p 40 33 - 47 odd

(33) $u = 0$
$a = -9.81 ms^{-2}$
$t = 3.25s$

$s = ut + \frac{1}{2}at^2 = \frac{1}{2}(-9.81 ms^{-2})(3.25s)^2$
$= -51.8$

∴ the cliff is 51.8 m high

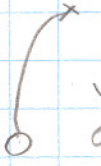
(35) $u = 0$
$a = -9.81 ms^{-2}$
$s = -380m$

(a) $s = ut + \frac{1}{2}at^2$
$t = \sqrt{\frac{2s}{a}}$
$= \sqrt{\frac{2(-380m)}{(-9.81 ms^{-2})}}$
$t = 8.8s$

(b) $v^2 = u^2 + 2as$
$= \sqrt{2(-9.81 ms^{-2})(-380m)}$
$v = -86 ms^{-1}$

(37) $u = ?$
$s = 0$
$a = -9.81 ms^{-2}$
$t = 3.0s$

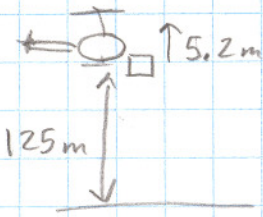
$s = ut + \frac{1}{2}at^2$
$u = -\frac{1}{2}at$
$= -\frac{1}{2}(-9.81 ms^{-2})(3.0s)$
$u = 14.715 ms^{-1}$



$u = 14.715 ms^{-1}$
$v = 0$
$a = -9.81 ms^{-2}$
$s = ?$
$v^2 = u^2 + 2as$
$s = \frac{-u^2}{2a}$
$= \frac{-(14.715 ms^{-1})^2}{2(-9.81 ms^{-2})}$
$s = 11.03m$

speed thrown = $15 ms^{-1}$
height = 11 m

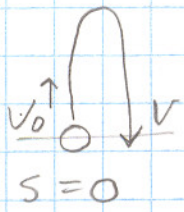
(39)



$u = 5.2 ms^{-1}$
$s = -125m$
$a = -9.81 ms^{-2}$
$t = ?$

$s = ut + \frac{1}{2}at^2$
$-125m = (5.2 ms^{-1})t + \frac{1}{2}(-9.81 ms^{-2})t^2$
$4.905t^2 - 5.2t - 125 = 0$
$t = \frac{5.2 \pm \sqrt{(5.2)^2 - 4(4.905)(-125)}}{2(4.905)}$
$= \frac{5.2 \pm 49.79}{9.81}$
$t = 5.61s$

(41)



$v^2 = u^2 + 2as$

$v = \sqrt{u^2} = \sqrt{v_0^2} = -v_0$, so the speed is v_0

(43) diameter of apple on picture = .5cm = 10 cm

(A) distance between 2 apples = .7cm (5 + 6 from bottom)

.5cm → 10 cm

.7cm → ?

14 cm = 0.14 m

(B) distance between apple 1 + 2 from bottom = 1cm

.5 cm → 10cm

1 cm → ?

20cm = 0.20 m

$a = \frac{\Delta v}{\Delta t}$ $\quad v = \frac{\Delta s}{\Delta t}$

$v_A = \frac{-.14m}{t}$ $\quad v_B = \frac{-.20m}{t}$

$a = \frac{\Delta v}{\Delta t} = \frac{v_B - v_A}{\Delta t} = \frac{\frac{-.20m}{t} - \frac{-.14m}{t}}{4t}$ ← four flashes take place between these positions

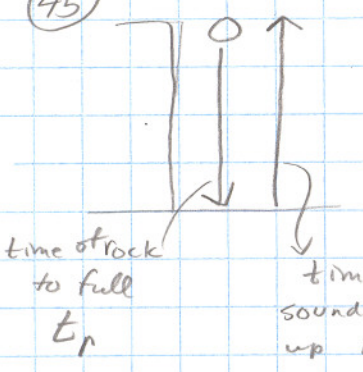
$a = \frac{\frac{-.06}{t}}{4t} = \frac{-.06}{4t^2}$

acceleration must be due to gravity $a = -9.81 ms^{-2}$

$-9.81 = \frac{-.06}{4t^2}$

$t = \sqrt{\frac{-.06}{4(-9.81)}} = \underline{0.0395}$

(45)



$t_r + t_s = 3.2\,s$

for rock

$u = 0$

$a = -9.81\ ms^{-2}$

$s = ?$

$t = t_r$

$s = ut + \frac{1}{2}at^2$

$s = \frac{1}{2}(-9.81\ ms^{-2})(t_r)^2$

$s = -4.905\,t_r^2$

for sound

$v = \frac{s}{t}$

$s = vt$

$s = (340\ ms^{-1})\,t_s$

$s = 340\,t_s$

but $t_s = 3.2 - t_r$ (from above)

so. $s = 340(3.2 - t_r)$

$s = 1088 - 340\,t_r$

These both represent the same distance, but the displacement of the rock will be negative and the displacement of the sound will be positive. So, we need to use the positive values of both to make them equal.

$4.905\,t_r^2 = 1088 - 340\,t_r$

$4.905\,t_r^2 + 340\,t_r - 1088 = 0$

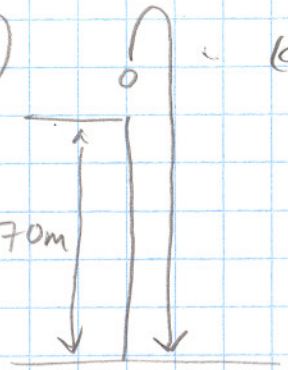
$$t_r = \frac{-340 \pm \sqrt{(340)^2 - 4(4.905)(-1088)}}{2(4.905)}$$

$$t_r = \frac{-340 \pm 370.06}{9.81} = 3.06\,s$$

So $s = -4.905\,t_r^2 = -4.905(3.06)^2 = -46.06$

∴ The cliff is 46 m high.

(47)



(a) $u = 12.0\ ms^{-1}$
$s = -70\ m$
$a = -9.81\ ms^{-2}$
$t = ?$

$s = ut + \frac{1}{2}at^2$

$-70 = 12t + \frac{1}{2}(-9.81)t^2$

$4.905t^2 - 12t - 70 = 0$

$t = 5.19\ s$

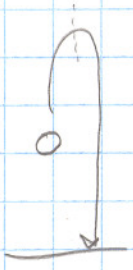
(b) $v^2 = u^2 + 2as$

$v = \sqrt{u^2 + 2as}$

$= \sqrt{(12.0\ ms^{-1})^2 + 2(-9.81\ ms^{-2})(-70\ m)}$

$v = -40.0\ ms^{-1}$

(c)



total distance = distance up + distance down

distance up

$u = 12.0\ ms^{-1}$
$v = 0$
$a = -9.81\ ms^{-2}$
$s = ?$

$v^2 = u^2 + 2as$

$s = \frac{-u^2}{2a}$

$= \frac{-(12.0\ ms^{-1})^2}{2(-9.81\ ms^{-2})}$

$s = 7.34\ m$

distance down

$u = 0$
$v = -40.0\ ms^{-1}$ (from b)
$a = -9.81\ ms^{-2}$
$s = ?$

$v^2 = u^2 + 2as$

$s = \frac{v^2}{2a}$

$= \frac{(-40.0\ ms^{-1})^2}{2(-9.81\ ms^{-2})}$

$= -81.5\ m$

Total distance = 7.34 m + 7.34 m + 70 m

$= 84.7\ m$