First we express Nusselt no. in the form \( \text{Nu} = \frac{h d}{k} \) where \( h \) = heat transfer co-efficient; \( d \) = diameter of tube and \( k \) = thermal conductivity of material.

Also the Reynold’s Number is given by \( \text{Re} = \frac{\rho \cdot u \cdot d}{\mu} \) where \( \rho \) = density of fluid; \( u \) = speed of fluid ; \( d \) = diameter of tube and \( \mu \) = viscosity of the fluid .

Now the Prandtl no. is given by \( \text{Pr} = \frac{C_p \cdot \mu}{k} \), where \( C_p \) is the specific heat capacity of the fluid; \( \mu \) = viscosity of the fluid and \( k \) = thermal conductivity of material .

Then what you should is express \( \text{Nu} = C.\text{Re}^m.\text{Pr}^n \) in the form of :

\[
\frac{h d}{k} = C. \left( \frac{\rho \cdot u \cdot d}{\mu} \right)^m . \left( \frac{C_p \cdot \mu}{k} \right)^n
\]

***********equation 1***********

now to answer the first part of your question ,

we place \( d = 0.5 \text{m} \); \( h_1 = 36 \text{ W/m}^2\text{K} \) and \( u_1 = 10 \text{ m/s} \) in equation 1 and leave all other values in their symbolic form.

Then you place \( d=0.5\text{m} ; h_2 = 50 \text{ W/m}^2\text{K} \) and \( u_2 = 15 \text{ m/s} \) in equation1 again separately and leave all other values in their symbolic form.

So now we have two equations formed after placing our respective values in equation 1.

Divide the two equations and all the symbols will cancel themselves.

You will be left with \( \frac{h_1}{h_2} = \left( \frac{u_1}{u_2} \right)^m \); now since we know the values of \( h_1, h_2, u_1, u_2 \) we can calculate the value of \( m \).

1) heat transfer co-efficient at \( u = 20 \text{ m/s} \) can be calculated using above equation \( \frac{h_1}{h_2} = \left( \frac{u_1}{u_2} \right)^m \)

Where \( m \) has been calculated already in the above step. Now simply replace \( h_1 \) with with \( 36 \text{ W/m}^2\text{K} \) and \( u_1 \) with \( 10 \text{ m/s} \); replace \( h_2 \) with \( h \) and \( u_2 \) with \( 20 \text{ m/s} \). solve the above equation and you have your value for the new heat transfer co-efficient at \( u=20\text{m/s} \).

2) for solving the second part of your question we go back to equation 1;

\[
\frac{h d}{k} = C. \left( \frac{\rho \cdot u \cdot d}{\mu} \right)^m . \left( \frac{C_p \cdot \mu}{k} \right)^n
\]

Now we are given that \( d_3 = 0.75\text{m} \) and \( u_3 =12 \text{ m/s} \). Place these values in the above equation.

Then again place \( h_1 = 36 \text{ W/m}^2\text{K} \) and \( u_1 = 10 \text{ m/s} \) and \( d_1 = 0.5 \text{ m} \) in equation 1 separately and divide the two equations formed. You will get the new heat transfer co-efficient ‘\( h \)’. \( (h_1 \text{ is the same as } h_1) \)

\[
h = \left( \frac{u_3 \cdot d_3}{u_1 \cdot d_1} \right)^m \cdot \left( \frac{h_1 \cdot d_1}{d_3} \right)
\]