Cooling Tower Rig Experiment

Aim: Demonstrate awareness and comprehension of the processes found in a forced draft cooling tower.

What you need to do:

1. View the “Cooling Tower Overview” Video. This video describes the operation of the whole rig and all its parts. In addition an explanation is given for the evaporative cooling phenomenon and the design of cooling tower stack media. It shows the heat exchange between “Electricity to Water”, and “Water to Air” and the “Evaporative Top Up” water rate. An important aspect is the balance of energy throughout the whole system.
2. View the “Cooling Tower Experiment” Video. This video goes through the calculations needed for this experiment using a sample set of results.
3. Your submission:
   a) Beside your name is your assigned Experiment Data #1, #2 or #3. You must use your assigned data. All the work must be your own.
   b) Complete the calculations for all three tests, 0.5kw, 1.0kw and 1.5kw in your Experiment Data #. Clearly show your work, calculations, steps and graphs used.
   c) Plainly state if the process is as you would expect! Are all three independent checks, (1) electrical energy to water energy, (2) water energy to air energy and (3) Top up water actually matching the expected calculated top up water values? Confirm if you believe from the data that the switches are connected to the appropriate heating element or were they switched by an unscrupulous technician. Don’t just state that “They were/weren’t switched”, you need to *__explain__* why, from what your observed, you have chosen that answer.
   d) Answer the following questions:
      a. Why are temperatures T3 and T4 closer to each other in value than T1 and T2. What does this mean?
      b. Why is T1 always hotter than T3 in these test results? Surly, if we are dissipating energy the outlet air temperature T3 should be hotter than the inlet air temperature T1! Is the machine broken? Would the T1 always be hotter than T3?

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Experiment Data #1						
	Description		**Units**	**Test 1**	**Test 2**	**Test 3**
Switch	Heating element		Kw	0.5	1	1.5
T1	Inlet Air Temp	Dry Bulb	°C	23.5	24.6	25.2
T2	Inlet Air Temp	Wet Bulb	°C	17.1	18.8	19.5
T3	Outlet Air Temp	Dry Bulb	°C	21.4	23.7	26.3
T4	Outlet Air Temp	Wet Bulb	°C	21	23.8	26.3
T5	Water Temp	In to Column	°C	24.2	29.1	34.3
T6	Water Temp	Out of Column	°C	20.7	23.2	25.3
X	Orifice Differential Pressure		mm/H20	12.5	12.5	12.5
	Water Flow Rate Manometer		g/s	40	40	40
	Evaporation Volume		ml	100	100	100
	Evaporation Time		Sec	285	245	182

Experiment Data #2						
	Description		**Units**	**Test 1**	**Test 2**	**Test 3**
Switch	Heating element		Kw	0.5	1	1.5
T1	Inlet Air Temp	Dry Bulb	°C	26	24.1	26.7
T2	Inlet Air Temp	Wet Bulb	°C	17.8	15.7	18.6
T3	Outlet Air Temp	Dry Bulb	°C	23.5	20.2	25.4
T4	Outlet Air Temp	Wet Bulb	°C	22.7	18.7	25.3
T5	Water Temp	Into Column	°C	28.8	23.4	33.3
T6	Water Temp	Out of Column	°C	22.2	19.5	24
X	Orifice Differential Pressure		mm/H20	13	12	13
	Water Flow Rate Manometer		g/s	40	40	40
	Evaporation Volume		ml	100	100	100
	Evaporation Time		Sec	241	402	200

Experiment Data #3						
	Description		**Units**	**Test 1**	**Test 2**	**Test 3**
Switch	Heating element		Kw	0.5	1	1.5
T1	Inlet Air Temp	Dry Bulb	°C	26.4	25.6	27.2
T2	Inlet Air Temp	Wet Bulb	°C	17.4	16.8	18.4
T3	Outlet Air Temp	Dry Bulb	°C	23.3	20.9	26.1
T4	Outlet Air Temp	Wet Bulb	°C	22.4	19.8	25.5
T5	Water Temp	Into Column	°C	28.6	23.9	34
T6	Water Temp	Out of Column	°C	22.3	20.2	24.5
X	Orifice Differential Pressure		mm/H20	13	12	13
	Water Flow Rate Manometer		g/s	40	40	40
	Evaporation Volume		ml	100	100	100
	Evaporation Time		Sec	241	402	200