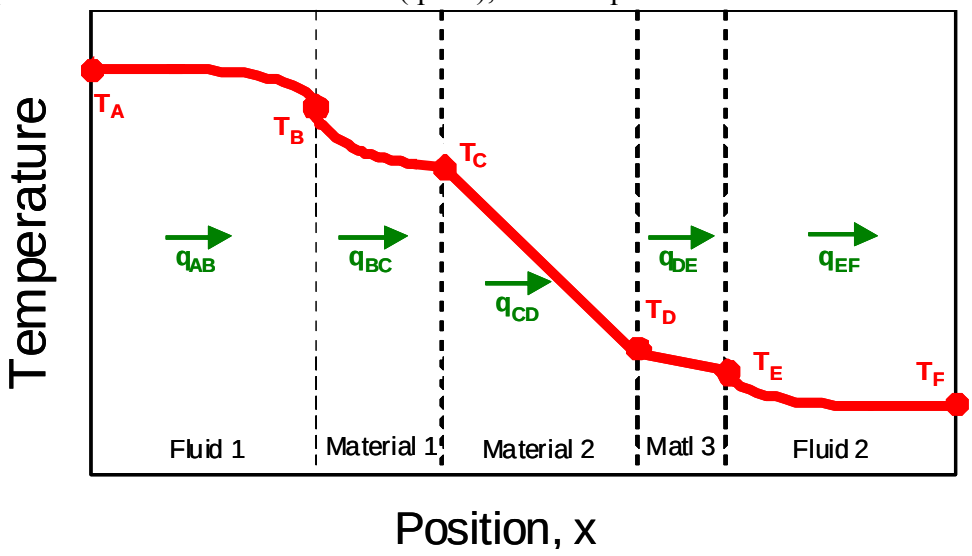
ChE 306: HEAT TRANSFER
FALL 2010
QUIZ #2 (10 points)
WEDNESDAY, SEPTEMBER 1 ***NAME: SOLUTIONS***

Given the temperature profile below for steady state, 1-dimensional heat transfer through a composite wall with no heat source (q-dot), answer questions 1-4:



_____*C*_____ 1. Which of these is true? (A) $k_3 = k_2$ (B) $k_3 < k_2$ (C) $k_3 > k_2$

_____*C*_____ 2. Which of these is true? (A) $q_{CD} > q_{BC}$ (B) $q_{CD} < q_{BC}$ (C) $q_{CD} = q_{BC}$

_____*C*_____ 3. If T_C and T_F are known, how many resistance terms must be included to find the heat transfer rate, q, using $q = \Delta T/\sum R$?
(A) 1 (B) 2 (C) 3 (D) 4 (E) 5 (F) 6 (G) 7

4. SHORT ANSWER The temperature profile in material 1 is nonlinear. If there is no heat source (or sink) within the material, what could explain this?

k must not be constant = k(T).

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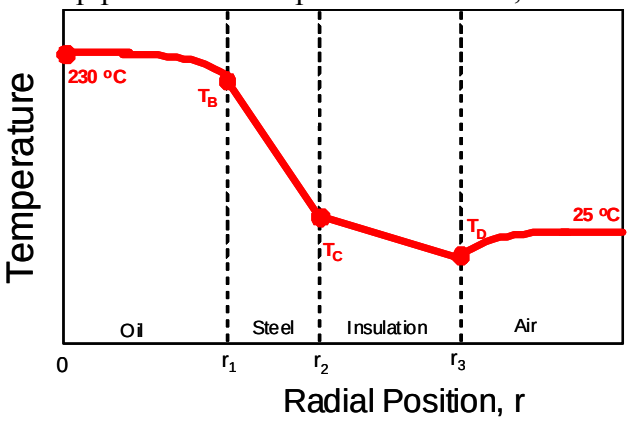
5. Hot oil at 230 °C flows through a cylindrical steel pipe coated with plastic insulation, with air on the outside at 25 °C. There is 1-dimensional (r-direction) steady state heat transfer with constant k for each material.



LIST TWO (2) things wrong with the temperature profile at right.
1. The temperature must always go downhill, so the curve in the air is wrong.
2. In cylindrical systems, the temperature profile is not linear- it has a ln r behavior.
3. The profile should be steeper in the insulation than in the steel.

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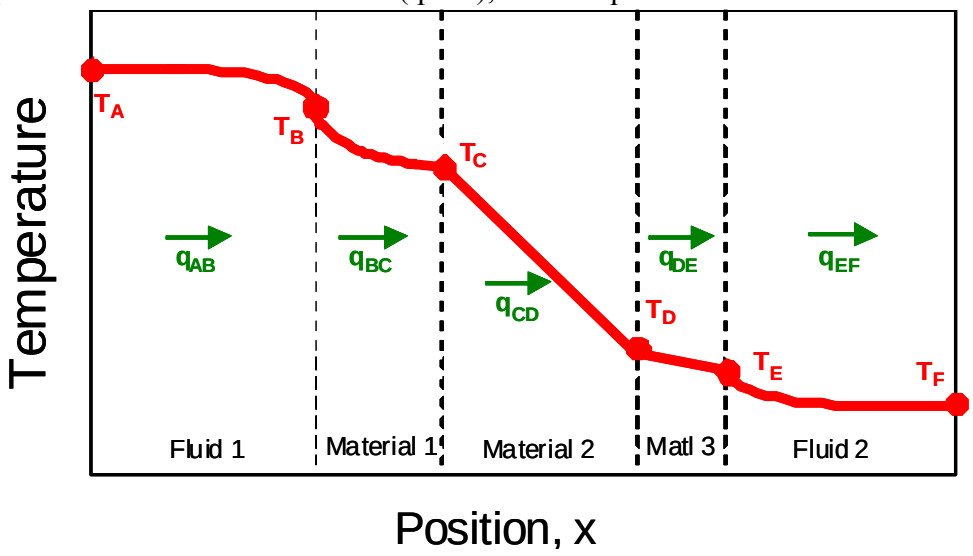

_____*B*_____ 1. Which of these is true? (A) $k_3 < k_2$ (B) $k_3 > k_2$ (C) $k_3 = k_2$

_____*A*_____ 2. Which of these is true? (A) $q_{CD} = q_{BC}$ (B) $q_{CD} < q_{BC}$ (C) $q_{CD} > q_{BC}$

_____*E*_____ 3. If T_C and T_F are known, how many resistance terms must be included to find the heat transfer rate, q, using $q = \Delta T/\sum R$?
(A) 7 (B) 6 (C) 5 (D) 4 (E) 3 (F) 2 (G) 1

4. SHORT ANSWER The temperature profile in material 1 is nonlinear. If there is no heat source (or sink) within the material, what could explain this?

k must not be constant = k(T).

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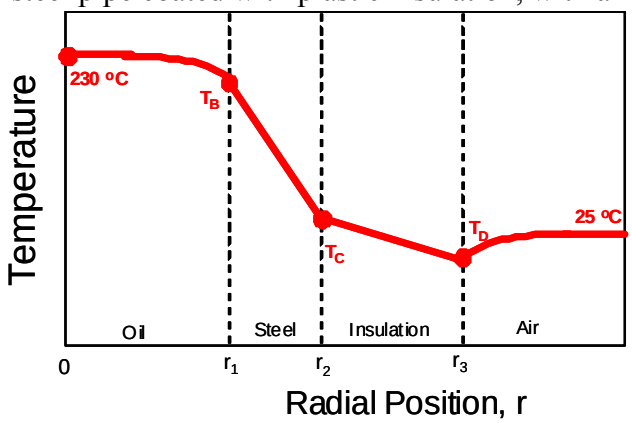

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