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Unit 13 - Week 11

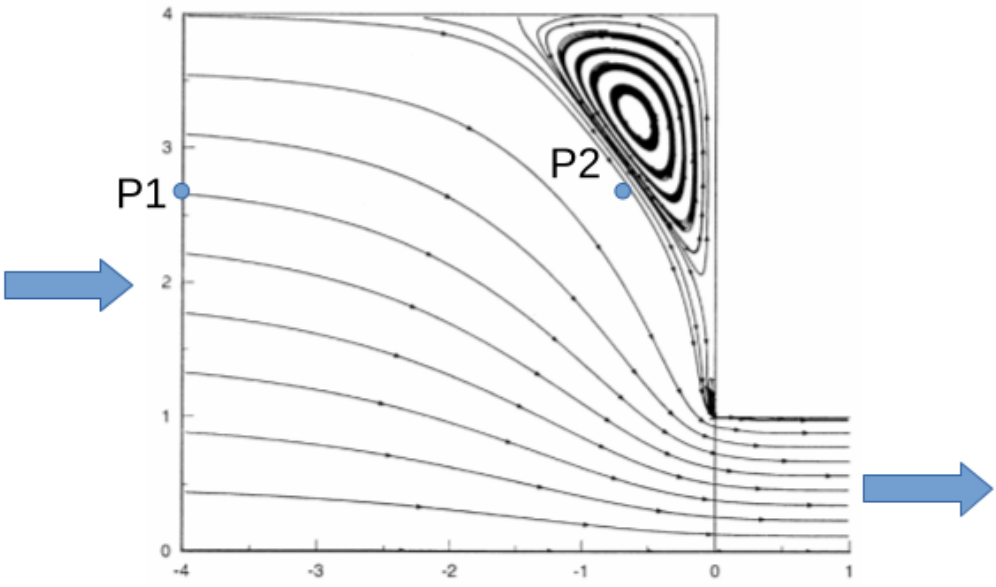
Assignment 11

The due date for submitting this assignment has passed. **Due on 2018-04-11, 23:59 IST.**

Submitted assignment

Based on the data given in question 2,answer the following up to 6

1) Following is example of a geometry in which cross-sectional area changes along the direction of flow. This is called a sudden contraction flow, and is a bench-mark flow to study flow behaviour of fluids. ***2 points***



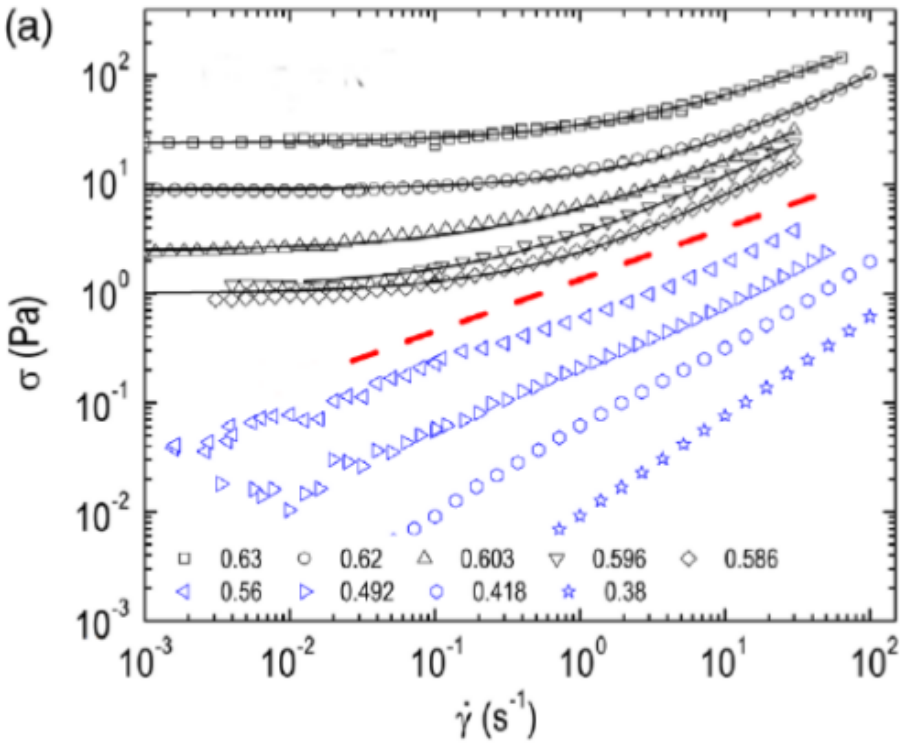
Based on the components of velocity gradients, type of flow/s important at different points are

- P1 and P2 - shear flow only
- P1 and P2 - extensional flow only
- P2 - shear flow and P1 - shear/extensional flow
- P1 - shear flow and P2 - shear/extensional flow

No, the answer is incorrect.
Score: 0

Accepted Answers:
P1 - shear flow and P2 - shear/extensional flow

2) The following graph stress as a function of strain rate for a suspension of poly methyl methacrylate (PMMA) particles [Bonn et al, Review of Modern Physics, 2017]. The legend shows the volume fraction of PMMA particles. ***2 points***



Match the following

Behaviour	**Volumer fraction**
I. Constant viscosity	a. 0.56
II. Yield stress followed by constant viscosity	b. 0.38
III. Yield stress followed by shear thinning	c. 0.62

- I-b,II-c,III-a
- I-c,II-b,III-a
- I-b,II-a,III-c
- I-a,II-c,III-b

No, the answer is incorrect.
Score: 0

Accepted Answers:
I-b,II-a,III-c

3) **Match the following** ***2 points***

Model	**Volume fraction**
I. Herschel Bulkley	a. 0.56
II. Newtonian	b. 0.38
III. Bingham	c. 0.62

- I-b,II-c,III-a
- I-c,II-b,III-a
- I-b,II-a,III-c
- I-a,II-c,III-b

No, the answer is incorrect.
Score: 0

Accepted Answers:
I-c,II-b,III-a

4) The yield stress for volume fraction of 0.586 is _____Pa. (to nearest integer)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Numeric) 1

2 points

5) For the overall data in the graph, the maximum viscosity is _____ Pa s. (to nearest integer)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 20000,30000

2 points

6) For the overall data in the graph, the lowest viscosity is _____ Pa s. (to nearest three decimals)

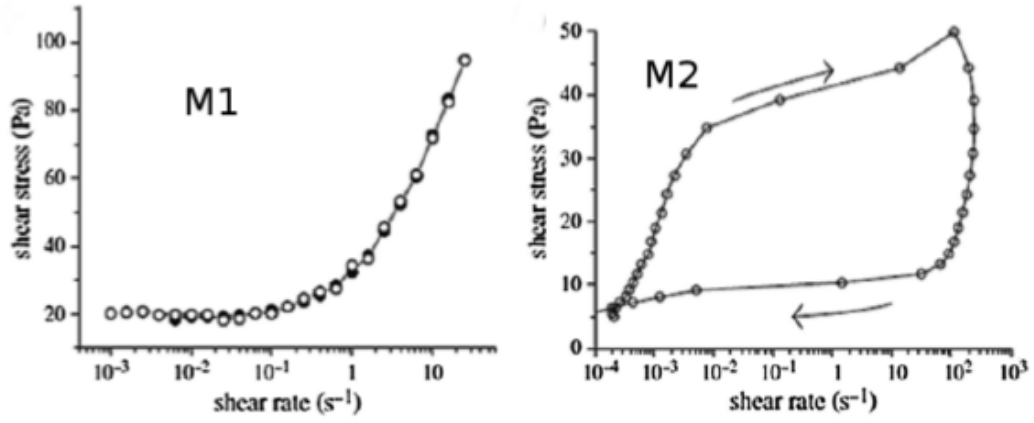
No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 0.005,0.015

2 points

Based on the data given in question 7, answer the following up to 12

7) The graphs show experimental measurements for two different systems [Bonn et al, Review of Modern Physics, 2017]. ***1 point***



Pick the correct measurements given the following behaviour

The sample has yield stress

- M1 only
- Both M1 and M2
- Neither M1 nor M2
- M2 only

No, the answer is incorrect.
Score: 0

Accepted Answers:
Both M1 and M2

8) The sample is thixotropic ***1 point***

- M1 only

- Both M1 and M2
- Neither M1 nor M2
- M2 only

No, the answer is incorrect.
Score: 0

Accepted Answers:
M2 only

9) The sample shows shear thinning after yield ***1 point***

- M1 only
- Both M1 and M2
- Neither M1 nor M2
- M2 only

No, the answer is incorrect.
Score: 0

Accepted Answers:
Both M1 and M2

10) The sample shows Newtonian fluid behaviour ***1 point***

- M1 only
- Both M1 and M2
- Neither M1 nor M2
- M2 only

No, the answer is incorrect.
Score: 0

Accepted Answers:
Neither M1 nor M2

11) The sample has microstructure breakup processes, and microstructure formation is instantaneous ***1 point***

- M1 only
- Both M1 and M2
- Neither M1 nor M2
- M2 only

No, the answer is incorrect.
Score: 0

Accepted Answers:
M1 only

12) The sample has microstructure breakup processes, and microstructure formation is not instantaneous ***1 point***

- M1 only
- Both M1 and M2
- Neither M1 nor M2
- M2 only

No, the answer is incorrect.
Score: 0

Accepted Answers:
M2 only

Based on the data given in question 13, answer the following

13 Following are components of Oldroyd B model for simple shear, *1 point*

$$\tau_{xx} + \lambda_1 \left[\frac{\partial \tau_{xx}}{\partial t} - 2 \frac{\partial v_x}{\partial y} \tau_{yx} \right] = -4\eta\lambda_2 \frac{\partial v_x}{\partial y} D_{yx}$$
$$\tau_{yx} + \lambda_1 \left[\frac{\partial \tau_{yx}}{\partial t} - \tau_{yy} \frac{\partial v_x}{\partial y} \right] = 2\eta D_{yx} + 2\eta\lambda_2 \frac{\partial D_{yx}}{\partial t}$$
$$\tau_{yy} + \lambda_1 \frac{\partial \tau_{yy}}{\partial t} = 0$$
$$\tau_{zz} + \lambda_1 \frac{\partial \tau_{zz}}{\partial t} = 0 \, .$$

State True/False.
When $\lambda_2 = 0$, the Oldroyd B model reduces to upper convected Maxwell model.

- True
- False

No, the answer is incorrect.
Score: 0

Accepted Answers:
True

14 Starting with initial conditions of stress being zero, the governing equation for τ_{yx} stress growth in simple shear flow at constant strain rate is, *2 points*

- $\tau_{yx} + \lambda_1 \left[\frac{\partial \tau_{yx}}{\partial t} - \tau_{yy} \frac{\partial v_x}{\partial y} \right] = 2\eta D_{yx} + 2\eta\lambda_2 \frac{\partial D_{yx}}{\partial t}$
- $\tau_{yx} + \lambda_1 \left[\frac{\partial \tau_{yx}}{\partial t} \right] = 2\eta D_{yx}$
- $\tau_{yx} = 2\eta D_{yx} + 2\eta\lambda_2 \frac{\partial D_{yx}}{\partial t}$
- $\tau_{yx} + \lambda_1 \left[\frac{\partial \tau_{yx}}{\partial t} \right] = 2\eta D_{yx} + 2\eta\lambda_2 \frac{\partial D_{yx}}{\partial t}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\tau_{yx} + \lambda_1 \left[\frac{\partial \tau_{yx}}{\partial t} \right] = 2\eta D_{yx}$

15 State True/False. *1 point*
Oldroyd B model can show non-monotonic stress growth or stress overshoot as a function of time, during a constant strain rate simple shear.

- True
- False

No, the answer is incorrect.
Score: 0

Accepted Answers:
False

16 If $\frac{\partial v_x}{\partial y} = \dot{\gamma}_{yx}$, steady value of τ_{xx} according to Oldroyd B model is *2 points*

- 0
- $2\eta\lambda_1\dot{\gamma}_{yx}^2$
- $2\eta\left(\lambda_1 - \lambda_2\right)\dot{\gamma}_{yx}^2$
- $2\eta\lambda_2\dot{\gamma}_{yx}^2$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$2\eta\left(\lambda_1-\lambda_2\right)\dot{\gamma}_{yx}^2$

17) The first normal stress difference coefficient, according to Oldroyd B model is *1 point*

- 0
- $2\eta\lambda_1$
- $2\eta\left(\lambda_1-\lambda_2\right)$
- $2\eta\lambda_2$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$2\eta\left(\lambda_1-\lambda_2\right)$

Previous Page End