Fluids lecture 4

- Fluid flow (Serway: 15.5 - 15.8)
  - Turbulence and Reynolds’ number
  - Energy transfer by the heart

Poiseuille’s Equation (1835)

\[ Q = \frac{\pi r^4}{8\eta L} \Delta P \]

Is it turbulent?

Determined by Reynolds’ number:

\[ N_R = \frac{L \nu \rho}{\eta} \]

where \( L = \) 
\( \nu = \)

Energy transfer by heart

- Force exerted by heart does work to pump blood

Area increased, and effect of viscosity decreased

narrow segment of fluid
Energy transfer by heart

Energy transferred = work done

\[ P \text{ fluid} \cdot A \]

\[ P \text{ fluid} \cdot A \]

\[ \text{energy transfer} = P_1 - 100 \text{torr} \]

\[ D \text{V} = 65 \text{cm}^3/\text{beat} \times 80 \text{beat/minute} \]

\[ \text{energy transfer} \]

Bernoulli's Equation

Energy conservation

Energy transferred by heart

\[ \text{Energy transferred} = \text{work done} \]

Energy transferred by heart
Bernoulli's Equation

Along a streamline, the sum of the

\[ P + \frac{1}{2} \rho v^2 + \rho g y \] = constant

Applying Bernoulli - tennis

Applying Bernoulli - atomiser

Applying Bernoulli - lift

Along a streamline, the sum of the

\[ p + \frac{1}{2} \rho v^2 + \rho g y \] = constant

Bernoulli's Equation
Applying Bernoulli - tennis

Pressure contours

Velocity vectors