Unit 4 - Week 2

Assignment 2

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

Due on 2020-02-12, 23:59 IST.

1) Which of the following is the correct representation of the Hagen-Poiseuille's equation? {All symbols have the usual meaning} *1 point*

a. $Q=\dfrac{\pi(P_0-P_L)}{8\mu L}R^4$

b. $Q=\dfrac{\pi(P_0-P_L)}{8\mu^2 L}R^3$

c. $Q=\dfrac{\pi(P_0-P_L)}{8\mu^{3/2} L^2}R^{2/3}$

d. $Q=\dfrac{\pi(P_0-P_L)}{8\mu L}R^2$

- a
- b
- c
- d

No, the answer is incorrect.
Score: 0
Accepted Answers:
a

2) **True or False:** Consider the two statements and even if one of them is false, then mark the entire question as false, else mark the question as true. *1 point*

For the case of Couette flow, if the pressure gradient and the motion of the top plate are along the same direction, then such a pressure gradient is termed as a favorable pressure gradient. On the other hand, if the pressure gradient is in a direction opposite to that of the motion of the plate, then such a pressure gradient is known as the adverse pressure gradient.

a. True
b. False

- a
- b

No, the answer is incorrect.
Score: 0
Accepted Answers:
a

3) **True or False:** Consider the two statements and even if one of them is false, then mark the entire question as false, else mark the question as true. *1 point*

There are two ways by which momentum from a fluid can enter a control volume: one is due to convection (which arises from the macroscopic movement of the fluid), on the other hand, there is momentum transfer due to viscosity (more precisely, due to the molecular motion), such a transport is called the radiative transport of momentum.

a. True
b. False

- a
- b

No, the answer is incorrect.
Score: 0
Accepted Answers:
b

4) The kind of stress wherein the principal direction of motion and the direction in which the momentum gets transported are identical is termed as? *1 point*

a. Tangential stress
b. Vertical stress
c. Normal stress
d. Equilibrium stress

- a
- b
- c
- d

No, the answer is incorrect.
Score: 0
Accepted Answers:
c

5) For an inviscid fluid, the equation of motion can be re-written as: *1 point*

a. $\rho\dfrac{D\vec{V}}{Dt}=-\nabla P+\rho g+\mu\nabla^2\vec{V}$

b. $\rho\dfrac{d\vec{V}}{dt}=-\nabla P+\rho g$

c. $\rho\dfrac{\partial\vec{V}}{\partial t}=-\nabla P+\rho g+\mu\nabla^2\mu\vec{V}$

d. $\rho\dfrac{D\vec{V}}{Dt}=-\nabla P+\rho g$

- a
- b
- c
- d

No, the answer is incorrect.
Score: 0
Accepted Answers:
d

6) **True or False:** Consider the two statements and even if one of them is false, then mark the entire question as false, else mark the question as true. *1 point*

Navier-Stokes equation for a fluid system is Newton's first law of motion for an open system. Euler's equation is very important and can be used for the derivation of Bernoulli's equation.

a. True
b. False

- a
- b

No, the answer is incorrect.
Score: 0
Accepted Answers:
b

7) The velocity distribution for the laminar, incompressible flow of a Newtonian fluid in a long vertical tube is as follows: $v_z=\dfrac{(P_0-P_L)R^2}{4\mu L}\left[1-\left(\dfrac{r}{R}\right)^2\right]$ *1 point*

where v_z is the z-component of velocity, R is the radius of the tube, L is the length of the tube, μ is the viscosity of the fluid, and r is the radial distance from the centre-line of the tube.

Calculate the average velocity (approx. in m s^{-1}) of a fluid whose density is 200 kg m^{-3}, and viscosity is 0.0001 Pa. s, traveling along a circular tube of cross-sectional area 1 cm^2, owing to a pressure gradient of 1000 Pa m^{-1}

a. 50
b. 40
c. 80
d. 25

- a
- b
- c
- d

No, the answer is incorrect.
Score: 0
Accepted Answers:
b

8) For the same problem statement as in question 7, calculate the mass flow rate (approx. in kg s^{-1}) of the fluid under the same conditions, except that the pressure gradient is reduced to $1/8^{th}$ its initial value. *1 point*

a. 0.01
b. 0.5
c. 0.005
d. 0.1

- a
- b
- c
- d

No, the answer is incorrect.
Score: 0
Accepted Answers:
d

9) For the same problem statement as in question 7, calculate the ratio of the average velocity to the maximum velocity $\left({}^{v_{avg}}\!/_{v_{max}}\right)$: *1 point*

a. 0.75
b. 0.5
c. 0.33
d. 1.25

- a
- b
- c
- d

No, the answer is incorrect.
Score: 0
Accepted Answers:
b

10) Which of the following equation accurately depict the relationship between the substantial derivative and the partial derivative? Consider "c" to be an arbitrary dependent variable and $\vec{\mathbf{v}}$ is the velocity vector. All other symbols carry the usual meaning: *1 point*

a. $\dfrac{Dc}{Dt}=\dfrac{\partial c}{\partial t}+(\vec{\mathbf{v}}\cdot\nabla c)$

b. $\dfrac{Dc}{Dt}=\dfrac{dc}{dt}+(\vec{\mathbf{v}}\cdot\nabla c)$

c. $\dfrac{Dc}{Dt}=\dfrac{\partial c}{\partial t}+\vec{\mathbf{v}}\cdot(\vec{\mathbf{v}}\cdot\nabla c)$

d. $\dfrac{Dc}{Dt}=\dfrac{\partial c}{\partial t}+(\vec{\mathbf{v}}\times\nabla c)$

- a
- b
- c
- d

No, the answer is incorrect.
Score: 0
Accepted Answers:
a