Phys 4A Chapter 2 Solutions

Chapter 2: 7, 11, 13, 16, 23, 27
31, 35, 41, 49, 60, 69

(7) $\bar{v} = \frac{\Delta x}{\Delta t} = \frac{(1500 + 40{,}000 + 10{,}000)\,m}{(3600 + 48(60) + 29)\,s}$

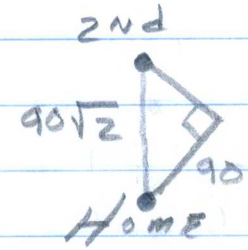
$= 7.91 \frac{m}{s}$

(11) $\frac{1\,m}{s}\left(\frac{3600\,s}{hr}\right)\left(\frac{1\,mile}{1609\,m}\right)$

$= 2.24 \frac{mi}{hr}$

$\Rightarrow 1 \frac{m}{s} = 2.24 \frac{mi}{hr}$

(13) DISTANCE BETWEEN 2nd AND HOME:



NEED TIME of pitch +
TIME of catch +
TIME of throw $\leq$ 3.4 s

$$\text{TIME of pitch} = \frac{61\,\text{ft}}{\left(\frac{90\,\text{mi}}{\text{hr}}\right)\left(\frac{5280\,\text{ft}\cdot\text{hr}}{3600\,\text{s}\cdot\text{mi}}\right)}$$

$$= .462\,\text{s}$$

$$\text{TIME of throw} = \frac{90\sqrt{2}}{\text{speed of throw}}$$

$$\leq 3.4 - .45 - .462$$

$$= 2.49\,\text{s}$$

$$\Rightarrow \text{speed of throw} \geq \frac{1}{(2.49)} \cdot 90.\sqrt{2}\,\text{ft}$$

$$\Rightarrow \text{speed of throw} \geq 51.1\,\frac{\text{ft}}{\text{s}}$$

$\Rightarrow$ speed of throw $\geq 51.1 \frac{ft}{s}$

$= (51.1)\left(\frac{3600}{5280}\right) \frac{mi}{hr}$

$= 34.8 \frac{mi}{hr}$

(16) $V_{ME} = 9 \frac{m}{s} = 1.2 V_B$

$V_B = \frac{9}{1.2} \frac{m}{s} = 7.5 \frac{m}{s}$

t_{ME} : $x_f = x_0 + V_{ME} t_{ME}$

$100 = 0 + 9 t_{ME}$

$t_{ME} = \frac{100}{9} = 11.11 \text{ s}$

t_B : $t_B = \frac{100}{7.5} = 13.33 \text{ s}$

HEAD START $= t_B - t_{ME} = 2.22 \text{ s}$

(23) (a) $y = bt - ct^2$

$$v = \frac{dy}{dt} = b - 2ct$$

$$= 82 - 9.8t$$

(b) $v = 0 = 82 - 9.8t$

$$t = 8.4\ s$$

(27) $$\bar{a} = \frac{v_f - v_i}{t_f - t_i} = \frac{4.50 \times 10^5 \frac{m}{s} - 0}{3600\ s}$$

$$= 125\ \frac{m}{s^2}$$

(31) $$v_f = \frac{3.20 \times 10^5}{3600} \frac{m}{s} = 88.89\ \frac{m}{s}$$

$$\Delta t = \frac{v_f - v_i}{\bar{a}} = \frac{88.89\ \frac{m}{s}}{2.9\ \frac{m}{s^2}}$$

$$\Rightarrow \Delta t = 30.7\ s$$

(35) $x = bt^3 - ct^2 + dt$

$$v = \frac{dx}{dt} = 3bt^2 - 2ct + d$$

$$a = \frac{dv}{dt} = 6bt - 2c$$

$$\Rightarrow a = 18t - 16$$

(41) (a) $v_f^2 = v_0^2 + 2a(x_f - x_0)$

$$(2.8)^2 = 0^2 + 2a(85)$$

$$\Rightarrow a = .046 \frac{km}{s^2}$$

(b) $v_f = v_0 + at$

$$t = \frac{2.8}{.046} = 60.7\ s$$

(49) $v_f^2 = v_0^2 + 2a(x_f - x_0)$

$32^2 = 18^2 + 2a(0 - .35)$

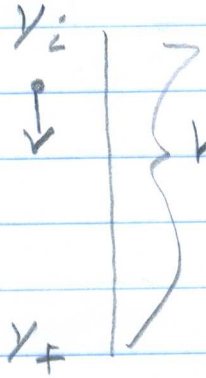
$\Rightarrow \quad a = -1000\ m$

$\Rightarrow \quad v_f = v_0 + at$

$32 = 18 - 1000t$

$t = \frac{14}{1000} = 14\ ms$

(60)

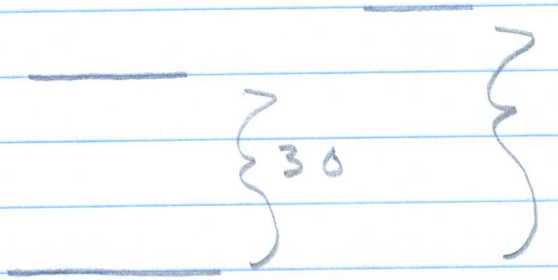


$= v_i t + v_0 t + \frac{1}{2} a t^2$

$0 = v_i + 0 + \frac{1}{2}(-9.8)(4.4)^2$

$v_i = h = 27.51\ m$

(69)



Minimum downward speed requires that bird dives as soon as fish is dropped.

$\Rightarrow$ TIME for fish to reach water:

$$y_f = y_i - \frac{1}{2} g t^2$$

$$0 = 30 - \frac{1}{2}(9.8) t^2$$

$$\Rightarrow t = \sqrt{\frac{60}{9.8}} = 2.47$$

v_i for diving fish:

$$0 \geq y_f = y_i + v_i t - \frac{1}{2} g t^2$$

$$0 \geq 35 + v_i (2.47) - \frac{1}{2}(9.8)(2.47)^2$$

$$\Rightarrow v_i \leq -2.07 \frac{m}{s}$$

NOTE: NEGATIVE SIGN INDICATES INITIAL VELOCITY IS DOWNWARD