Power Plant and River Warming (Part A) **Name_____**

A power plant has a power output of 880 MW and operates with an efficiency of 29%. Excess energy is carried away as heat from the plant to a nearby river that has a flow rate of 5×10^6 kg/s. How much energy is transferred as heat to the river each second?_____

How much will the temperature of the river rise?_____

Is that temperature change a big problem?

Answers to part B

$0.30X = 7.5 \times 10^8$ W, so $X = \frac{7.5 \times 10^8}{0.30} = 2.5 \times 10^9$ W put into the power plant. So, since 7.5×10^8 is available as electric power, the rest is put in the river as heat. $2.5 \times 10^9 - 7.5 \times 10^8 = 1.75 \times 10^9$ W.

$Q = Cm\Delta T$, so $\Delta T = \frac{Q}{C\,m} = \frac{1.75\,x\,10^9}{4168\,\cdot 6\,x\,10^6} = 0.07$ degrees, not likely a problem.

Power Plant and River Warming (Part B) **Name_____**

A power plant has a power output of 750 MW and operates with an efficiency of 30%. Excess energy is carried away as heat from the plant to a nearby river that has a flow rate of 6×10^6 kg/s. How much energy is transferred as heat to the river each second?_____

How much will the temperature of the river rise?_____

Is that temperature change a big problem?

Answers to part A

$0.29X = 8.8 \times 10^8$ W, so $X = \frac{8.8 \times 10^8}{0.29} = 3.03 \times 10^9$ W put into the power plant. So, since 8.8×10^8 is available as electric power, the rest is put in the river as heat. $3.03 \times 10^9 - 8.8 \times 10^8 = 2.15 \times 10^9$ W.

$Q = Cm\Delta T$, so $\Delta T = \frac{Q}{C\,m} = \frac{2.15\,x\,10^9}{4168\,\cdot 5\,x\,10^6} = 0.1$ degree, not likely a problem.