

ABE 457
Spring 2018
Homework #4

Due: 2/12/18

1. Following data is obtained from the stress relaxation experiment on a food product. The food product is subject to a constant strain of 0.15.

Time (s)	Shear stress (Pa)
0	40.0
250	32.03
500	25.83
750	21.0
1000	14.31
2000	7.79
3000	5.39
4000	4.51
5000	4.24

Fit the data to an appropriate viscoelastic model and determine the model parameters.

2. The creep compliance function $J = \frac{\gamma}{\tau_0}$ for a creep compliance test for skim milk curd is given below. In this experiment, the sample is subjected to a constant stress τ_0 .

Time (s)	J ($\text{cm}^2 / \text{dyne}$)
0	0.0022
0.89	0.00249
2.01	0.00264
3.79	0.00293
8.93	0.00331
14.06	0.00355
18.97	0.00372
23.44	0.00386
28.71	0.00398
34.02	0.00408
44.20	0.00426
68.97	0.00458
93.75	0.00485
109.25	0.00499
118.97	0.00509

Fit the data to appropriate model and determine the model parameters.

3. Dynamic testing of a concentrated protein solution when subjected to a constant strain of 0.1 yielded the following data of amplitude of stress (τ_0) and phase angle (δ) at different frequencies:

ω (rad/s)	τ_0 (lbf/in ²)	δ (degrees)
0.02	0.604	82.4
0.04	0.824	75.96
0.1	1.676	72.65
0.2	3.4	61.93
0.5	4.12	60.95
1.0	7.2	56.31
2.0	12.8	51.34
10.0	25.6	38.66

Plot G' (storage modulus) and G'' (loss modulus) of the solution versus ω . Discuss the viscoelastic behavior of the solution at different frequencies.