1) While making the shell momentum balance on a fluid flowing in a circular tube, the assumptions that we made is
a) Flow is fully developed
b) There is no end effect
c) Flow must be incompressible
d) All the above

Ans. (d)

2) For the flow to occur through a horizontal pipe, what is the condition of pressure at inlet ($p_{in}$) and pressure at outlet ($p_{out}$) of the pipe.
a) $p_{in} > p_{out}$
b) $p_{in} < p_{out}$
c) $p_{in} = p_{out}$
d) None of the above

Ans. (a) There must be higher pressure in the inlet to force the fluid to move through the pipe to the outlet. If $p_{in} < p_{out}$ flow will be in the reverse direction and if $p_{in} = p_{out}$ then the fluid will remain stationary in its position.

3) The maximum velocity for the laminar flow through a pipe is given as
a) $v_{max} = (\Delta PR^2)/(2\mu L)$
b) $v_{max} = (\Delta PR^2)/(4\mu L)$
c) $v_{max} = (\Delta PR^2)/(6\mu L)$
d) $v_{max} = (\Delta PR^2)/(8\mu L)$

Ans. (b)
Since, $v_x = \frac{\Delta PR^2}{4\mu L}\left[1-\left(\frac{r}{R}\right)^2\right]$
And $V_{max} = \Delta R^2 / 4\mu L$, at r = 0

4) While deriving Hagen-Poiseuille's equation using Navier Stoke's equations, the initial conditions of velocity that we considered are
a) $v_r = v_z = 0$ , and $\partial v_\Theta/\partial\Theta = 0$
b) $v_r = v_\theta = 0$ , and $\partial v_z/\partial z = 0$
c) $v_z = v_\theta = 0$ , and $\partial v_r/\partial r = 0$
d) None of these

Ans. (b)

5) If an incompressible fluid is flowing between two vertical coaxial cylinders, such that outer one is stationary and inner one is rotating at an angular velocity ω. Then, it can be stated that

a) $v_z = v_\theta = 0$ , and $\partial v_r/\partial r = 0$

b) $v_z = v_r = 0$ , and $\partial v_\Theta/\partial \Theta = 0$

c) $v_\Theta = v_r = 0$ , and $\partial v_z/\partial z = 0$

d) None of these

Ans. (b)

6) Shell momentum balance inside a pipe is valid, if fluid is:

a) Compressible and Newtonian

b) Compressible and Non-Newtonian

c) Incompressible and Newtonian

d) Incompressible and Non-Newtonian

Ans. (c)

7) Shell momentum balance inside a pipe is valid, if flow is:

a) Laminar and un-steady state

b) Laminar and one dimensional steady state

c) Turbulent and one dimensional steady state

d) Turbulent and un-steady state

Ans. (b)

8) If flow is fully developed with no end effects inside a pipe, then momentum by bulk flow:

a) Momentum in > momentum out

b) Momentum in < momentum out

c) Momentum in = momentum out

d) All of the above

Ans. (c)

9) When a Newtonian fluid is flowing through a pipe, velocity at the wall is

(a) Zero

(b) Minimum

(c) Maximum

(d) None of these

Ans. (a)

10) Fanning friction factor for a flow of Newtonian fluid through slit is

(a) $f = 28/N_{Re}$

(b) $f = 24/N_{Re}$

(c) $f = 20/N_{Re}$
(d) $f = 16/N_{Re}$

Ans. (d)

$f = \tau_s / (\rho v^2/2) = ((\Delta p_f \times \pi R^2) / 2\pi RL / (\rho v^2/2) = (\Delta p_f R)/ L\rho v^2 = (\Delta p_f D)/ 2L\rho v^2$

or, $\Delta p_f = 2f L\rho v^2 / D = 4f L\rho v^2 /2D$

And, $\Delta p_f = 32 \mu vL / D^2 = 4f\rho (L /D)(v^2/2)$

or, $f = 16 / (\rho vD/\mu)$, or $f = 16/N_{re}$ (for Laminar flow)