Unit 5 - Constitutive Equations

Course outline
How does an NPTEL online course work?
Introduction to viscoelasticity
Viscoelasticity and Introduction to polymers
Viscoelasticity and Introduction to polymers
Constitutive Equations
● Freely jointed model
○ Constitutive equations
○ Constitutive equations (Cont.)
○ Constitutive equations (Cont.)
○ Viscoelastic effects
○ Quiz : Week 4 Assessment
Viscoelastic models
Viscoelastic models
Viscoelastic models (cont.) & Constitutive modelling
Response to Sinusoidal oscillations
Weekly Feedback forms
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Week 4 Assessment

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-03-25, 23:59 IST.

1) A polymer chain consists of 3.5×10^4 segments with length of each segment as 4×10^{-10}m. What is the approximate length of the polymer molecule in meters? ***1 point***

○ 7×10^{-8}
○ 7.48×10^{-8}
○ 6.8×10^{-8}
○ 3.74×10^{-8}

No, the answer is incorrect.
Score: 0
Accepted Answers:
7.48×10^{-8}

2) Based on the data given in the above question, what is the maximum length possible for the polymer molecule? ***1 point***

○ 2×10^{-5}m
○ 1.5×10^{-5}m
○ 1.4×10^{-5}m
○ 1.4×10^{-6}m

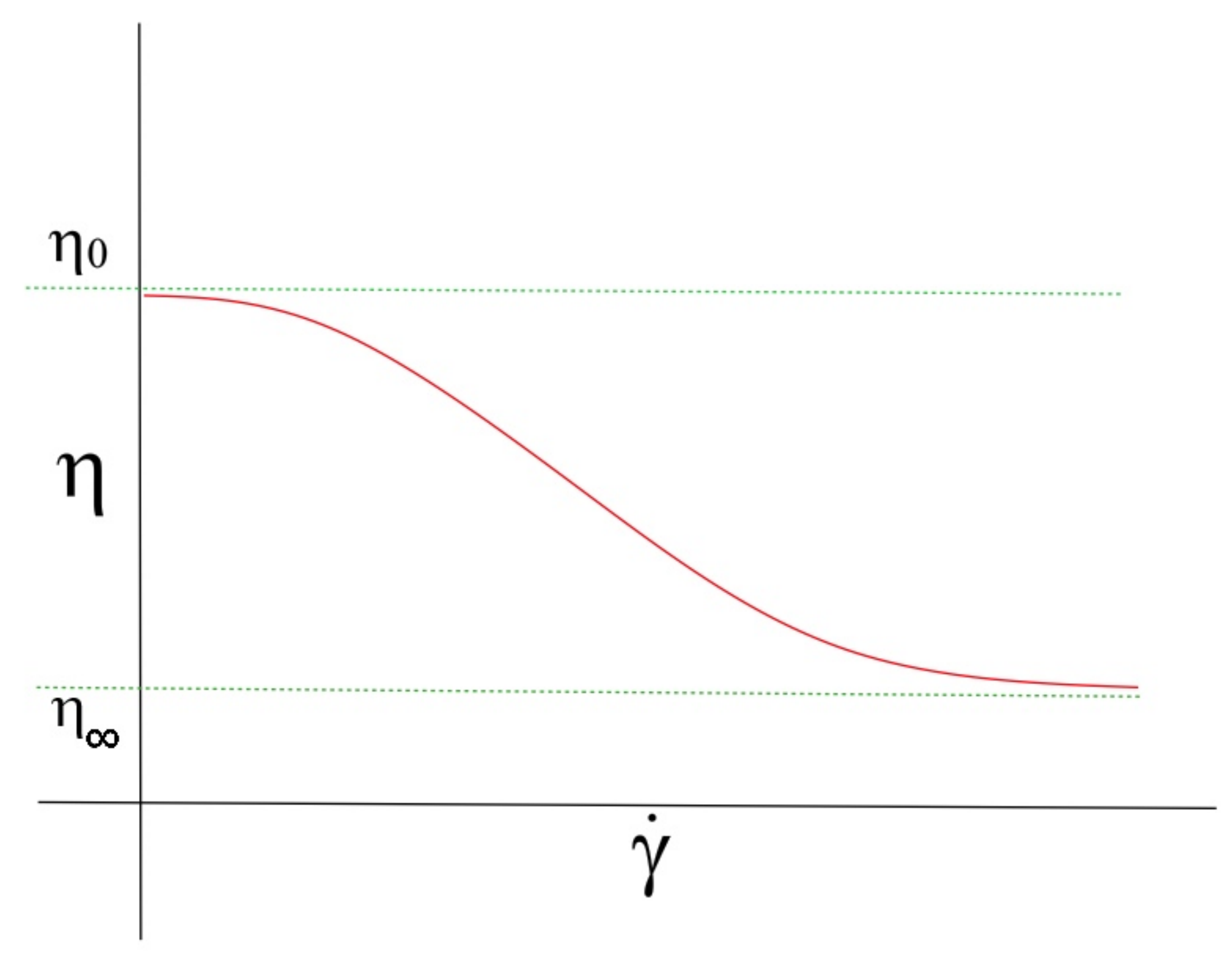
No, the answer is incorrect.
Score: 0
Accepted Answers:
$1.4 \times 10^{-5} m$

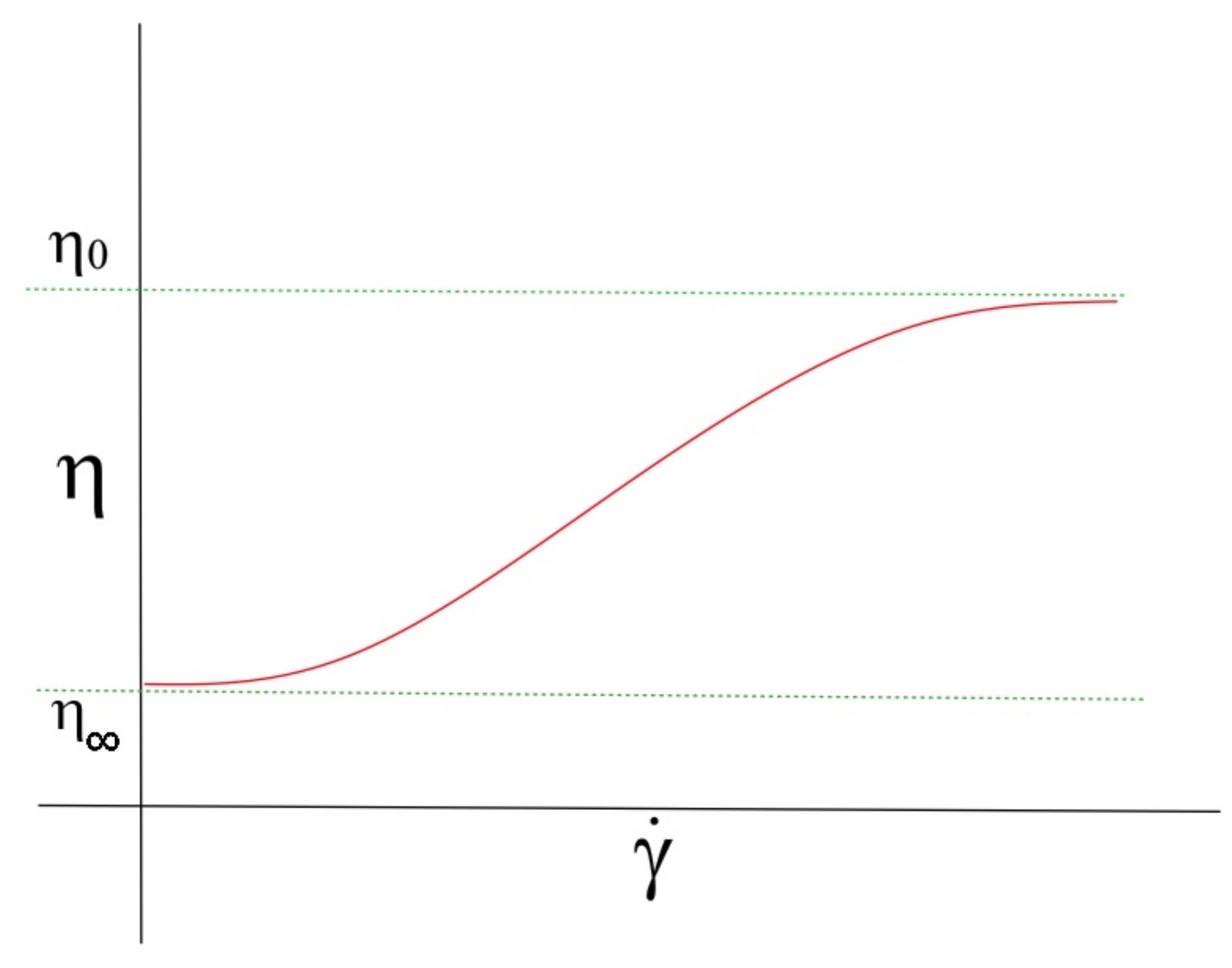
3) Which of the following statements given are correct? ***0 points***

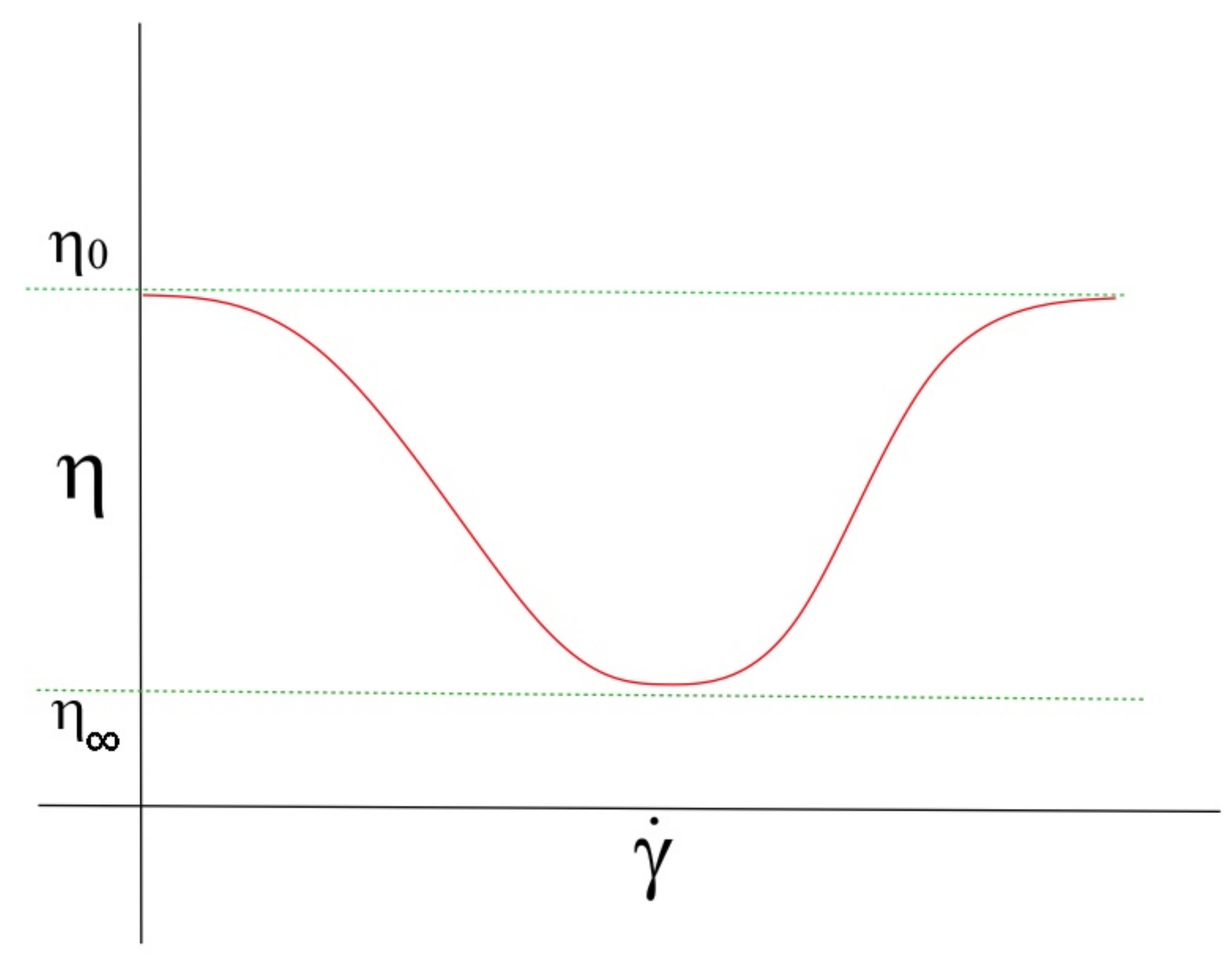
○ If the atmos in a liquid crystal have positional order, then it is a called a Nematic liquid crystal.
○ If the atmos in a liquid crystal have positional and partial orientational order, then it is a called a Nematic liquid crystal.
○ If the atmos in a liquid crystal have positional order, then it is a called a Smectic liquid crystal.
○ If the atmos in a liquid crystal have positional and partial orientational order, then it is a called a Smectic liquid crystal.

No, the answer is incorrect.
Score: 0
Accepted Answers:
If the atmos in a liquid crystal have positional and partial orientational order, then it is a called a Smectic liquid crystal.

4) Which of the following plots represent a Carreau fluid? ***1 point***

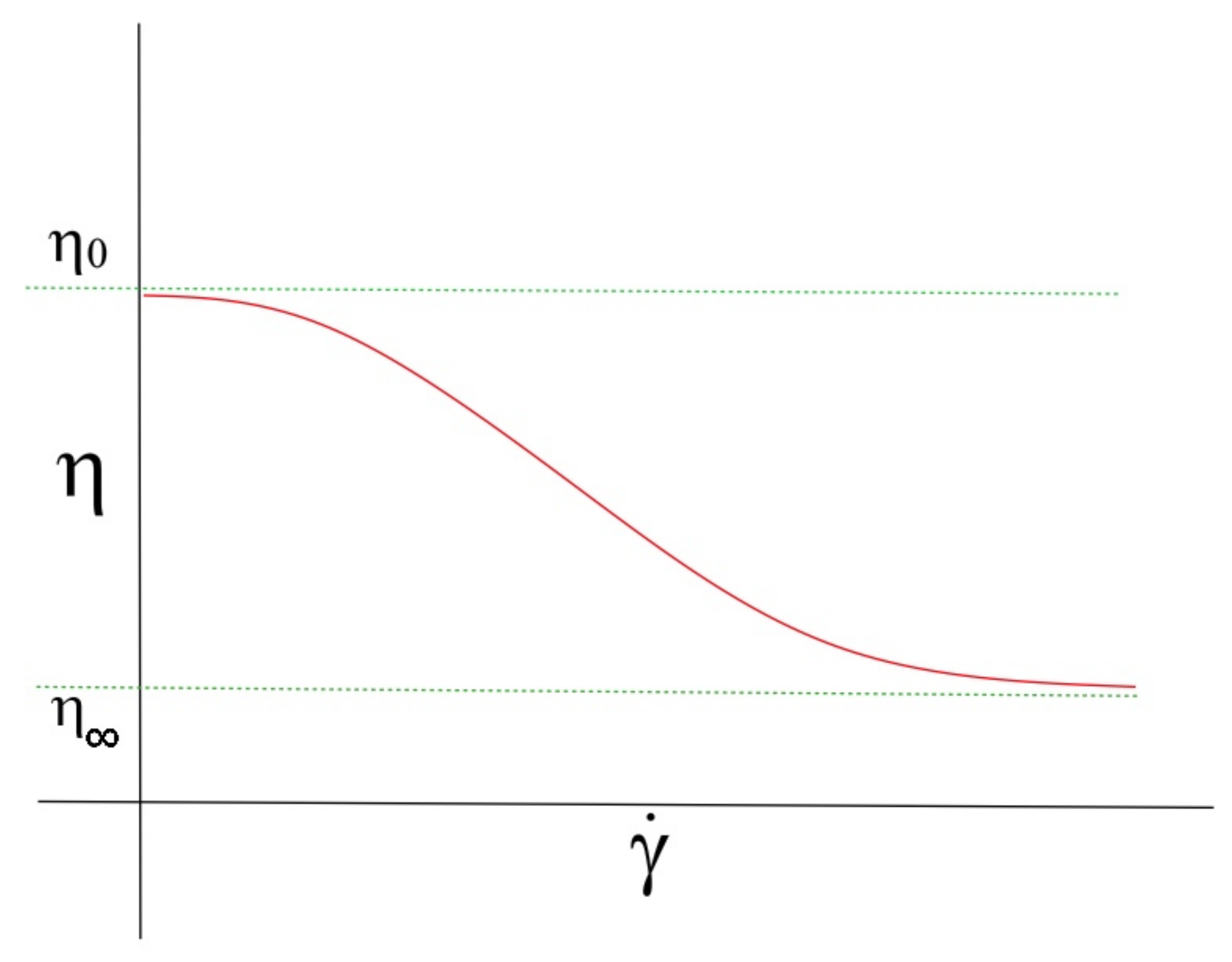
○


○


○


○ None of these

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



5) A Carreau fluid with $\eta_o = 0.08\ Pa\ s$ has a viscosity of 0.04 Pa s at the strain rate of 40 s^{-1} with n = 0.2 and characteristic time constant = 1s for the fluid. What is the infinite shear viscosity for the fluid? ***1 point***

○ 0.0325 Pa s
○ 0.0237 Pa s
○ 0.0183 Pa s
○ 0.0378 Pa s

No, the answer is incorrect.
Score: 0
Accepted Answers:
0.0378 Pa s

6) Given a velocity vector $\mathbf{V} = 4xyi + 3x^2zj + 5y^3zk$ where i, j and k are unit basis vectors. The strain-rate tensor is ? ***1 point***

○
$$\begin{bmatrix} 4y & 2x(2+3z) & 0 \\ 2x(2+3z) & 0 & 3(x^2+5y^2z) \\ 0 & 3(x^2+5y^2z) & 5y^3 \end{bmatrix}$$

○
$$\begin{bmatrix} 4y & x(2+3z) & 0 \\ x(2+3z) & 0 & 1.5(x^2+5y^2z) \\ 0 & 1.5(x^2+5y^2z) & 5y^3 \end{bmatrix}$$

○
$$\begin{bmatrix} 2y & 2x(2+3z) & 0 \\ 2x(2+3z) & 0 & 3(x^2+5y^2z) \\ 0 & 3(x^2+5y^2z) & 2.5y^3 \end{bmatrix}$$

○
$$\begin{bmatrix} 4y & 4x(2+3z) & 0 \\ 4x(2+3z) & 0 & 6(x^2+5y^2z) \\ 0 & 6(x^2+5y^2z) & 5y^3 \end{bmatrix}$$

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

$$\begin{bmatrix} 4y & x(2+3z) & 0 \\ x(2+3z) & 0 & 1.5(x^2+5y^2z) \\ 0 & 1.5(x^2+5y^2z) & 5y^3 \end{bmatrix}$$

7) For a power-law fluid with the relation: $\eta(\dot{\gamma}) = k|\dot{\gamma}|^{n-1}$, what are the range of values of n for which the fluid shows shear-thickening behavior? ***1 point***

○ $n > 1$
○ $n \geq 1$
○ $1 < n < 2$
○ $n = 2$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$n > 1$

8) What is the effective viscosity of a power-law fluid with strain, $\gamma(t) = 0.005t^2$, power-law index = 4 and constant term = 7 at time t = 15s? ***1 point***

○ 10 Pa s
○ 0.0236 Pa s
○ 0.0354 Pa s
○ 0.0428 Pa s

No, the answer is incorrect.
Score: 0
Accepted Answers:
0.0236 Pa s

9) Cosnider an infinitely long cylindrical geometry with two concentric cylinders. A certain Newtonian fluid is filled in the gap between them and the outer cylinder is rotated. Then the resulting flow is a simple shear flow. ***1 point***

○ True
○ False

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

10) A viscoelastic material with known second normal stress coefficient of 0.48 is subjected to a strain rate of 5 s^{-1} has the stress tensor A as shown below. ***1 point***

Then what is the numerical value of x?
$$\begin{bmatrix} 30 & 12 & 10 \\ 0 & 14 & 8 \\ 12 & 0 & x \end{bmatrix}$$

○ 12
○ 10
○ 6
○ 2

No, the answer is incorrect.
Score: 0
Accepted Answers:
2