1 Convective Heat Transfer consists in the transfer of the heat through fluids or gases from a place to another.

The rate of convective heat transfer depends on three factors:

- Temperature difference
- Velocity of liquid or gas
- Kind of liquid or gas

Two types of Convection exist: natural and forced. We have a Natural Convection when the fluid movement depends on a density variation, caused by a variation of the fluid/gas temperature. In this case, air gets colder and goes down, whereas hot air goes up because of the difference of density.
We have Forced Convection instead when the fluid is forced to move by for example wind, or any external force that occurs and influences the heat transfer process.

Newton's Law of Cooling regulates this process and states that the loss of heat in an object is proportional to the temperature difference between the object itself and the environment around it. It is important to pay attention to the heat transfer coefficient, that can be indipendent or dipendet on the temperature between the object and the environment it is surrounded by.

The formula of Convective Heat Transfer is the following:

dotQ = hA(Ts – T∞)

where *dotQ* is the heat transfer, *h* is the coefficient, *A* is the area, *Ts* is the temperature of object surface and *T∞* is the temperature of air not affected by *Ts* (it has to be homogenious).

Why increasing the thickness of a single pane glass the total resistance doesn't increase as well?
Because when the convection heat transfer coefficient *h* is very large (so we have a very large single pane glass), the surface offers no resistance to convection and so the heat transfer doesn't change, not slow down nor increase.

3 Solve the problem of a double pane window:

DATA:
glass thickness for each glass(L): 6 mm = 0.006 m
k=0.78 W/m°C
air-gap thickness: 13 mm = 0.013 m
k=0.026 W/m°C
h1=10 W/m2
h2=40 W/m2
A=0.8m x 1.5m = 1.2 m

dotQ = (T∞1 - T∞2)/Rtotal

Rtotal= Rconv.1 + Rwall1 + Rwall2 + Rconv.2 = 1/h1A + L1/k1A + L2/k2A + 1/h2A

= 1/10x1.2 + 0.006/0.78x1.2 + 0.013/0.026x1.2 + 1/40x1.2 =

= 0,083 + 0.00641 + 0.0416 + 0.020 = 0.1510 °C/W

dotQ = (20 + 10)/0.1510 = 198,67 °C/W