TASK 2

DATA:
1) **Window west** = double layer glass/wooden frame/fixed /14.4 m2
2) **Window south 1** = double layer glass/wooden frame/fixed /3.6 m2
3) **Window south 2** = double layer glass/wooden frame/operable /3.6 m2

1)**Window west:**

- Heating

<u>With wooden frame</u>

$U_{window_{west}} = 2.84 \dfrac{W}{M^2 K}$

$HF_{window_{west}} = U_{window_{west}} \times \Delta T_{heating} = 2.84 * 24.8 = 70.4 \dfrac{W}{m2}$

$Q_{window_{west}} = HF_{window_{west}} \times A_{window_{west}} = 70.4 * 14.4 =$ **1014.2 W**

<u>With aluminium frame</u>

$U_{window_{west}} = 3.61 \dfrac{W}{M^2 K}$

$HF_{window_{west}} = U_{window_{west}} \times \Delta T_{heating} = 3.61 * 24.8 = 89.53 \dfrac{W}{m2}$

$Q_{window_{west}} = HF_{window_{west}} \times A_{window_{west}} = 89.53 * 14.4 =$ **1289.23 W**

The total value change: 1289.23-1014.2= ***275.03 W***

- Cooling

<u>With wooden frame</u>

$$CF_{fen} = U(\Delta t - 0.46\,DR) + PXI \times SHGC \times IAC \times FF_s$$

$CF_{windw_{west_{heatTrasnferPart}}} = U_{window_{east}}(\Delta T_{cooling} - 0.46\,DR)$
$= 2.84\,(7.9 - 0.46 * 11.9) = 6.9 \dfrac{W}{m2}$

$PXI_{window_{west}} = E_D + E_d = 559 + 188 = 747$

SHGC = 0.54
NO internal shading so IAC = 1

From the table FFs = 0.56

$$CF_{windwo_{east\_IrradiationPart}} = PXI \times SHGC \times IAC \times FF_S = 747 * 0.54 * 1 * 0.56$$
$$= 225.9$$

$$CF_{window\square_{west}} = CF_{windwwest\_heatTrasnferPart} + CF_{windwwest\_IrradiationPart}$$
$$= 6.9 + 225.9 = 232.8 \frac{W}{m^2}$$

$$Q\square_{windwo_{east}} = CF_{windwo_{east}} \times A_{window_{east}} = 232.8 * 14.4 = \mathbf{3352.32\ W}$$

<u>With aluminium frame</u>

$$CF_{windw\square_{west_{heatTrasnferPart}}} = U_{window_{east}}(\Delta T_{cooling} - 0.46\ DR)$$
$$= 3.61\ (7.9 - 0.46 * 11.9) = 8.76 \frac{W}{m2}$$

$$PXI_{window_{west}} = E_D + E_d = 559 + 188 = 747$$

SHGC = 0.56
NO internal shading so IAC = 1

From the table FFs = 0.56

$$CF_{windwo_{east\_IrradiationPart}} = PXI \times SHGC \times IAC \times FF_S = 747 * 0.56 * 1 * 0.56$$
$$= 234.26$$

$$CF_{window\square_{west}} = CF_{windwwest\_heatTrasnferPart} + CF_{windwwest\_IrradiationPart}$$
$$= 8.76 + 234.26 = 243.02 \frac{W}{m^2}$$

$$Q\square_{windwo_{east}} = CF_{windwo_{east}} \times A_{window_{east}} = 243.02 * 14.4 = \mathbf{3499.49\ W}$$

*The total value change: 3499.49-3352.32= **147.17W***

2)**Window south 1:**

- Heating

<u>With wooden frame</u>

$$U_{window_{S1}} = 2.84 \frac{W}{M^2K}$$

$$HF_{window_{S1}} = U_{window_{S1}} \times \Delta T_{heating} = 2.84 * 24.8 = 70.4 \frac{W}{m2}$$

$$Q_{window_{S1}} = HF_{window_{S1}} \times A_{windoS2} = 70.4 * 3.6 = \mathbf{253.44\ W}$$

<u>With aluminium frame</u>

$$U_{window_{S1}} = 3.61 \frac{W}{M^2K}$$

$$HF_{window_{S1}} = U_{window_{S1}} \times \Delta T_{heating} = 3.61 * 24.8 = 89.53 \frac{W}{m2}$$

$$Q_{window_{S1}} = HF_{window_{S1}} \times A_{windoS2} = 89.53 * 3.6 = \textbf{\textit{322.31 W}}$$

*The total value change: 322.31-253.44= **68.87W***

- Cooling

<u>With wooden frame</u>

$$CF_{fen} = U(\Delta t - 0.46\,DR) + PXI \times SHGC \times IAC \times FF_s$$

$$CF_{windwS1_{heatTrasnferPart}} = U_{window_{S1}}\left(\Delta T_{cooling} - 0.46\,DR\right)$$
$$= 2.84\,(7.9 - 0.46 * 11.9) = 6.9 \frac{W}{m2}$$

$$PXI_{windowS1} = E_D + E_d = 348 + 209 = 557$$

SHGC = 0.54
NO internal shading so IAC = 1

From the table FFs = 0.47

$$CF_{windwo_{S1\_IrradiationPart}} = PXI \times SHGC \times IAC \times FF_S = 577 * 0.54 * 1 * 0.47$$
$$= 146.4$$

$$CF_{windowS1} = CF_{windwS1\_heatTrasnferPart} + CF_{windwS1\_IrradiationPart}$$
$$= 6.9 + 146.4 = 153.3 \frac{W}{m^2}$$

$$Q_{windwo_{S1}} = CF_{windwo_{S1}} \times A_{window_{S1}} = 153.3 * 3.6 = \textbf{551.88 W}$$

<u>With aluminium frame</u>

$$CF_{windwS1_{heatTrasnferPart}} = U_{window_{S1}}\left(\Delta T_{cooling} - 0.46\,DR\right)$$
$$= 3.61\,(7.9 - 0.46 * 11.9) = 8.76 \frac{W}{m2}$$

$$PXI_{windowS1} = E_D + E_d = 348 + 209 = 557$$

SHGC = 0.56
NO internal shading so IAC = 1

From the table FFs = 0.47

$$CF_{windwo_{S1\_IrradiationPart}} = PXI \times SHGC \times IAC \times FF_S = 577 * 0.56 * 1 * 0.47$$
$$= 151.87$$

$$CF_{windowS1} = CF_{windwS1\_heatTrasnferPart} + CF_{windwS1\_IrradiationPart}$$
$$= 8.76 + 151.87 = 160.63 \frac{W}{m^2}$$

$$Q^{\square}_{windwo_{S_1}} = CF_{windwo_{S_1}} \times A_{window_{S_1}} = 160.63 * 3.6 = \mathbf{578.27\ W}$$

*The total value change: 578.27-551.88= **26.39W***

3)**Window south 2:**

- Heating

<u>With wooden frame</u>

$$U_{window_{S2}} = 2.87 \frac{W}{M^2 K}$$

$$HF_{window_{S2}} = U_{window_{S2}} \times \Delta T_{heating} = 2.87 * 24.8 = 71.18 \frac{W}{m2}$$

$$Q_{window_{S2}} = HF_{window_{S2}} \times A_{windo_{S2}} = 71.18 * 3.6 = \mathbf{256.25\ W}$$

<u>With aluminium frame</u>

$$U_{window_{S2}} = 4.62 \frac{W}{M^2 K}$$

$$HF_{window_{S2}} = U_{window_{S2}} \times \Delta T_{heating} = 4.62 * 24.8 = 114.58 \frac{W}{m2}$$

$$Q_{window_{S2}} = HF_{window_{S2}} \times A_{windo_{S2}} = 114.58 * 3.6 = \mathbf{412.49\ W}$$

*The total value change: 412.49-256.25= **156.24W***

- Cooling

<u>With wooden frame</u>

$$\text{CF}_{fen} = U(\Delta t - 0.46\,\text{DR}) + \text{PXI} \times \text{SHGC} \times \text{IAC} \times \text{FF}_s$$

$$CF_{windwS2_{heatTrasnferPart}} = U_{window_{S2}}(\Delta T_{cooling} - 0.46\,DR)$$
$$= 2.87\,(7.9 - 0.46 * 11.9) = 6.96 \frac{W}{m2}$$

$$PXI_{windowS2} = E_D + E_d = 348 + 209 = 557$$

SHGC = 0.46
NO internal shading so IAC = 1

From the table FFs = 0.47

$$CF_{windwo_{S2\_IrradiationPart}} = PXI \times SHGC \times IAC \times FF_S = 577 * 0.46 * 1 * 0.47$$
$$= 124.75$$

$$CF_{windowS2} = CF_{windwS2\_heatTrasnferPart} + CF_{windwS2\_IrradiationPart}$$
$$= \; 6.96 + 124.75 = 131.71 \frac{W}{m^2}$$

$$Q\square_{windwo_{S2}} = \; CF_{windwo_{S2}} \times A_{window\,S2} = 131.71 \; * 3.6 = \mathbf{474.16\,W}$$

<u>With aluminium frame</u>

$$CF_{windwS2_{heatTrasnferPart}} = U_{window_{S2}}\left(\Delta T_{cooling} \; - 0.46\,DR\right)$$
$$= 4.62\,(7.9 - 0.46 * 11.9) = \; 11.21 \frac{W}{m2}$$

$$PXI_{windowS2} = E_D + E_d = 348 + 209 = 557$$

SHGC = 0.55
NO internal shading so IAC = 1

From the table FFs = 0.47

$$CF_{windwo_{S2}\_IrradiationPart} = PXI \times SHGC \times IAC \times FF_S = \; 577 \; * 0.55 * 1 \; * 0.47$$
$$= 149.15$$

$$CF_{windowS2} = CF_{windwS2\_heatTrasnferPart} + \; CF_{windwS2\_IrradiationPart}$$
$$= \; 11.21 + 149.15 = 160.36 \frac{W}{m^2}$$

$$Q\square_{windwo_{S2}} = \; CF_{windwo_{S2}} \times A_{window\,S2} = 160.36 \; * 3.6 = \mathbf{577.3\,W}$$

*The total value change: 577.3-474.16= **103.14W***