

7. a)

$$Re = \frac{\rho V_{avg} D}{\mu}$$

$$= \frac{1650 \times 50 \times 0.06}{0.446 \times 10^{-3}}$$

$$\approx \underline{2200}$$

Reynolds number  $\leq 2300$  is a laminar flow  
in circular pipes

b)

$$Re = \frac{DV}{\nu}$$

=

$$c) Re_i = \frac{N_i D_i^2 \rho}{\mu}$$

$\mu$  - ~~Kinematic~~ <sup>velocity</sup> ~~viscosity~~ of the fluid.  
 $\nu$  - Kinematic viscosity of the fluid  
 $N_i$  - ~~viscosity~~ length of pipe

$D_i$  - Hydraulic diameter.

9a) Yield stress which essentially means that it behaves as a fluid above the yield stress. It also behaves like a solid below a stress level.

b) i) Pseudoplastic  
Non-Newtonian - changes when shear rate is increased or reduced.

ii) Thixotropic  
Newtonian - Does not change with change in shear rate.

c) There will be no change. It is a Newtonian liquid.

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a - Use of Alternate raw materials  
- Providing quality water, food and chemicals

b. Feedstock price  
Process conditions  
Innovation potential.

c) It does not provide the impact of waste used and the nature of the waste as well is not considered.

d)

$$\% \text{ yield} = \frac{\text{actual mass}}{\text{theoretical mass}}$$