1. Q = UAΔTm

Where ΔTm is the logarithm mean temperature difference

For initial condition,

 Q = (m1$×$ 4.18) (320 – 280 ) = U1A1 $\frac{\left(360-280\right)-(360-320)}{ln\frac{\left(360-280\right)}{360-320}}$

162.2m1 = U1A1  $\frac{(40)}{ln\frac{80}{40}}$

 = m1/U1A1 = 0.345

 In the second case m2=m1 , u2=u1 and A2=5A1

Q2= (m1 $×$4.18)(T-280)=5U1A1$\frac{\left(360-280\right)-(360-T)}{ln\frac{360-280}{360-T}}$

4.18(m1/U1A1)$\frac{T-280}{5}$ = $\frac{80-360+T}{ln\frac{80}{360-T}}$

 Substitute for m1/U1A1

0.289(T-280)= $\frac{T-280}{ln\frac{80}{360-T}}$

$ $T= 357.5K

2. Fourier's law, states that the rate of heat transfer through a material is proportional to the negative gradient in the temperature and to the area, at right angles to that gradient, through which the heat flows.

3.Conduction is a process in which heat is transported between parts of a continuum, through direct physical contact.

 WHILE

Convection is the principle, wherein heat is transmitted by currents in a fluid, i.e. liquid or gas.

 WHILE

Radiation is the heat transfer mechanism, in which the transition takes place through electromagnetic waves.