

## Unit 4 - Week 2 : Rheology of Blood

### Course outline

How does an NPTEL online course work?

Week 0 : Prerequisite

Week 1 : Review of Basic Concepts

Week 2 : Rheology of Blood

- Lec 1: Rheology of blood
- Lec 2: Blood morphology
- Lec 3: Blood flow in a channel
- Lec 4: Viscometers and Rheometers

Quiz : Assignment 2

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Week 3 : Arterial Bifurcations and Pulsatile Flow

Week 4 : Pulsatile Flow and Elastic tubes

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## 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 statements about red blood cells (RBCs) in a healthy human is correct? 1 point
- Lifespan of about 30 days  
 Rigid  
 Spherical in shape  
 Contains haemoglobin
- No, the answer is incorrect.**  
Score: 0  
Accepted Answers: Contains haemoglobin
- 2) The blood corpuscles are of \_\_\_\_ kinds. 1 point
- 1  
 2  
 3  
 4
- No, the answer is incorrect.**  
Score: 0  
Accepted Answers: 3
- 3) Interior of WBC is \_\_\_\_\_. 1 point
- Thixotropic  
 Newtonian  
 Viscoelastic  
 Rheopectic
- No, the answer is incorrect.**  
Score: 0  
Accepted Answers: Viscoelastic
- 4) Choose the correct sentence- 1 point
- Spinning RBCs tend to move near wall  
 Plasma skimming layer exists near wall  
 Plasma skimming layer exists at the centre  
 Viscosity of blood decreases with increase in Hct
- No, the answer is incorrect.**  
Score: 0  
Accepted Answers: Plasma skimming layer exists near wall
- 5) In Fåhræus–Lindqvist effect \_\_\_\_ 1 point
- Blood viscosity increases with decrease in tube diameter  
 Blood viscosity decreases with decrease in tube diameter  
 Blood viscosity does not change with tube diameter  
 RBC count decreases with decrease in tube diameter
- No, the answer is incorrect.**  
Score: 0  
Accepted Answers: Blood viscosity decreases with decrease in tube diameter
- 6) For the velocity distribution  $u = 0.45 y - y^2$  (m/s) for a fully-developed flow, the magnitude of shear stress at  $y = 0.25$  m will be \_\_\_\_  $\times 10^{-6}$  Pa? (fluid viscosity is 1.2 cP). 1 point
- 0.06  
 0.03  
 30  
 60
- No, the answer is incorrect.**  
Score: 0  
Accepted Answers: 60
- 7) Fibrinogen present in blood does NOT cause the following. 1 point
- Yield stress behavior of blood  
 Rouleaux formation  
 Coagulation of blood  
 Decrease in blood viscosity
- No, the answer is incorrect.**  
Score: 0  
Accepted Answers: Decrease in blood viscosity
- 8) Which of the following fluids can be classified as non-Newtonian? 1 point
- Kerosene oil  
 Human blood  
 Milk  
 Diesel oil
- No, the answer is incorrect.**  
Score: 0  
Accepted Answers: Human blood
- 9) For a shear thinning fluid 1 point
- The viscosity increases with an increase in shear stress  
 The viscosity is independent of change in shear stress  
 The viscosity decreases with an increase in shear stress  
 The viscosity first increases and then decreases
- No, the answer is incorrect.**  
Score: 0  
Accepted Answers: The viscosity decreases with an increase in shear stress
- 10) Power law model \_\_\_\_ 1 point
- Can describe viscosity at very high and very low shear rates  
 Cannot describe viscosity at very high and very low shear rates  
 Can describe viscosity at very high shear rates but cannot describe at very low shear rates  
 Cannot describe viscosity at very high shear rates but can describe at very low shear rates
- No, the answer is incorrect.**  
Score: 0  
Accepted Answers: Cannot describe viscosity at very high and very low shear rates
- 11) For steady flow of a viscous incompressible fluid through a circular pipe of a constant diameter, the average velocity in fully developed region is constant. Which one of the following statements about the average velocity in the developing region is TRUE? 1 point
- It increases until the flow is fully developed.  
 It is constant and is equal to the average velocity in the fully developed region.  
 It decreases until the flow is fully developed.  
 It is constant but is always lower than the average velocity in the fully developed region
- No, the answer is incorrect.**  
Score: 0  
Accepted Answers: It is constant and is equal to the average velocity in the fully developed region.
- 12) The velocity profile for a fully developed laminar flow in a straight circular pipe is given by the expression  $u = -R^2/4\mu(dP/dx)(1 - r^2/R^2)$ . The average velocity of fluid in the pipe is 1 point
- $-R^2/8\mu(dP/dx)$   
  $-R^2/4\mu(dP/dx)$   
  $-R^2/2\mu(dP/dx)$   
  $-R^2/\mu(dP/dx)$
- No, the answer is incorrect.**  
Score: 0  
Accepted Answers:  $-R^2/8\mu(dP/dx)$
- 13) The relation between shear stress  $Z$  and velocity gradient  $du/dy$  of a fluid is given by  $Z = A [(du/dy)]^n + B$  where  $A$ ,  $n$  and  $B$  are constants. Which of the following conditions will hold for a dilatant fluid showing yield behaviour? 1 point
- $A = 0; B \neq 0; n > 1$   
  $A \neq 0; B = 0; n > 1$   
  $A = 0; B = 0; n < 1$   
  $A \neq 0; B \neq 0; n > 1$
- No, the answer is incorrect.**  
Score: 0  
Accepted Answers:  $A \neq 0; B \neq 0; n > 1$
- 14) Which of the following is NOT true about rheological behaviour of blood? 1 point
- At low shear rate yielding behaviour is observed  
 At low shear rate blood is a Newtonian fluid  
 At high shear rate blood is a Newtonian fluid  
 At low shear rates blood shows shear thinning behaviour
- No, the answer is incorrect.**  
Score: 0  
Accepted Answers: At low shear rate blood is a Newtonian fluid
- 15) Capillary viscometer is generally used for rheological measurements in \_\_\_\_\_. 1 point
- Newtonian fluids  
 Pseudoplastic fluids  
 Rheopectic fluids  
 Viscoelastic fluids
- No, the answer is incorrect.**  
Score: 0  
Accepted Answers: Newtonian fluids
- 16) When the tube diameter decreases from 20 mm to 10 mm, pressure drop per unit length (assuming Poiseuille flow in the tube) for the same flow rate: 1 point
- Decreases 16 times  
 Decreases 2 times  
 Increases 16 times  
 Increases 2 times
- No, the answer is incorrect.**  
Score: 0  
Accepted Answers: Increases 16 times
- 17) Which of the following is NOT true about RBC: 1 point
- They are biconcave in shape  
 They have an ability to deform without change in surface area  
 They do not deform  
 They carry haemoglobin
- No, the answer is incorrect.**  
Score: 0  
Accepted Answers: They do not deform
- 18) What percentage of the body weight (in kg) is composed of blood? What percentage of this blood is composed of plasma? 1 point
- 20%; 55 %  
 20%; 45%  
 7%; 45%  
 7 %; 55%
- No, the answer is incorrect.**  
Score: 0  
Accepted Answers: 7 %; 55%
- 19) Cone and plate viscometer has a \_\_\_\_ 1 point
- Constant shear rate  
 Linearly increasing shear rate  
 Zero shear rate  
 Infinite shear rate
- No, the answer is incorrect.**  
Score: 0  
Accepted Answers: Constant shear rate
- 20) The yield stress for blood is 0.14 dyne/cm<sup>2</sup>. For a capillary viscometer of length 40 cm and radius 2 mm, calculate the required pressure difference (in mm Hg) for the sample of blood to start flowing. 1 point
- 0.062  
 0.042  
 0.082  
 0.102
- No, the answer is incorrect.**  
Score: 0  
Accepted Answers: 0.042