EXAMPLE 1

A wood frame wall that is built around 38-mm 90-mm wood studs with a center-to-center distance of 400 mm. The 90 mm wide cavity between the studs is filled with glass fiber insulation. The inside is finished with 13-mm gypsum wallboard and the outside with 13-mm wood fiberboard and 13-mm 200-mm wood bevel lapped siding. The insulated cavity constitutes 75 % of the heat transmission area while the studs, plates, and sills constitute 21 percent. The headers constitute 4 percent of the area, and they can be treated as studs.

	Wood	Insulation
Outside air	0.03	0.03
Wood bevel (13*200mm)	0.14	0.14
Plywood (13mm)	0.11	0.11
Urethane Rigif Foam (90mm)	—	0,98x90/25=3.528
Wood Studs (90mm)	0.63	—
Gypsum board (13mm)	79	79
Inside surface	0.12	0.12

$R_{\text{with wood}} = (0.03+0.14+0.11+0.63+0.079+0.12) = 1.109\ m^2°C/W$

$R_{\text{with insulation}} = (0.03+0.14+0.11+3.528+0.079+0.12) = 4.007\ m^2°C/W$

$$U_{\text{wood}} = \frac{1}{R'_{\text{withwood}}} = \frac{1}{1.109} = 0.902 \frac{w}{m^2 \cdot °C}$$

$$U_{insulation} = \frac{1}{R'_{insulation}} = \frac{1}{4.007} = 0.2496 \frac{w}{m^2 \cdot °C}$$

$$U_{total} = \frac{A_{wood} * U_{wood}}{A_{total}} + \frac{A_{insulation} * U_{insulation}}{A_{total}} = 25\% * 0.902 + 75\% * 0.2496 = 0.412 \frac{W}{m^2 \cdot °C}$$

$$R_{value} = \frac{1}{U_{total}} = \frac{1}{0.4126} = 2.424 \frac{m^2 \cdot °C}{W}$$

$$\dot{Q}_{total} = U_{total} * A_{total} * \Delta T = 0.412 * 50 * 2.5 * (1 - 20\%) * 22°C - \quad (-2°C) \quad = 990.24W$$

QUESTION 2

Radiative heat transfer occurs when a body transfers agitated molecules.It is emitted as electromagnetic waves. It occurs in the ultraviolet ,visible and infrared spectrum but it is more predominant in the infrared spectrum.Radiation unlike conduction and convection does not require a medium for heat exchange. Radiation can even occur in vacuum.

BlackBody is considered as perfect emitter and absorber to which all calculations are referenced to. It does not occur in nature though something similar can be constructed by creating a hole in a box containing absorption materials. This exhibits uniform radiation. However no object in reality has uniform radiation, it is always nonuniform. This was first described by max plank.
The black body is hypothetical and completely absorbs all wavelengths of radiations which fall on it.They do not reflect any light.
Radiation occurs in all bodies when they are heated to a particular temperature.

According to Boltzmann Law,

$q = \sigma T^4 A$
where $\sigma = 5.670 \times 10^{-8}\ W/m^2$

This equation states that the radiation entry per unit time from a black body is proportional to the fourth power of the absolute temperature.