

## Ph.D Qualifiers

### Biomedical Materials

What is the structural chemical difference between these two polymers , polyethylene and polypropylene, used for biomedical devices, and what/why are different methods required for their sterilization?

Cardiovascular Biomechanics Qualifier '08 Questions.

1. What is responsible for blood's non-Newtonian nature?
2. How is the velocity profile modified if you treat blood as a non-Newtonian Casson's fluid?
3. When or where in the vasculature do the non-Newtonian characteristics of blood become significant?
4. How do the various components of a muscular artery wall contribute to the stress vs. strain relation or elasticity of the artery?
5. Describe one mechanism or pathway (chemical, neurological...) which will cause a blood vessel to relax.
6. The Hagen-Poiseuille flow model,  $u = \frac{-\Delta p}{4\mu L}(a^2 - r^2)$ , is derived from the Navier-Stokes equation after making several assumptions. What are the assumptions and how reasonable do they seem?
7. Derive the volume flow rate,  $Q$ , of the Hagen-Poiseuille law.
8. What assumptions are made when applying Bernoulli's equation to find the pressure difference between two points in the vasculature?