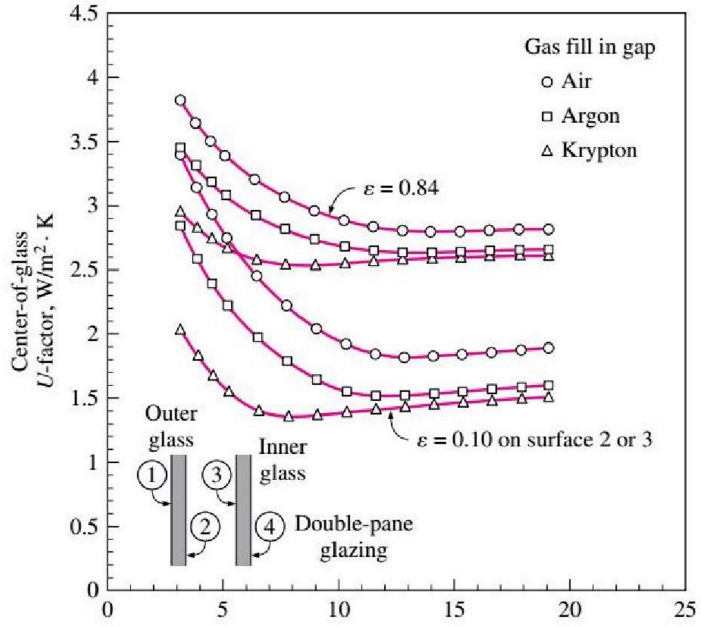
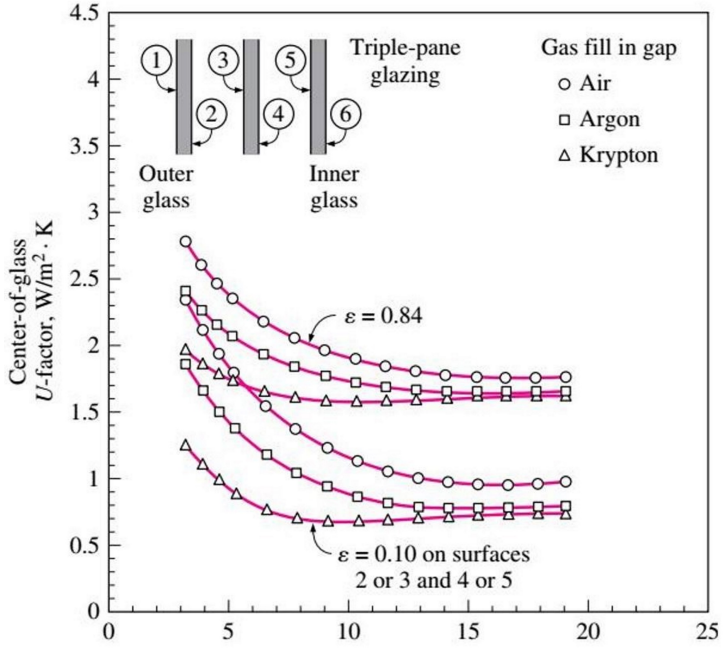
WeeklySubmission8

# 1.

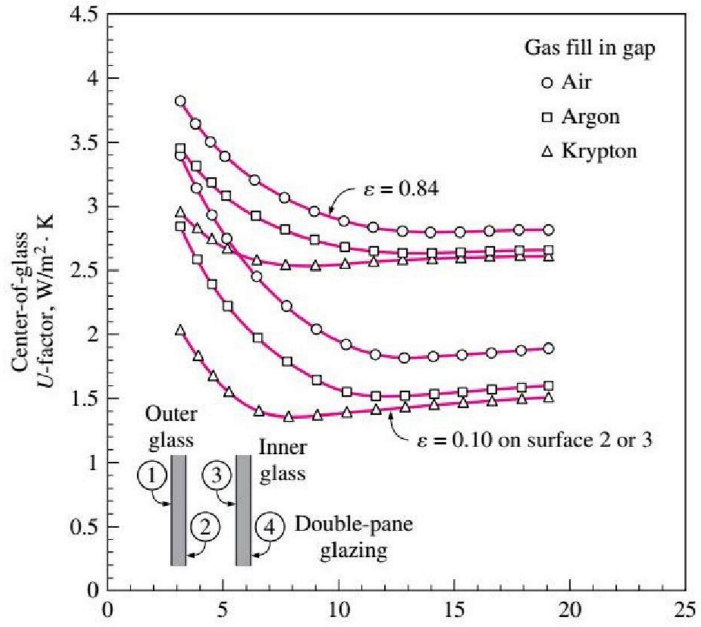
Changing Gas reduce:
Argon: 6.43%
Krypton: 7.14%




Adding an extra pane:
55.6%



Low emissivity Coating:
55.6%




# 2.

## Heating and Cooling Load on the West, Fixed window
## Wooden Frame

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

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

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

$CF_{windwo_{west\downarrow heatTrasnferPart}} = U_{window_{west}} (\Delta T_{cooling} - 0.46\ DR)$

$= 2.84\ (7.9 - 0.46 * 11.9) = 6.9 \frac{W}{m2}$

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

$SHGC = 0.54$
$IAC = 1$
$FFs = 0.31$

$CF_{windwo_{west\downarrow IrradiationPart}} = PXI \times SHGC \times IAC \times FF_S = \ 747 \ * 0.54 \ * 1 \ * 0.31 = 125.1$

$CF_{windwo_{ewest}} = CF_{windwo_{west\downarrow heatTrasnferPart}} + \ CF_{windwo_{west\downarrow IrradiationPart}}$
$= \ 6.9 + 125.1 = 132 \frac{W}{m^2}$

$Q_{windwo_{west}} = \ CF_{windwo_{west}} \times A_{window_{west}} = 132 \ * 14.4 = 1900.8 \ W$

Aluminium Frame

$\mathrm{U}_{\mathrm{window}_{\mathrm{west}}} = 3.61 \frac{W}{M^2K}$
$HF_{window_{west}} = U_{window_{east}} \times \Delta T_{heating} = 3.61 \ * 24.8 = 89.5 \frac{W}{m2}$
$Q_{window_{west}} = \ HF_{window_{east}} \times A_{window_{east}} = 89.5 * 14.4 = 1289.2 \ W$

$CF_{fen} = U(\Delta T - 0.46DR) + PXI \times SHGC \times IAC \times FFs$
$CF_{window-west-heattransferpart} = U_{window-west} \times \Delta(T_{heating} - 0.46DR)$
$=3.61(7.9-o.46\times11.9)$
$=8.8 \ W/m2$

$PXI=Ep+Ed=599+188=747$
$SHGC=0.56$
$IAC=1$
$CF_{window-west} = 8.8 + 747 \times 0.56 \times 1 \times 0.31 = 138.5 \ W/m2$

Heating and Cooling Load on the South, Fixed window
Wooden Frame

$U_{window_{south}} = 2.84 \frac{W}{M^2K}$
$HF_{window_{south}} = U_{window_{south}} \times \Delta T_{heating} = 2.84 \ * 24.8 = 70.4 \frac{W}{m2}$
$Q_{window_{south}} = \ HF_{window_{south}} \times A_{window_{south}} = 70.4 * 3.6 = 253.4 \ W$

$CF_{windwo_{south\downarrow heatTrasnferPart}} = U_{window_{south}} \Delta(T_{cooling} - 0.46 \ DR)$
$= 2.84 \ (7.9 - 0.46 * 11.9) = \ 6.9 \frac{W}{m2}$

$PXI_{window_{south}} = E_D + E_d = 348 + 209 = 557$

$SHGC = 0.54$
$IAC = 1$
$FFs = 0.47$

$CF_{windwo_{south\downarrow IrradiationPart}} = PXI \times SHGC \times IAC \times FF_S = \ 557 \ * 0.54 \ * 1 \ * 0.47 = 141.4$

$CF_{window_{south}} = CF_{windwo_{south\downarrow heatTrasnferPart}} + \ CF_{windwo_{south\downarrow IrradiationPart}} = \ 6.9 + 141.4 = 148.3 \frac{W}{m^2}$

$Q_{window_{south}} = \ CF_{windwo_{south}} \times A_{window_{south}} = 148.3 \ * 3.6 = 533.9 \ W$

Aluminium Frame

$\mathrm{U}_{\mathrm{window}_{\mathrm{south}}} = 3.61 \frac{W}{M^2K}$

$HF_{window_{south}} = U_{window_{south}} \times \Delta T_{heating} = 3.61 \ * 24.8 = 89.5 \frac{W}{m2}$

$Q_{window_{south}} = \ HF_{window_{south}} \times A_{window_{south}} = 89.5 * 3.6 = \ 1289.2 \ W$

$CF_{fen} = U(\Delta T_{\square} - 0.46DR) + PXI \times SHGC \times IAC \times FFs$

$CF_{windwo_{south\downarrow heatTrasnferPart}} = U_{window_{south}} \times (T_{heating} - 0.46DR)$

*=3.61(7.9-o.46×11.9)*

*=8.8 W/m2*

*PXI=Ep+Ed=599+188=557*

*SHGC=0.56*

*IAC=1*

*FFs=0.47*

$CF_{window_{south}} = 8.8 + 557 \times 0.56 \times 1 \times 0.47 = 155.4 \frac{W}{m2}$

$Q_{window_{south}} = \ CF_{windwo_{south}} \times A_{window_{south}} = 155.4 \ * 3.6 = 559.4 \ W$

Heating and Cooling Load on the South, Operable window

Wooden Frame

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

$HF_{window_{south}} = U_{window_{south}} \times \Delta T_{heating} = 2.87 \ * 24.8 = 71.2 \frac{W}{m2}$

$Q_{window_{south}} = \ HF_{window_{south}} \times A_{window_{south}} = 71.2 * 3.6 = \ 256.3 \ W$

$$CF_{windwo_{south}\downarrow heatTrasnferPart} = U_{window_{south}}(\Delta T_{cooling} - 0.46\,DR)$$
$$= 2.87\,(7.9 - 0.46 * 11.9) = \ 7.0\frac{W}{m2}$$

$$PXI_{window_{south}} = E_D + E_d = 348 + 209 = 557$$

*SHGC = 0.46*
*IAC = 1*
*FFs = 0.47*

$$CF_{windwo_{south}\downarrow IrradiationPart} = PXI \times SHGC \times IAC \times FF_S = \ 557 * 0.46 * 1 * 0.47$$
$$= 120.4$$

$$CF_{window_{south}} = CF_{windwo_{south}\downarrow heatTrasnferPart} + CF_{windwo_{south}\downarrow IrradiationPart}$$
$$= \ 7 + 120.4 = 127.4\frac{W}{m^2}$$

$$Q_{window_{south}} = \ CF_{windwo_{south}} \times A_{window_{south}} = 127.4 * 3.6 = 458.6\,W$$

Aluminium Frame

$$\mathrm{U_{window_{south}}} = 4.62\frac{W}{M^2K}$$
$$HF_{window_{south}} = U_{window_{south}} \times \Delta T_{heating} = 4.62 * 24.8 = 114.6\frac{W}{m2}$$
$$Q_{window_{south}} = \ HF_{window_{south}} \times A_{window_{south}} = 114.6 * 3.6 = 412.6\,W$$

$$CF_{fen} = U(\Delta T_{\square} - 0.46DR) + PXI \times SHGC \times IAC \times FFs$$
$$CF_{windwo_{south}\downarrow heatTrasnferPart} = U_{window_{south}} \times (\Delta T_{heating} - 0.46DR)$$
*=4.62(7.9-o.46×11.9)*
*=11.2 W/m2*

*PXI=Ep+Ed=599+188=557*
*SHGC=0.55*
*IAC=1*
*FFs=0.47*

$$CF_{window_{south}} = 11.2 + 557 \times 0.55 \times 1 \times 0.47 = 144\frac{W}{m2}$$
$$Q_{window_{south}} = \ CF_{windwo_{south}} \times A_{window_{south}} = 144 * 3.6 = 518.4\,W$$