

**SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY
DEPARTMENT OF METALLURGICAL ENGINEERING**

MET 422
MI 223

HQ 1
(closed book)

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Noon

1. Write Newton's Law of Viscosity and give the units of each quantity in the equation. Use the CGS system of units.
2. Derive the equation showing the velocity profile for flow in a vertical tube. Only gravity causes the fluid to flow.
3. Derive an equation showing the laminar velocity distribution between two vertical flat plates. One plate (the one at $x = 0$) is stationary while the second plate (the one at $x = \delta$) is moving upward at velocity U . Assume the z direction is down.
4. Fluid Velocity down a plane inclined angle β from the vertical
where ρ = density
 g = gravitational constant
 d = layer thickness
 x = distance from the fluid surface towards the inclined plane
 n = viscosity
5. Derive an equation for the volume rate of flow along an plane inclined downward from the horizontal by angle β .