Unit 9 - Week 7

Assignment 7

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

Due on 2020-11-04, 23:59 IST.

1) Which of the following is/are false according to a boundary layer theory? *1 point*

- the flow is split into two parts
- flow is irrotational away from the wall
- Viscous effects are important close to the wall
- viscous effects are unimportant close to the wall

No, the answer is incorrect.
Score: 0
Accepted Answers:
viscous effects are unimportant close to the wall

2) What does $\hat{F_L}$ mean in an engineering Bernoulli equation given as *1 point*

$$\frac{\Delta p}{\rho} + \frac{\Delta v^2}{2} + g\,\Delta x + \hat{F_L} + \hat{W_s} = 0?$$

- Flow rate per unit mass
- Frictional losses per unit mass
- Pressure drop
- Shaft work done

No, the answer is incorrect.
Score: 0
Accepted Answers:
Frictional losses per unit mass

3) Which of the following statements are true? *1 point*

- Total energy is conserved
- Thermal energy is conserved
- Thermal energy is not conserved
- Total energy is not conserved

No, the answer is incorrect.
Score: 0
Accepted Answers:
Total energy is conserved
Thermal energy is not conserved

4) Thermal diffusivity (α) has the units *1 point*

- $m^2\ s^{-2}$
- $m^2\ s^{-1}$
- $m\ s^{-2}$
- $m\ s^{-1}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$m^2\ s^{-1}$

5) From the expression for thermal energy transfer given below, what does ($\vec{\nabla}.\vec{q}$) indicate? *1 point*

$$\frac{\partial}{\partial t}\rho\left(\hat{U}+\frac{1}{2}v^2\right) = -\left(\vec{\nabla}.\rho\vec{v}\left(\hat{U}+\frac{1}{2}v^2\right)\right) - (\vec{\nabla}.\vec{q}) + (\rho(\vec{v}.\vec{g})) + (\vec{\nabla}.\rho\vec{v}) - (\vec{\nabla}.[t.\vec{v}]) + \dot{Q}_{OTHER} - W_{OTHER}$$

puv: per unit volume

- Rate of energy in puv by convection
- Rate of energy in puv by conduction
- Rate of work done on the fluid puv by gravitational forces
- Rate of work done on the fluid puv by viscous forces

No, the answer is incorrect.
Score: 0
Accepted Answers:
Rate of energy in puv by conduction

6) Consider an exothermic reaction occurring in the contents of a test tube where heat generated ($\dot{Q}_g$) is constant and uniform. Considering only the cylindrical area of the test tube and conduction occurring only in radial direction, develop an expression for variation of temperature with radial distance during heat transfer to the surface of the test tube. The temperature at the surface (Ts) is constant and the radius of the test tube is R. *2 points*

Hint: Derivation is needed.

- $T = T_s + \frac{\dot{Q}_g R^2}{4k}[1 - \left(\frac{r}{R}\right)^2]$
- $T = T_s + \frac{\dot{Q}_g R^2}{4k}[1 - \frac{r}{R}]$
- $T = T_s - \frac{\dot{Q}_g}{4k}[1 - \left(\frac{r}{R}\right)^2]$
- $T = T_s - \frac{\dot{Q}_g}{4k}[1 - \frac{r}{R}]$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$T = T_s + \frac{\dot{Q}_g R^2}{4k}[1 - \left(\frac{r}{R}\right)^2]$

7) Find the rate of heat dissipation from the surface of the test tube of length L to the surroundings in the above problem. *1 point*

- $2\pi RL\dot{Q}_g$
- $\frac{2\pi R\dot{Q}_g}{L}$
- $\pi R^2 L\dot{Q}_g$
- $2\pi rL + \dot{Q}_g$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\pi R^2 L\dot{Q}_g$

8) Find the maximum heat T_{max} in the test tube. *1 point*

- $T_{max} = T_s + \frac{\dot{Q}_g R^2}{4k}$
- $T_{max} = T_s$
- $T_{max} = \frac{\dot{Q}_g R^2}{4}$
- $T_{max} = 0$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$T_{max} = T_s + \frac{\dot{Q}_g R^2}{4k}$

9) In a lab doing cancer research, animal cells are cultivated in a suitable medium in petri dishes. A researcher, inoculates the medium with a few cells and incubates the dish in a temperature controlled incubator. Here the cells are assumed to be spherical. We will consider only one such cell of radius R. During inoculation, the cells were at a temperature of 25^0C (T_0) and the incubator operates at 37^0C (T_s). Assuming that the medium is also at 37^0C and there is no generation of heat. Identify the suitable boundary conditions to find the temperature profile inside the cell. *2 points*

- t = 0, $T = T_0$, $0 < r < R$
- t > 0, $T = T_0$, $r = R$
- t = 0, $T = T_s$, $0 > r > R$
- t > 0, $T = T_s$, $r = R$

No, the answer is incorrect.
Score: 0
Accepted Answers:
t = 0, $T = T_0$, $0 < r < R$
t > 0, $T = T_s$, $r = R$