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NPTEL

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Courses » Rheology of Complex Materials

Announcements **Course** Ask a Question Progress Mentor

Unit 2 - Week 0 - Pre-requisites

Assignment 0

The due date for submitting this assignment has passed. **Due on 2018-01-22, 23:59 IST.**

Submitted assignment (Submitted on 2017-12-27, 04:03)

Rheology of complex materials is about deformation behaviour of systems which are generally composed of polymeric and/or multiphase nature. Given that deformation is closely linked to the microstructure of these materials, we will discuss some aspects of polymeric and colloidal systems. To understand the deformation behaviour, we subject the material to controlled conditions of stress, strain or strain rate. Therefore, knowledge of mechanics and fluid mechanics is useful to analyze the material response to controlled conditions. The governing equations of rheology, the constitutive relations, are integral and differential equations, and their solutions are useful to understand the behaviour. Given that oscillatory or
sinusoidal variation of controlled variables is often used, we use complex variables to describe the behaviour. A preliminary familiarity with Engineering mathematics is quite useful to understand concepts in rheology.
Polymeric and colloidal systems

1) The building unit of a polymer is called

Monomer

Hint

Yes, the answer is correct.
Score: 1

Accepted Answers:
(Type: String) Monomer

1 point

2) Which of the following polymers is branched *1 point*

- (•) LDPE
- ( ) Nylon
- ( ) PVC
- ( ) Polystyrene

Yes, the answer is correct.
Score: 1

Accepted Answers:
LDPE

3) Polymer molecule can be thought of contained in a spherical volume. The radius of this sphere is called *1 point*

- ( ) End-to-end distance

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Interaction Session

MATLAB: Introduction

MATLAB: Vector and Matrix Operations

MATLAB: Advanced Topics

- Hydraulic radius
- Radius of gyration
- Countour distance

Yes, the answer is correct.
Score: 1

Accepted Answers:
Radius of gyration

4) Which of the following sized particle is likely to have Brownian motion *1 point*

- 1 cm
- 1 μm
- 10 cm
- 1 m

Yes, the answer is correct.
Score: 1

Accepted Answers:
1 μm

5) Polymer melt is generally shows the following behaviour *1 point*

- [x] Pseudoplastic
- [ ] Newtonian
- [ ] Inviscid
- [x] non-Newtonian

Yes, the answer is correct.
Score: 1

Accepted Answers:
Pseudoplastic
non-Newtonian

6) Match the particle type with the dominant force of interaction *1 point*

Particles	**Interaction force**
I. Silica particles silinol groups	a. Electrostatic interactions
II. Polyethylene particles	b. Hydrogen bonding
III. Polystyrene sulfonate particles Interaction force	c. van der Waals interactions

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

Yes, the answer is correct.
Score: 1

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

Mechanics, Fluid Mechanics

7) Following is the number of components of stress? *1 point*

- 1
- 4
- 9
- 16

Yes, the answer is correct.
Score: 1

Accepted Answers:
9

8) Reynolds number signifies the ratio of *1 point*

- inertial to gravity forces
- inertial to pressure forces
- gravity io viscous forces
- inertial to viscous forces

Yes, the answer is correct.
Score: 1

Accepted Answers:
inertial to viscous forces

9) Match the terms of Navier Stokes equation to their significance *1 point*

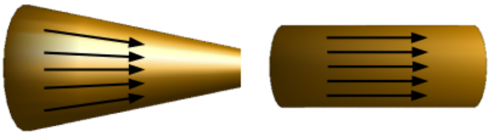
Term	**Signficance**
I. $\rho\frac{\partial \mathbf{v}}{\partial t}$	a. Pressure
II. $\rho\,(\mathbf{v}\cdot \mathrm{grad})\,\mathbf{v}$	b. Viscous term
III. $\rho\mathbf{g}$	c. Unsteady term
IV. $\mathrm{grad}p$	d. Intertial term
V. $\mu(\nabla^2\mathbf{v})$	e. Gravity

- I-b;II-a;III-e;IV-c;V-d
- I-c;II-d;III-e;IV-a;V-b
- I-a;II-b;III-e;IV-c;V-d
- I-c;II-d;III-e;IV-b;V-a

No, the answer is incorrect.
Score: 0

Accepted Answers:
I-c;II-d;III-e;IV-a;V-b

10) Consider the flow shown for a conical die and a capillary *1 point*



Conical die Capillary

Which of the following statement/s is/are TRUE?

- The steady nature of flow cannot be ascertained from the figures.
- The flow is turbulent in the conical die.
- Velocity changes as a fuction of flow direction for the conical die.
- The flow in capillary can be a developed flow.

Yes, the answer is correct.
Score: 1

Accepted Answers:
The steady nature of flow cannot be ascertained from the figures.
Velocity changes as a fuction of flow direction for the conical die.
The flow in capillary can be a developed flow.

11) Based on Stokes law, pick the CORRECT statement *1 point*

- The terminal settling velocity is directly proportional to size.
- The drag force is directly propotional to viscosity.

The drag force is proportional to square of the velocity.

The terminal settling velocity is inversely proportional to square of viscosity.

Yes, the answer is correct.
Score: 1

Accepted Answers:
The drag force is directly propotional to viscosity.

12) Material derivative of a quantity q (denoted as q̇) in rectangular coordinate is *1 point*

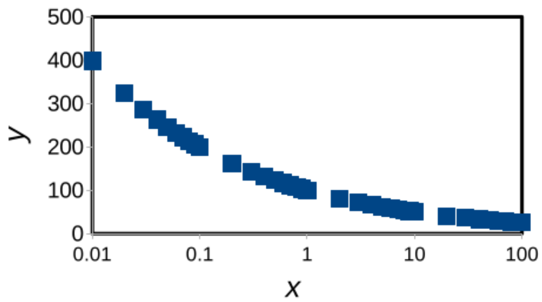
- $\frac{\partial q}{\partial t}$
- $\frac{\partial q}{\partial t} + \left[v_x \frac{\partial q}{\partial x} + v_x \frac{\partial q}{\partial y} + v_x \frac{\partial q}{\partial z}\right]$
- $\frac{\partial q}{\partial t} + \left[q \frac{\partial v_x}{\partial x} + q \frac{\partial v_y}{\partial y} + q \frac{\partial v_z}{\partial z}\right]$
- $\frac{\partial q}{\partial t} + \left[v_x \frac{\partial q}{\partial x} + v_y \frac{\partial q}{\partial y} + v_z \frac{\partial q}{\partial z}\right]$

Yes, the answer is correct.
Score: 1

Accepted Answers:
$\frac{\partial q}{\partial t} + \left[v_x \frac{\partial q}{\partial x} + v_y \frac{\partial q}{\partial y} + v_z \frac{\partial q}{\partial z}\right]$

Engineering mathematics

13 Fit the following data to power law relation $y = Kx^{n-1}$



The value of n is ______.

0.67

Yes, the answer is correct.
Score: 1

Accepted Answers:
(Type: Range) 0.65,0.75

1 point

14 Consider the following ordinary differential equation *1 point*

$\tau_{yx} + \lambda \frac{\partial \tau_{yx}}{\partial t} = G_2 \gamma_{yx} + (G_1 + G_2) \lambda \frac{\partial \gamma_{yx}}{\partial t}$

The solution to the above ODE if $\gamma_{yx} = \gamma_{yx}^0 =$ constant is given as follows:

$\tau_{yx}(t) = \mathscr{A} \gamma_{yx}^0 + \mathscr{B} \gamma_{yx}^0 \exp\left(-\frac{t}{\mathscr{C}}\right)$

If the initial condition is $\tau_{yx} = (G_1 + G_2)\gamma_{yx}^0$, the constants $\mathscr{A}, \mathscr{B}, \mathscr{C}$ are

- $G_2, G_1, \lambda \frac{G_1}{G_2}$
- G_1, G_2, λ
- G_2, G_1, λ

- $G_1, G_2, \lambda\frac{G_2}{G_1}$

Yes, the answer is correct.
Score: 1

Accepted Answers:
G_2, G_1, λ

15 If $G^* = G' + iG'' = \frac{1}{J^*} = \frac{1}{J' - iJ''}$, then *1 point*

- $G' = \frac{J''}{J'^2 + J''^2}$; $G'' = \frac{J'}{J'^2 + J''^2}$
- $G' = \frac{J'}{J'^2 + J''^2}$; $G'' = \frac{J''}{J'^2 + J''^2}$
- $G' = \frac{1}{J'}$; $G'' = \frac{1}{J''}$
- $G' = \frac{1}{J''}\frac{J'}{J' + J''}$; $G'' = \frac{1}{J'}\frac{J''}{J' + J''}$

Yes, the answer is correct.
Score: 1

Accepted Answers:
$G' = \frac{J'}{J'^2 + J''^2}$; $G'' = \frac{J''}{J'^2 + J''^2}$

16 If $q = Ax + By$, the gradient of q $\rightarrow$ grad$q$ is ($\mathbf{e}_x$,$\mathbf{e}_y$,$\mathbf{e}_z$ are unit vectors in x, y, z directions) *1 point*

- $A\mathbf{e}_x + B\mathbf{e}_y$
- 0
- $B\mathbf{e}_x + A\mathbf{e}_y$
-

Yes, the answer is correct.
Score: 1

Accepted Answers:
$A\mathbf{e}_x + B\mathbf{e}_y$

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