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Courses » Rheology of Complex Materials

Announcements **Course** Ask a Question Progress Mentor

Unit 9 - Week 7

Assignment 7

The due date for submitting this assignment has passed. **Due on 2018-03-14, 23:59 IST.**

Submitted assignment

Based on the data given in question 1 , answer the following up to question 3

1) *1 point*

Assume that a constant shear stress τ^0_{yx} is being applied for a creep test. Following is the expression for Voigt model.

$$G\epsilon_{yx} + \eta\frac{\partial \epsilon_{yx}}{\partial t} = \tau_{yx}\ . \qquad (1)$$

The simplified form of Voigt model for creep will be

$$\mathscr{A}\epsilon_{yx} + \mathscr{B}\frac{\partial \epsilon_{yx}}{\partial t} = \mathscr{C}\tau^0_{yx}\ . \qquad (2)$$

$\mathscr{A}$, $\mathscr{B}$ and $\mathscr{C}$ in Eq. 2 will be,

- $\mathscr{A} = G,\ \mathscr{B} = 0,\ \mathscr{C} = 1$
- $\mathscr{A} = G,\ \mathscr{B} = \eta,\ \mathscr{C} = 0$
- $\mathscr{A} = 1,\ \mathscr{B} = 0,\ \mathscr{C} = 1$
- $\mathscr{A} = G,\ \mathscr{B} = \eta,\ \mathscr{C} = 1$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\mathscr{A} = G,\ \mathscr{B} = \eta,\ \mathscr{C} = 1$

2) Solution to Eq.2 will be of the form $\epsilon_{yx} = \mathscr{A} + \mathscr{B}\frac{\tau^0_{yx}}{G}\left[1 - \exp\left(-\frac{t}{\mathscr{C}}\right)\right]$ *2 points*

- $\mathscr{A} = 1,\ \mathscr{B} = 0,\ \mathscr{C} = \frac{\eta}{G}$
- $\mathscr{A} = 0,\ \mathscr{B} = 1,\ \mathscr{C} = \frac{\eta}{G}$
- $\mathscr{A} = 0,\ \mathscr{B} = 1,\ \mathscr{C} = \frac{G}{\eta}$
- $\mathscr{A} = G,\ \mathscr{B} = \eta,\ \mathscr{C} = 1$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$\mathscr{A} = 0,\ \mathscr{B} = 1,\ \mathscr{C} = \frac{\eta}{G}$

3) As $t \to \infty$, the strain will be **2 points**

- $\frac{\tau^0_{yx}}{G}$
- $\frac{\tau^0_{yx} t}{\eta}$
- 0
- ∞

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{\tau^0_{yx}}{G}$

Based on the data given in question 4, answer the following

4) Consider the following integral model, **2 points**

$$\tau_{yx}(t) = \int_{-\infty}^{t} \left[\frac{\eta_0}{\lambda_1}\left(1 - \frac{\lambda_2}{\lambda_1}\right)\exp\left(-\frac{t-t'}{\lambda_1}\right)\right]\dot{\gamma}_{yx}dt' + \frac{\eta_0\lambda_2}{\lambda_1}\dot{\gamma}_{yx}\ .$$

- Voigt
- Maxwell
- Carreau Yasuda
- Power law

No, the answer is incorrect.
Score: 0

Accepted Answers:
Maxwell

5) The response of this model to steady shear is, **2 points**

- Constant viscosity given by $\eta_0 \frac{\lambda_2}{\lambda_1}$
- Constant viscosity given by $\eta_0 \left(1 - \frac{\lambda_2}{\lambda_1}\right)$
- Constant viscosity given by η_0.
- Constant viscosity given by $\eta_0 \frac{\lambda_1}{\lambda_2}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
Constant viscosity given by η_0.

6) The differential form of the above model is given by **2 points**

$$\tau_{yx} + \lambda_1 \frac{\partial \tau_{yx}}{\partial t} = \eta_0 \dot{\gamma}_{yx} + \eta_0 \lambda_2 \frac{\partial \dot{\gamma}_{yx}}{\partial t}\ .$$

The response of this model to stress relaxation is: the stress

- decreases exponentially with time.
- increases exponentially with time.
- remains constant.

decreases exponentially and then becomes constant to a non-zero value.

No, the answer is incorrect.
Score: 0

Accepted Answers:
decreases exponentially with time.

7) The storage and loss moduli based on this model are **2 points**

$$G' = \frac{G\omega^2\lambda_1(\lambda_1 - \lambda_2)}{1+\omega^2\lambda_1^2} \quad ; \quad G'' = \frac{G\omega\lambda_1(1+\lambda_1\lambda_2\omega^2)}{1+\omega^2\lambda_1^2}.$$

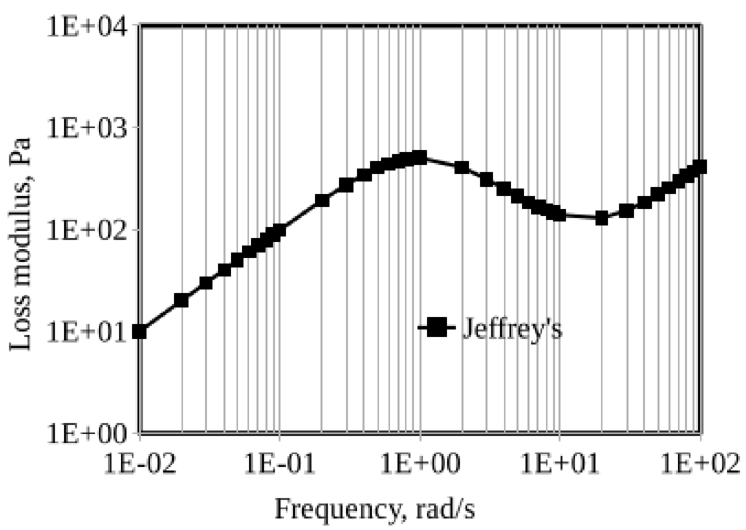
Based on this model, the low frequency loss modulus and the high frequency loss modulus, are

- inversely proportional and proportional to frequency, respectively
- proportional and inversely proportional to frequency, respectively
- both inversely proportional to frequency
- both proportional to frequency

No, the answer is incorrect.
Score: 0

Accepted Answers:
both proportional to frequency

8) From the following graph, value of λ_1 is ______ s (to 3 decimal places)



No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 0.800,1.200

1 point

9) Based on the graph given in question 8, answer this question.

value of λ_2 is ______ s (to 3 decimal places).

No, the answer is incorrect.
Score: 0

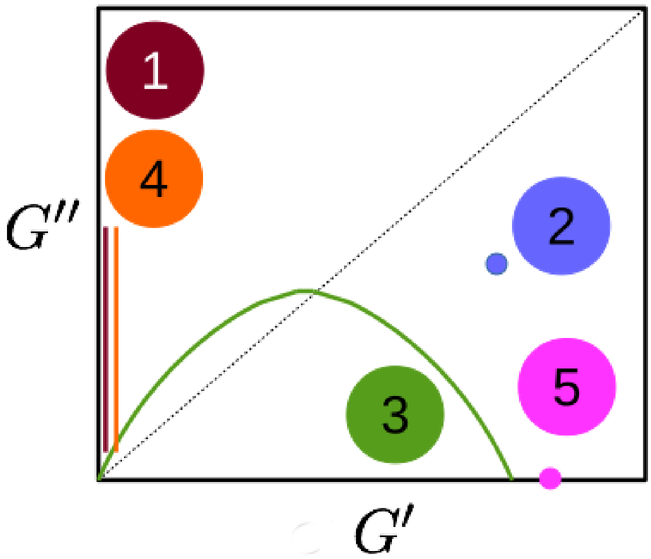
Accepted Answers:
(Type: Range) 0.001,0.008

1 point

Based on the data given in question 10, answer the following

10)

The following graph shows Cole-Cole plot (also called the Nyquist plot) of loss modulus Vs storage modulus for various materials. Enter the curve number next to the type of the material:



Gel ___________(enter an integer value)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 2

1 point

11)Newtonian fluid __________. (enter an integer value)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 1
(Type: Numeric) 4

1 point

12)Generalized Newtonian fluid _________ (enter an integer value)

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 1
(Type: Numeric) 4

1 point

13)Maxwell fluid___________ (enter an integer value)

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 3

1 point

14)Glassy solid ____________ (enter an integer value)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 5

1 point

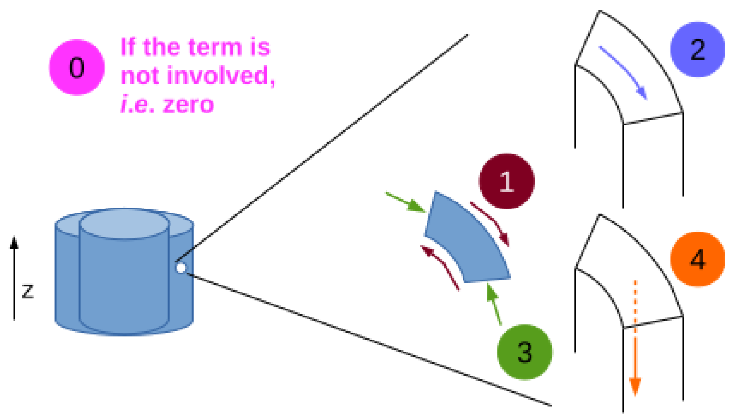
Based on the data given in the question 15, answer the following

15)

Following equation is θ direction equation of motion, that can be used for shear flow in concentric cylinder geometry:

$$0 = \rho b_\theta - \frac{1}{r}\frac{\partial p}{\partial \theta} + \left[\frac{1}{r^2}\frac{\partial\left(r^2\tau_{r\theta}\right)}{\partial r} + \frac{1}{r}\frac{\partial \tau_{\theta\theta}}{\partial \theta} + \frac{\partial \tau_{z\theta}}{\partial z} + \frac{\tau_{\theta r} - \tau_{r\theta}}{r}\right]$$

Following set of forces being shown as arrows will be acting on a fluid element in the concentric cylinder geometry:



ρb_θ ________ . (enter an integer value)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 0

1 point

16 $\frac{1}{r}\frac{\partial p}{\partial \theta}$ ________ . (enter an integer value)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 3

1 point

17 $\frac{1}{r^2}\frac{\partial\left(r^2\tau_{r\theta}\right)}{\partial r}+\frac{\tau_{\theta r}-\tau_{r\theta}}{r}$ ________ . (enter an integer value)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 1

1 point

18 $\frac{1}{r}\frac{\partial\tau_{\theta\theta}}{\partial\theta}$ ________ . (enter an integer value)

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 0
(Type: Numeric) 3

1 point

19 $\frac{\partial\tau_{z\theta}}{\partial z}$ ________ . (enter an integer value)

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 0
(Type: Numeric) 2

1 point

Previous Page End