14 + 0.11 + 0.63 + 0.079 + 0.12 = \mathbf{1.109 \text{ m}^2\text{°C/W}}$$

$$R'_{\text{with insulation}} = 0.03 + 0.14 + 0.11 + 3.528 + 0.079 + 0.12 = \mathbf{4.007 \text{ m}^2\text{°C/W}}$$

$$U_{\text{with wood}} = 1 / R'_{\text{with wood}} = 1 / 1.109 = \mathbf{0.902 \text{ W/ m}^2\text{°C}}$$

$$U_{\text{with insulatio}} = 1 / R'_{\text{with insulatio}} = 1 / 4.007 = \mathbf{0.25 \text{ W/ m}^2\text{°C}}$$

$$U_{\text{overall}} = (U \cdot f_{\text{area}})_{\text{with wood}} + (U \cdot f_{\text{area}})_{\text{with insulatio}} = 0.902 \times 0.25 + 0.25 \times 0.75 = \mathbf{0.413 \text{ W/ m}^2\text{°C}}$$

$$Q = U_{\text{overall}} \cdot A \cdot \Delta T = 0.413 \times (50 \times 2.5 \times 0.8) \times [22 - (-2)] = \mathbf{991.2 \text{ W}}$$

2.

- a) All physical material in solid, liquid, or gaseous states can emit energy via a process of electromagnetic radiation.
- b) The energy of a photon is inversely proportional to its wavelength.
- c) Thermal radiation is continuously emitted by all material whose temperature is above absolute zero.
- d) A blackbody emits the maximum amount of radiation by a surface.
- e) The hotter an object, the shorter the wavelength of its radiation spectrum