Unit 7 - Week 5

Assignment 5

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

Due on 2020-10-21, 23:59 IST.

1) A boundary condition for velocity at the solid-liquid interface is: ***1 point***

- the velocity with which the solid surface is moving
- the velocity with which the bulk liquid is moving
- the velocity at the entrance
- the infinite velocity

No, the answer is incorrect.
Score: 0
Accepted Answers:
the velocity with which the solid surface is moving

2) Which of the following statement/s is/are true in a well-developed laminar flow in a pipe without external forces acting? ***1 point***

- The velocity of the fluid near the circumference of the pipe is the minimum
- The velocity of the fluid near the circumference of the pipe is the maximum
- The velocity profile across the cross section of the pipe is parabolic
- The velocity of the fluid does not vary along the circular cross section of the pipe

No, the answer is incorrect.
Score: 0
Accepted Answers:
The velocity of the fluid near the circumference of the pipe is the minimum
The velocity profile across the cross section of the pipe is parabolic

3) A fluid with a well -developed laminar flow is flowing in a cylindrical pipe of length 'x' such that the direction of flow is from x=0 to x. The change in pressure 'P' along the length is $\Delta P = P_x - P_0$. For a flow to occur, which of the following condition/s is/are normally satisfied? ***1 point***

- $P_x > P_0$
- $P_x < P_0$
- ΔP is positive
- $-\Delta P$ is positive

No, the answer is incorrect.
Score: 0
Accepted Answers:
$P_x < P_0$
$-\Delta P$ *is positive*

4) For the above flow, identify from below the equation for maximum velocity in its velocity profile. R- Radius of the pipe, μ- viscosity of the fluid ***1 point***

- $\vartheta_{max} = \frac{(-\Delta P)R^2}{4\mu x}$
- $\vartheta_{max} = \frac{(-\Delta P)R^4}{4\mu x}$
- $\vartheta_{max} = \frac{(-\Delta P)R^2}{\mu}$
- $\vartheta_{max} = \frac{(-\Delta P)R^4}{\mu}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\vartheta_{max} = \frac{(-\Delta P)R^2}{4\mu x}$

5) The above pipe with same flow properties had to be used in an application that required the volumetric flow rate to be a specific 16 fold the current flow rate. If $(-\Delta P)$ is kept the same in the new operation, which of the following could satisfy the requirement? ***1 point***

- Increase the pipe length 4 times i.e x = 4x
- Increase the radius of the pipe 2 times i.e R = 2R
- decrease the radius of the pipe 2 times i.e R = 0.5 R
- Increase the radius of the pipe 4 times i.e R = 4 R

No, the answer is incorrect.
Score: 0
Accepted Answers:
Increase the radius of the pipe 2 times i.e R = 2R

6) Capillary rise dynamics was studied for a mixture of ethanol and water. Capillary tubes of different diameters were used in the study. A high speed camera was used to record the capillary rise. The data corresponding to the 80% ethanol- water mixture rise is given below:
The mixture had a surface tension of 24.77 X 10^{-3} N/m, a viscosity of 1.140 X10^{-3} Pa s. The capillary tube used had an inner radius of 0.30 mm and length 20 mm. The contact angle of the liquid mixture and the capillary was 60^0 . Find the volumetric flow rate of the capillary rise. ***2 points***

- 0.215 cm^3/s
- 0.685 cm^3/s
- 4.698 cm^3/s
- 1.152 cm^3/s

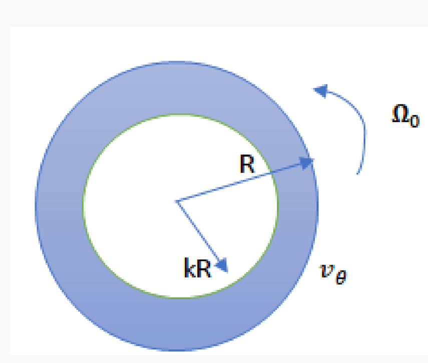
No, the answer is incorrect.
Score: 0
Accepted Answers:
1.152 cm^3/s

7) For the above flow, find the penetration velocity (Vp). ***2 points***

- 4.073 cm/s
- 1.153 cm/s
- 3.254 cm/s
- 0.548 cm/s

No, the answer is incorrect.
Score: 0
Accepted Answers:
4.073 cm/s

8) In the tangential annular flow in a couette viscometer with stationary inner cylinder and moving outer cylinder of length 'L', the cross section of which is shown below, identify the boundary conditions that is best suited to get the velocity profile along the θ component ***1 point***



- at $r = kR, \quad v_\theta = \Omega_0 R; \quad$ at $r = R, v_\theta = 0$
- at $r = kR, \quad v_\theta = \Omega_0 kR; \quad$ at $r = R, v_\theta = 0$
- at $r = kR, \quad v_\theta = 0; \quad$ at $r = R, v_\theta = \Omega_0 R$
- at $r = 0, \quad \frac{dv_\theta}{dt} = 0; \quad$ at $r = kR, v_\theta = \Omega_0 kR$

No, the answer is incorrect.
Score: 0
Accepted Answers:
at $r = kR, \quad v_\theta = 0; \quad$ *at* $r = R, v_\theta = \Omega_0 R$

9) The torque needed to turn the outer cylinder in the above setup is given by ***1 point***

- $4\pi\mu\Omega_0$
- $4\pi\Omega_0 R^2 \left(\frac{1-k^2}{k^2}\right)$
- $4\Omega_0 R^2 \left(\frac{k^2}{1-k^2}\right)$
- $4\pi\mu\Omega_0 L R^2 \left(\frac{k^2}{1-k^2}\right)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$4\pi\mu\Omega_0 L R^2 \left(\frac{k^2}{1-k^2}\right)$

10) If there are 'n' variables in a problem and these variables contain 'm' primary dimensions, the equation relating all the variables will have ______ dimensionless groups according to the Buckingham Pi theorem ***1 point***

- n — m
- m — n
- m
- n

No, the answer is incorrect.
Score: 0
Accepted Answers:
n — m