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NPTEL

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Courses » Rheology of Complex Materials

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## Unit 4 - Week 2

### Course outline

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#### Week 2

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- Stress and strain rate 1
- Stress and strain rate 2
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## Assignment 2

The due date for submitting this assignment has passed. **Due on 2018-02-07, 23:59 IST.**

### Submitted assignment

1) Due to the hypothesis of continuum, material points between any two material points are **1 point**

- Depends on the material
- Can be stated only for fluids
- Infinite
- Finite

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*Infinite*

2) The continuum governing equations of rheology will be written in terms of field variables. These field variables are functions of position and time. **1 point**

- True
- False

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*True*

3) Which type of forces are the contact forces and the body forces? **1 point**

- Contact forces - volume forces; Body forces - volume forces
- Contact forces - volume forces; Body forces - surface forces
- Contact forces - surface forces; Body forces - surface forces
- Contact forces - surface forces; Body forces - volume forces

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*Contact forces - surface forces; Body forces - volume forces*

4)  $\tau_{zy}$  is the stress on \_\_\_\_\_ surface in \_\_\_\_\_ direction.

Hint

Week 12

DOWNLOAD  
VIDEOSInteraction  
SessionMATLAB:  
IntroductionMATLAB: Vector  
and Matrix  
OperationsMATLAB:  
Advanced Topics**No, the answer is incorrect.****Score: 0****Accepted Answers:***(Type: String) z,y**(Type: String) z, y*

5) For a very general deformation, the number of components of stress which have to be determined are

**1 point****1 point**

- 3
- 4
- 6
- 1

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

6

6) Cone and plate geometry is useful for rheology because

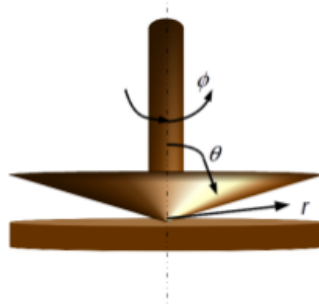
**1 point**

- Uniform deformation throughout the geometry
- Small amount of sample
- Large amount of sample
- Varying deformation at different position within the geometry

**No, the answer is incorrect.****Score: 0****Accepted Answers:***Uniform deformation throughout the geometry**Small amount of sample*

In a Cone and plate geometry, Couvette flow is achieved by the motion of top cone. Due to the motion of the cone, material particles move in a particular direction, called the direction of velocity. The velocity of neighbouring material particles predominantly changes in another direction, called the direction of shear.

7) As shown in the sketch below,  $\theta$  is the direction of \_\_\_\_\_ and  $\phi$  is the direction of \_\_\_\_\_.




Hint

**No, the answer is incorrect.****Score: 0****Accepted Answers:***(Type: String) shear, velocity**(Type: String) shear,velocity***2 points**

8) Considering shear flow in the cone and plate device, the stress component which will be most significant, especially for determining the torque required for the cone to move:

2 points

- $\tau_{\phi r}$
- $\tau_{\theta \phi}$
- $\tau_{\theta r}$
- $\tau_{\theta \theta}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$\tau_{\theta \phi}$

9) Velocity in a cone and plate geometry will be a function of

1 point

- $r, \theta$
- $r$
- $\theta$
- $r, \phi$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$r, \theta$

10) In a stagnant fluid, the only contact force present is pressure. Pick the correct statement/s from below:

2 points

- Pressure is same in all directions
- Only diagonal components of stress are non-zero
- Pressure varies from a position to another
- All the diagonal components of stress are the same

No, the answer is incorrect.

Score: 0

Accepted Answers:

*Pressure is same in all directions*

*Only diagonal components of stress are non-zero*

*Pressure varies from a position to another*

*All the diagonal components of stress are the same*

11) In shear flow, if there is elasticity in fluid, normal stress components will be zero.

1 point

- True
- False

No, the answer is incorrect.

Score: 0

Accepted Answers:

*False*

12)

2 points

Total stress and deviatoric stress are related to each other, for example for  $xx$  and  $xy$  components,  $\sigma_{xx} = \mathcal{A}p + \mathcal{B}\tau_{xx}$  and  $\sigma_{xy} = \mathcal{C}p + \mathcal{D}\tau_{xy}$ . The values of  $\mathcal{A}$ ,  $\mathcal{B}$ ,  $\mathcal{C}$ ,  $\mathcal{D}$  are

- 0,1,0,1
- 0,1,-1,1
- 1,1,-1,1

-1,1,0,1

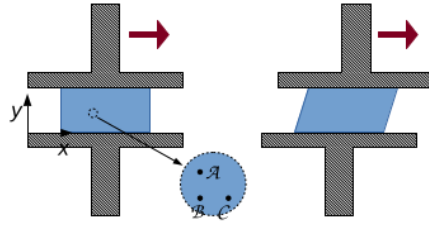
**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

-1,1,0,1

13) Consider flow in parallel plate, with top plate moving in x direction as shown below. 2 points



There is relative displacement between points A and C , but no relative displacement between points A and B

There is relative displacement between points A and B, but no relative displacement between points B and C

There is relative displacement between all the points A , B and C

There is relative displacement between points A and B, but no relative displacement between points A and C

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*There is relative displacement between points A and B, but no relative displacement between points B and C*

14) Strain is related to gradient of \_\_\_\_\_, while strain rate is related to gradient \_\_\_\_\_ of

Hint

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*(Type: String) displacement, velocity*

*(Type: String) displacement, velocity*

1 point

15) Generally, during rheological characterization, the Reynolds number will be small. This statement is 1 point

False

True

**No, the answer is incorrect.**

**Score: 0**

**Accepted Answers:**

*True*

16

2 points

The velocity gradient tensor is  $k \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$  for a particular flow.

The strain rate tensor and vorticity tensors are given by,

- $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}, k \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$
- $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$
- $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}, k \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$
- $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

**No, the answer is incorrect.**

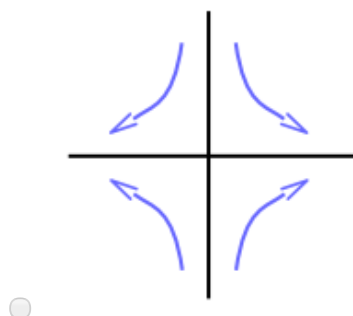
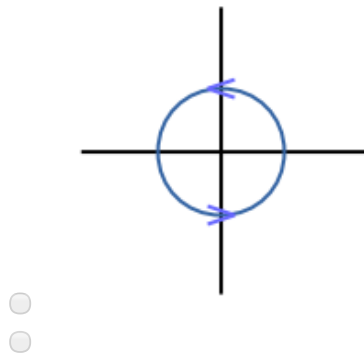
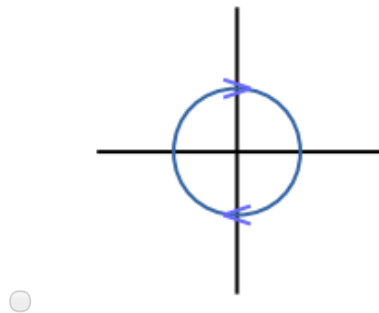
**Score: 0**

**Accepted Answers:**

$$\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}, k \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$$

17) Which of the following represent the flow given by the above velocity gradient

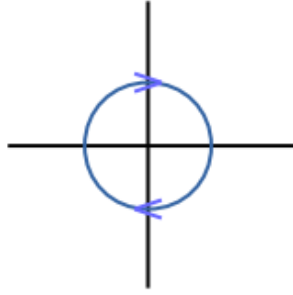
2 points



No, the answer is incorrect.

Score: 0

Accepted Answers:



18) The flow given by velocity gradient above is an example of

1 point

- Extensional flow
- Shear flow
- Rigid body rotation flow
- Combination of extensional, shear and rigid body rotation

No, the answer is incorrect.

Score: 0

Accepted Answers:

*Rigid body rotation flow*

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