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General Physics I, Quiz 4
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Quiz-4 Solution

1. **Solution : *(Similar to problem no. 47, chap.14, text book 8th edition)***

(a) Using Bernoulli's equation we write

$P_1 + \rho v_1^2 / 2 = P_2 + \rho v_2^2 / 2$

$P_1 - P_2 = \rho (v_2^2 - v_1^2)/2 = \rho v_1^2 [(A_1/A_2)-1]/2 = 15/2\ \rho v_1^2$

$\Delta P = 15x\ 350\ v_1^2$

$v_1 = \sqrt{(3500 / 5250)} = \sqrt{(0.66)} = 0.81$ m/s

So, $v_2 = (A_1/A_2)\ v_1 = 4 \times 0.81 = 3.25$ m/s (Outlet velocity)

(b) We know, F= ma = (m/t)v

Given flow rate $(v_2A_2) = 1000\ cm^3/sec$ = volume / sec

We can write

Mass / time = Density (ρ) x (Volume /sec)

= $700\ kg/m^3 \times 0.001\ m^3/sec$

= 0.7 kg/ sec

So, $F = (m/t)\ v_2 = 0.7 \times 3.25 = 2.3$ N

We know from equation of continuity, $v_1 A_1 = v_2 A_2$

Or, $A_1/A_2 = v_2/v_1$,

Or , $v_2/v_1 = A_1/A_2 = (4/2)^2 = 4$

[A= area= πr^2]

$\rho = 700\ kg/m^3$

$\Delta P = 3.5 \times 10^3$ Pa

ρ = mass / volume

2. **Solution: *(Similar to problem no. 39, chap.15, text book 8th edition)***

(a) We know that the angular frequency of damped oscillation is given by

$\omega = \sqrt{[\omega_0^2 - (b/ 2m)^2]}$

$= \sqrt{[205^2 - (5/200)^2]}$

= 205/sec

So we can write the linear frequency

$f = \omega/2\pi = 205/ (2 \times 3.14) = 32.7 \sim 33$Hz

(b) Oscillation can be considered as SHO

Given,
b = damping coefficient
= 5.00 N. s/m
m = 100 kg

We know the angular frequency of un-damped oscillation is

$\omega_0 = \sqrt{k/m}$

$\omega_0 = (2.05 \times 10^4/100)$/sec

= 205/sec

3. **Solution: *(It is very fundamental question from wave motion. Almost similar to problem no. 11+15, chap.16, text book 8th edition)***

(a) 1- is transverse and 2- is longitudinal wave.

(b) Frequency, $f = v/\lambda = 20/2.0 = 10$ Hz

Angular frequency, $\omega = 2\pi f = 2 \times 3.14 \times 10 = 63$/sec

(c) Wave number , $k = 2\pi/\lambda = 2 \times 3.14/ 2.0 = 3.14$ rad/m

(d) $y = A \sin(kx - \omega t + \varphi) = (0.01m) \sin(3.14x/m - 63t/s + 0)$

$y = (0.01m) \sin(3.14\ x/m - 63t/s)$, since it started from origin (0, 0).