Assignment 7

The due date for submitting this assignment has passed.
As per your record you have not submitted this assignment.

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Due on 2020-11-24, 22:09 IST.

1) Which of the following liquids flow according to a boundary layer theory?
   - fluid is split into two parts
   - flow is rotational away from the wall
   - viscosity effects are important close to the wall
   - viscous effects are unimportant close to the wall

2) What does $F_{12}$ mean in an engineering Bernoulli equation given as
   \[
   \frac{\partial}{\partial x} \left( \rho \frac{v^2}{2} \right) + \frac{\partial}{\partial y} \left( \rho v \right) + \frac{\partial}{\partial z} \left( \rho w \right) = \frac{\partial P}{\partial x} + \frac{\partial P}{\partial y} + \frac{\partial P}{\partial z} - h_{loss} - h_{gain}
   \]
   - fluid flow per unit mass
   - friction losses per unit area
   - pressure drop
   - shaft work done

3) Which of the following statements are true?
   - total energy is conserved
   - thermal energy is conserved
   - energy is not conserved
   - total energy is not conserved

4) Thermal conductivity (k) has the units
   - $\text{m}^2 \cdot \text{s}^{-1}$
   - $\text{m} \cdot \text{s}^{-1}$
   - $\text{m} \cdot \text{w} \cdot \text{m}^{-1} \cdot \text{s}^{-1}$
   - $\text{m} \cdot \text{s} \cdot \text{w}^{-1}

5) From the expression for thermal energy transfer given below, what does $Q_{rad}(x)$ indicate?
   \[
   Q_{rad}(x) = \frac{d}{dx} \left( \rho c_p \frac{\partial T}{\partial x} \right)
   \]
   - power per unit volume
   - rate of energy by conduction
   - rate of energy by conduction on the fluid per unit gravitational force
   - rate of work done on the fluid per unit gravitational force

6) Consider an adiabatic reaction occurring in the presence of a reactant where heat generated ($Q_{gen}$) is constant and uniform.
   - Consider the adiabatic wall of the test tube and calculate the energy change using the first law of thermodynamics. Develop an expression for the variation of temperature with radial distance along heated transfer to the surface of the test tube. The temperature at the surface ($T_s$) is constant and the radius of the test tube is $R$.
   - Heat. Derivation is needed
     \[
     T = T_0 + \frac{Q_{gen}}{\rho c_p} \left( 1 - \left( \frac{r}{R} \right)^4 \right)
     \]
   - No, the player is incorrect.
     Accepted Answers:
     \[
     T = T_0 + \frac{Q_{gen}}{\rho c_p} \left( 1 - \left( \frac{r}{R} \right)^4 \right)
     \]

7) Find the rate of heat dissipation from the surface of the test tube of height $L$ in the surrounding in the above problem.
   - $Q_{rad}(x)$
   - $Q_{gen}$
   - $\rho c_p$
   - $\frac{d}{dx} \left( \rho c_p \frac{\partial T}{\partial x} \right)$
   - No, the player is incorrect.
   - Accepted Answers:
   - $Q_{rad}(x)$

8) Find the minimum heat $T_{min}$ in the test tube.
   - $T_{min} = T_0 + \frac{Q_{gen}}{4\rho c_p}$
   - $T_{min} = T_0$
   - $T_{min} = \frac{Q_{gen}}{4\rho c_p}$
   - $T_{min} = 0$
   - No, the player is incorrect.
   - Accepted Answers:
   - $T_{min} = T_0 + \frac{Q_{gen}}{4\rho c_p}$

9) In a lab doing cancer research, a small cell of color, red and straight, is presented with a solution of all chemicals. The cell is resistant to the solution and is able to survive. The cell receives a heat stimulus of 1°C, and there is no generation of heat. Identify the suitable boundary conditions to find the temperature profile inside the cell.
   - $T_{wall} = T_0$
   - $T_{wall} = 0$
   - $T_{wall} = \frac{Q_{gen}}{4\rho c_p}$
   - No, the player is incorrect.
   - Accepted Answers:
   - $T_{wall} = T_0$

10) A lab mistake has led to a decrease in the concentration of a solution by 5%. This concentration change affects the reaction rate. Calculate the new concentration.
   - $C_{new} = C_{old} \times 0.95$
   - $C_{new} = C_{old} \times 1.05$
   - $C_{new} = C_{old} \times 1.1$
   - No, the player is incorrect.
   - Accepted Answers:
   - $C_{new} = C_{old} \times 0.95$

11) In a lab doing cancer research, a small cell of color, red and straight, is presented with a solution of all chemicals. The cell is resistant to the solution and is able to survive. The cell receives a heat stimulus of 1°C, and there is no generation of heat. Identify the suitable boundary conditions to find the temperature profile inside the cell.
   - $T_{wall} = T_0$
   - $T_{wall} = 0$
   - $T_{wall} = \frac{Q_{gen}}{4\rho c_p}$
   - No, the player is incorrect.
   - Accepted Answers:
   - $T_{wall} = T_0$