Chap 1

16 a) $\Delta X = v_1 t_1 + v_2 t_2 = 40 \times 1 + 60 \times 2 = 160 Km$

b) average velocity $= \frac{\Delta X}{\Delta t} = \frac{160}{1+2} = 53.33\ Km/h$

17) $\Delta X = 100\ Km$ $\quad \Delta t = 2h$ $\quad \bar{v}_1 = 40 km/h$ $\quad t_1 = 1.5 h$

$t_2 = 0.5 h$ $\quad \bar{v}_2 = ??$

$$\Delta X = \bar{v}_1 t_1 + \bar{v}_2 t_2 \Rightarrow \bar{v}_2 = \frac{\Delta X - \bar{v}_1 t_1}{t_2} = \frac{100 - 40 \times 1.5}{0.5} = 80 Km/h$$

26) 4Km ↑ ↓ 6km

$\Delta X = 6 - 4 = 2 Km \Rightarrow$ a) $\bar{v} = \frac{\Delta X}{\Delta t} = \frac{2}{4} = 0.5\ Km/h$

$D = 6 + 4 = 10\ Km \Rightarrow$ b) $\bar{speed} = \frac{D}{\Delta t} = \frac{10}{4} = 2.5\ Km/h$

28) $v(t = 5s) = \frac{50}{5} = 10\ m/s$ (it is the slope of the curve)

$v(t = 15s) = 0$

$v(t = 25s) = \frac{-100}{5} = -20\ m/s$

$v(t = 35s) = \frac{100}{10} = 10\ m/s$

33) $\Delta X = 100m$ $\quad v_{max} = 12.5\ m/s$ $\quad \Delta t = 9.9s$

$\bar{v} = \frac{\Delta X}{\Delta t} = \frac{100}{9.9} \approx 10.1\ m/s$

Since average velocity is smaller than the maximum velocity, so these number are consistent

38) $v_0 = 20 m/s$ $\quad a = -2 m/s^2$ $\quad v = 0$

$\Delta X = \frac{v^2 - v_0^2}{2a} = 100\ m$

43) $v_0 = 0$ $a = +4 m/s^2$, $\Delta t = 5 s$

a) $\Delta X = v_0 t + \frac{1}{2} a t^2 = 2t^2 = 2 \times (5)^2 = 50 m$

b) $v = v_0 + at = 4t = 4 \times 5 = 20 m/s$

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a) object is at rest from t_2 to t_3

b) it is moving at constant velocity from "o" to T_1

c) it has a positive velocity from (o) to T_2

d) it has a negative velocity from T_3 to T_4

e) it has a positive acceleration from T_3 to T_4 ($v \nearrow$)

f) it has a negative acceleration from T_1 to T_2 (because the velocity is diminishing to zero at T_2)

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$\vec{v}_c \uparrow \uparrow \vec{v}_g$

down stream

$\Delta t_1 = 2h$

$\Delta X = (v_g + v_c) \Delta t_1$

$12 = (v_g + v_c) \times 2$

$6 = v_g + v_c$ (1)

$\vec{v}_c \uparrow \downarrow \vec{v}_g$

return trip

$\Delta t_2 = 3h$

$\Delta X = (v_g - v_c) \Delta t_2$

$12 = (v_g - v_c) \times 3$

$4 = v_g - v_c$ (2)

(v_g = velocity of girl
v_c = current velocity)

So $v_c = 6 - 4 = 1 km/h$

$v_g = \frac{10}{2} = 5 Km/h$

80) $v_0 = 0 m/s$ $\Delta X = 12 m$ $\Delta t = 4 s$

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

$12 = \frac{a}{2} \times (4)^2 \Rightarrow a = 1.5 m/s^2$

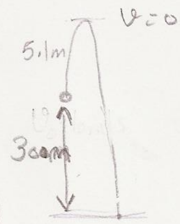
$v = 4 m/s$
$t = ?$

$v = v_0 + at = 1.5 t$

$4 = 1.5 t \Rightarrow t = 2.67 s$

86 at the maximum height $v=0$

$v_0 = 10 m/s$ $a = -g = -9.8 m/s^2$



(a) $v^2 = v_0^2 - 2g\Delta Y$

$\Delta Y = 5.1 m$

The sand bag started from 300 above the ground.

its total height = 300 m + 5.1 m = 305.1 m

(b) suppose that the position of The Sandbag after 5sec is $h = 300 + h_1$

$h_1 = v_0 t + \frac{1}{2} a t^2$, $v_0 = 10 m/s$

$= 10 \times 5 - \frac{1}{2} 9.8 \times 25 = 122.5 m$

$h = 300 + 5.1 - 1.225 = 227.5 m$

$v = v_0 - gt$

$= 10 - 9.8 \times 5 = -39 m/s$

c) when the sandbag hit the ground $h=0$

$0 = 300 + v_0 t - \frac{1}{2} g t^2 = 300 + 10t - \frac{9.8}{2} t^2$

$t = 8.91$ sec. or $\boxed{t = -6.87 \text{ sec}}$ ignore.

OR

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

$Y - Y_0 = v_0 t - \frac{g}{2} t^2$

$0 - 300 = 10t - \frac{9.8}{2} t^2$

$0 = 300 + 10t - \frac{9.8}{2} t^2$

$t = 8.91$ sec

$\{ Y = 0$

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The depth of the well ΔY , t_1 time for the rock to reach the bottom of the well.

starting from rest so $U_0 = 0$ $\qquad \Delta Y = ?$

$\Delta Y = U_0 t + \frac{1}{2} a t_1^2 \Rightarrow \Delta Y = \frac{1}{2} a t_1^2 = -\frac{9.8}{2} t_1^2$

$|\Delta Y| = \left| -\frac{9.8}{2} t_1^2 \right|$ ①

The Sound takes $(3 - t_1)$ sec to travel ΔY from the bottom of the well to the dropper.

$\Delta Y = v_{sound} (3 - t_1) = 344 (3 - t_1)$ ②

The velocity of Sound is constant = 344 m/s so the acceleration = 0

from 1 and 2

$\frac{9.8}{2} t_1^2 = 344 (3 - t_1)$

so $t = 2.88$ sec

$\Delta Y = -4.9 (2.88)^2 = 40.64$

$v_0 = 10 m/s$

$v = 0$

~~ΔY=~~ $v^2 = v_0^2 \cancel{+} - 2g\Delta Y$

$\Delta Y = \frac{10^2}{2\times 9.8} = \frac{100}{19.6} = 5.1 m$

∴ maximum height = 305.1 m

after 5 sec

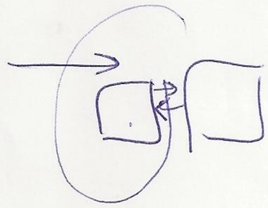
$\Delta Y = v_0 t - \frac{1}{2} g t^2$

$= 10\times 5 - \frac{9.8}{2} \times 25$

$= 50 - 4.9\times 25 = 1,225$

its position

305 - 12



$m_1 a = \underline{F} - \underline{f_{21}}$

$2\times 1 = 5 - f_{21}$

$f_{21} = 5 - 2 = 3N$.