Fluids #5

p 389 Reading 95, 96, 98
p 414 mc 3
p 415 Problem 1, 4, 5
Online - Block Suspend Water

(9)

p389 - Reading

95) free diver — Pressure of water

$h = 209.6m$

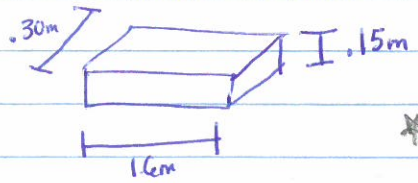
$P = P_{atm} + \rho_{water} g h$

(3)

$= 1.0 \times 10^5 N/m^2 + (1025 kg/m^3)(9.81 m/s^2)(209.6m)$

$= 2.2 \times 10^6 N/m^2$

96) $F_g = 670N$
$\ell = 1.6m$
width = .30m
thick = .15m



F_{water} exerts on one side body

$F_{side} = P A_{side} = P(\ell \cdot w)$
$= (2.2 \times 10^6 N/m^2)(1.60m)(.30m)$
$= 1.1 \times 10^6 N$

* online changes P so calc new P

98) As he descends F_B what happen to F_B?

- F_B remains the same

F_B = weight displaced fluid

p 414 – Multiple Choice

3) river flows downstream + widens, flow speed slows. Compare pressure on dock downstream to up

(1)

$$P_2 + \frac{1}{2}\rho V_2^2 + \rho g y_2 = P_1 + \frac{1}{2}\rho V_1^2 + \rho g y_1$$

$$P_{down} + \frac{1}{2}\rho V_{down}^2 = P_{up} + \frac{1}{2}\rho V_{up}^2$$

since $V_{down} < V_{up}$ $P_{down} > P_{up}$ to balance

– Problems

1) water flowers

a) flowrate = ?

$V_1 = 32\ cm/s = .32\ m/s$

$r_1 = 1.2cm = .012m$

$Q_1 = A_1 V_1 = \pi r_1^2 V_1$

$= \pi (.012m)^2 (.32m/s)$

(1)

$Q_1 = 1.4 \times 10^{-4}\ m^3/s$

b) second hose connect

$r_1 = 1.0cm = .010m$

$V_2 = ?$

$A_1 V_1 = A_2 V_2$

$\pi r_1^2 V_1 = \pi r_2^2 V_2$

$$V_2 = \frac{r_1^2 V_1}{r_2^2} = \frac{(.012m)^2 (.32m/s)}{(.010m)^2}$$

$V_2 = .46\ m/s$

4) main waterline delivers water

$Q_{max} = .010\ m^3/s$
$v = .30\ m/s$
$r = ?$

(1)

$Q = Av = \pi r^2 v$

$r = \sqrt{\frac{Q}{\pi v}} = \sqrt{\frac{(.010\ m^3/s)}{\pi (.30\ m/s)}}$

$r = .10\ m$

5) flow rate of blood in aorta

$Q = 80\ cm^3/s$
$\# = 6 \times 10^9$ capillaries
$r = 8.0 \times 10^{-4}\ cm$
$V = ?$

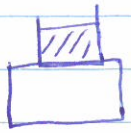
(1)

$Q = Av$
$Q = N \pi r^2 v$

$V = \frac{Q}{\# \pi r^2} = \frac{80\ cm^3/s}{(6 \times 10^9)\pi (8.0 \times 10^{-4}\ cm)}$

$V = 6.6 \times 10^{-3}\ cm/s$

- Online - Block Suspended in water



- Flask of water on scale reads 100N
- Small block submerge in water

a) new reading on scale

- 100N
- greater than 100N
- less than 100N
- Can't determine

~~cattle horse~~ → now has F_g block

b) experiment repeated w 6 blocks

	mass	volume
A	100	50
B	100	200
C	200	50
D	50	100
E	200	100
F	400	50

Rank blocks based on scale reading

$F_B = \rho g V$ (fluid, block)

B D E A C F

↑ Volume block ↑ F_B

c) Blocks released while submerge, which sink?

$\rho = m/V$ $\rho_{water} = 1.0 g/cm^3$

$\rho_A = 2$
$\rho_B = .5$
$\rho_C = 4$
$\rho_D = .5$
$\rho_E = 2$
$\rho_F = 8$

Anything denser will sink

A C E F