P282 35, 36, 38, 40, 43, 44, 82 – 86

(35) $A_1 v_1 = A_2 v_2$

$\pi r_1^2 v_1 = A_2 v_2$

$$v_2 = \frac{\pi r_1^2 v_1}{A_2} = \frac{\pi (1.2\times10^{-2})^2 (.4)}{2\times10^{-4}} = \underline{0.90} \text{ m/s}$$

(36) $A_1 v_1 = A_2 v_2 = \frac{V_2}{t}$

$$v_1 = \frac{V_2}{A_1 t} = \frac{(9.2\times5\times4.5)}{\pi(.15)^2(16\times60)} = \underline{3.1 \text{ m/s}}$$

(38) $\cancel{P_1} + \rho g y_1 + \cancel{\tfrac{1}{2}\rho v_1^2} = \cancel{P_2} + \cancel{\rho g y_2} + \tfrac{1}{2}\cancel{\rho} v_2^2$

Both ends open to atmosphere $P_1 = P_2$

Velocity at top = 0

position at bottom = 0

$$v_2 = \sqrt{2gy_1} = \sqrt{2(9.8)(4.6)} = \underline{9.5 \text{ m/s}}$$

(40) $P_1 + \cancel{\rho g y_1} + \cancel{\frac{1}{2}\rho v_1^2} = P_2 + \rho g y_2 + \cancel{\frac{1}{2}\rho v_2^2}$

Starting height = 0
Velocity same at both points $v_1 = v_2$
P_2 is atmospheric pressure.

$P_1 = P_0 + \rho g y_2$

$P_1 = P_0 + P_{Gauge}$

$P_{Gauge} = P_1 - P_0$

$P_{Gauge} = \rho g y_2$

$= (1\times10^3)(9.8)(15) = \underline{1.5\times10^5 \ Pa}$

(43) $P_1 + \cancel{\rho g y_1} + \frac{1}{2}\rho v_1^2 = P_2 + \cancel{\rho g y_2} + \cancel{\frac{1}{2}\rho v_2^2}$

flat $y_1 = y_2$
velocity inside, $v_2 = 0$

Net force $= \Delta P A = P_{inside} - P_{outside} = P_2 - P_1$

$F = \frac{1}{2}\rho v_1^2 A$

$= \frac{1}{2}(1.29)(35)^2(240)$

$\underline{F = 1.9\times10^5 \ N}$

(44) $P_1 + \cancel{\rho g y_1} + \frac{1}{2}\rho v_1^2 = P_2 + \cancel{\rho g y_2} + \frac{1}{2}\rho v_2^2$

top and bottom of wing are about
the same height $y_1 = y_2$

$$P_1 - P_2 = \frac{1}{2}\rho\left(v_2^2 - v_1^2\right)$$

$$\text{lift} = F = \Delta P A$$

$$F_{lift} = \frac{1}{2}\rho A\left(v_2^2 - v_1^2\right)$$

$$= \frac{1}{2}(1.29)(78)(260^2 - 150^2)$$

$$= \underline{2.3 \times 10^6\ N}$$

(82) $A_1 V_1 = A_2 V_2$

$$\frac{\cancel{\pi} d^2}{\cancel{4}} V_0 = \frac{\cancel{\pi} d_1^2}{\cancel{4}} V_1$$

$$V_1 = \frac{d^2 V_0}{d_1^2}$$

$$\cancel{P_0} + \cancel{\rho g y_0} + \frac{1}{2}\cancel{\rho} v_0^2 = \cancel{P_1} + \cancel{\rho} g y_1 + \frac{1}{2}\cancel{\rho} v_1^2$$

$P_0 = P_1$ both open to atmosphere.

$y_0 = 0$

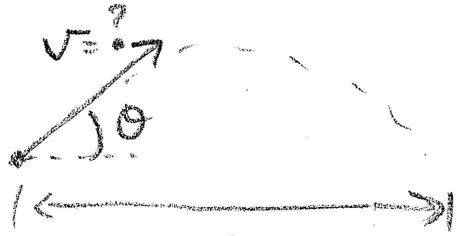
$$\frac{1}{2} v_0^2 = g y_1 + \frac{1}{2} \frac{d^4 v_0^2}{d_1^4}$$

$$v_0^2 = 2 g y_1 + \frac{d^4 v_0^2}{d_1^4}$$

$$d_1^4 = \frac{d^4 v_0^2}{v_0^2 - 2 g y_1}$$

$$d_1 = \sqrt[4]{\frac{d^4 v_0^2}{v_0^2 + 2 g y_1}}$$

(83) (a)



x

$V = V_0 \cos\theta$

$a = 0$

$x = 8$

$t =$

$x = v_0 t + \cancel{\frac{1}{2} a t^2}$

$t = \frac{x}{V_0} = \frac{x}{V_0 \cos\theta}$

y

$v = V_0 \sin\theta$

$a = -9.8$

$y = 0$

$t =$

$\cancel{y} = v_0 t + \frac{1}{2} a t^2$

$-V_0 \cancel{t} = \frac{1}{2} a t^{\cancel{2}}$

$\cancel{-} V_0 \sin\theta = \frac{1}{2}(\cancel{-} g) t$

$V_0 \sin\theta = \frac{g x}{2 V_0 \cos\theta}$

$V_0 = \sqrt{\frac{g x}{2 \sin\theta \cos\theta}}$

$V_0 = \sqrt{\frac{(9.8)\,8}{2 \sin 35 \cos 35}}$

$V_0 = 9.13 = \underline{9.1\ m/s}$

(b) Volume flow rate

$$= A v \times 4$$

$$= \frac{\pi d^2}{4} v \times 4$$

$$= \frac{\pi (3\times10^{-3})^2}{\cancel{4}} (9.13) \times \cancel{4}$$

$$= 2.58 \times 10^{-4}\ m^3/s$$

$$= \underline{0.26\ L/s}$$

(c)

$$\underbrace{A_1 V_1}_{\text{part (b)}} = A_2 V_2$$

$$V_2 = \frac{4Q}{\pi d^2} = \frac{4(2.58\times10^{-4})}{\pi (1.9\times10^{-2})^2} = \underline{0.91\ m/s}$$

(84) (a) $\cancel{P_1} + \rho g y_1 + \cancel{\frac{1}{2}\rho v_1^2} = \cancel{P_2} + \cancel{\rho g y_2} + \frac{1}{2}\rho v_2^2$

$$g y_1 = \frac{1}{2} v_2^2$$

$$v = \sqrt{2 g y_1} = \sqrt{2(9.8)(.5)}$$

$$v = 3.130 = \underline{3.1 \text{ m/s}}$$

(b) $Q = Av = \pi r^2 v$

$$= \pi (1\times10^{-2})^2 (3.130)$$

$$= 9.833 \times 10^{-4} \text{ m}^3/\text{s}$$

$$Q = \frac{V_{sink}}{t}$$

$$t = \frac{V_{sink}}{Q} = \frac{.48(4\times10^{-2})}{9.833\times10^{-4}} = 19.52$$

$$\underline{t = 20 \text{ s}}$$

(85) $\cancel{P_1} + \rho g y_1 + \cancel{\frac{1}{2}\rho v_1^2} = \cancel{P_2} + \cancel{\rho g y_2} + \frac{1}{2}\rho v_2^2$

$$\cancel{\rho} g y_1 = \frac{1}{2}\cancel{\rho} v_2^2$$

$$v = \sqrt{2 g y_1}$$

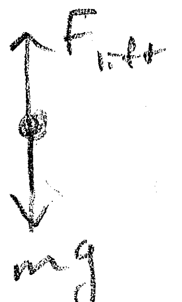
$$Q = Av = \pi r^2 v$$

$$= \pi r^2 \sqrt{2 g y_1}$$

$$= \pi(.6\times10^{-2})^2 \sqrt{2(9.8)(0.64)}$$

$$= \underline{4.0\times10^{-4}\ m^3/s}$$

(86)



$\Sigma F = 0$

$F_{lift} = mg \qquad F_{lift} = \Delta P_0 A = (P_{bot} - P_{top})A$

P

$P_1 + \cancel{\rho g y_1} + \frac{1}{2}\rho v_1^2 = P_2 + \cancel{\rho g y_2} + \frac{1}{2}\rho v_2^2$

$y_1 \simeq y_2$

P_1 = bottom $\quad P_2$ = top

$P_1 - P_2 = \Delta P = \frac{1}{2}\rho v_2^2 - \frac{1}{2}\rho v_1^2$

$$\Delta P = \frac{mg}{A} = \frac{1}{2}\rho(v_2^2 - v_1^2)$$

$$v_2 = \sqrt{\frac{2mg}{\rho A} + v_1^2}$$

$$= \sqrt{\frac{2(2\times10^6)(9.8)}{(1.29)(1200)} + (95)^2}$$

$$v_2 = 185 = \underline{190 \text{ m/s}}$$