1/ A parallel flow heat exchanger has oil in the shell (c_{oil} = 1160Jkg^{-1}K^{-1}) and water in the tubes (c_{water} = 4190Jkg^{-1}K^{-1}). The input temperature for the oil is 83^{o}C and for the water is 18^{o}C. The output temperature of the oil is 50^{o}C. The flow rates for the oil and water are 1.3kg/s and 0.6kg/s respectively.

i) Calculate the output temperature of the water
ii) Calculate the log mean temperature difference
iii) Calculate the UA value for the heat exchanger

[37.8^{o}C, 31.6^{o}C, 1577WK^{-1}]

2/ A counter flow heat exchanger has oil in the shell (c_{oil} = 1160Jkg^{-1}K^{-1}) and water in the tubes (c_{water} = 4190Jkg^{-1}K^{-1}). The input temperature for the oil is 23^{o}C and for the water is 98^{o}C. The output temperature of the oil is 75^{o}C. The flow rates for the oil and water are 1.3kg/s and 0.6kg/s respectively.

i) Calculate the output temperature of the water
ii) Calculate the log mean temperature difference
iv) Calculate the UA value for the heat exchanger

[66.8^{o}C, 32.3^{o}C, 2427WK^{-1}]

3/ A parallel flow heat exchanger has benzene in the shell ($c_{benzene}$ = 1080Jkg^{-1}K^{-1}) and water in the tubes (c_{water} = 4190Jkg^{-1}K^{-1}). The input temperature for the benzene is 15^{o}C and for the water is 85^{o}C. The output temperature of the water is 65^{o}C and the output temperature of the benzene is 45^{o}C. The flow rate for the water is 2.0kg/s.

i) Draw a diagram showing the temperature profiles of the hot and cold steams across the heat exchanger
ii) Calculate the flow rate of the benzene
iii) Calculate the log mean temperature difference
v) Calculate the UA value for the heat exchanger

[5.17kg/s, 39.9^{o}C, 4200WK^{-1}]

4/ A counter flow double pipe heat exchanger has an input stream of water (heat capacity = 4190Jkg^{-1}^{o}C^{-1}) at a temperature of 370K and at a flow rate of 5kg/s and an input stream of oil (heat capacity = 1160Jkg^{-1}^{o}C^{-1}) at a temperature of 278K. The output temperature of the water stream is 340K and the output temperature of the oil stream is 360K.

i) Calculate the flow rate of the oil stream
ii) Calculate the log mean temperature difference
iii) Calculate the UA value for the heat exchanger

[6.61kg/s, 28.5^{o}C, 22.05 kWK^{-1}]

5/ A counter flow double pipe heat exchanger has water (heat capacity = 4190Jkg^{-1}^{o}C^{-1}) in both streams. One stream has an input temperature of 350K and an output temperature of 300K. The other stream has an input temperature of 290K and an output temperature of 320K. The heat exchanger has a UA value of 5kW/K.

i) Calculate the log mean temperature difference
ii) Calculate the flow rate of the hot stream
iii) Calculate the flow rate of the cold stream

[18.2^{o}C, 0.43kg/s, 0.724kg/s]