Exercise 2.3

Cognitive levels of questions

Recall	Comprehension	Analysis, application	Eval synth
		1, 2, 3, 4, 5, 6, 7	

1. a) $v_f^2 = v_i^2 + 2a\Delta x$
$(300)^2 = (-200)^2 + 2(9,8)\Delta x$
$\Delta x = 2551,02$ m

b) $v_f = v_i + a\Delta t$
$(300) = (-200) + 2(9,8)\Delta t$
$\Delta t = 25,51$ s

2. a) $v_f = v_i + a\Delta t$
$v_f = (-5) + (9,8)(5)$
$v_f = 44$ m.s^{-1} down

b) $\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$\Delta x = (-5)(5) + \frac{1}{2}(9,8)(5)^2$
$\Delta x = 97,5$ m

3. a) $v_f^2 = v_i^2 + 2a\Delta x$
$(0)^2 = (-9)^2 + 2(9,8)\Delta x$
$\Delta x = -4,13$ m
height $= 4,13 + 87 = 91,13$ m

b) $v_f^2 = v_i^2 + 2a\Delta x$
$v_f^2 = (-9)^2 + 2(9,8)(87)$
$v_f^2 = 42,26$ m.s^{-1}

$v_f = v_i + a\Delta t$
$(42,26) = (-9) + (9,8)\Delta t$
$\Delta t = 5,23$ s

4. $v_f^2 = v_i^2 + 2a\Delta x$
$v_f^2 = (-7)^2 + 2(9,8)(55)$
$v_f = 33,57$ m.s^{-1}

$v_f = v_i + a\Delta t$
$(33,57) = (-7) + (9,8)\Delta t$
$\Delta t = 4,14$ s

5. a) $v_f = v_i + a\Delta t$
$v_f = (8) + (9,8)(2,5)$
$v_f = 32,5$ m.s^{-1} down

b) $\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$\Delta x = (8)(2,5) + \frac{1}{2}(9,8)(2,5)^2$
$\Delta x = -50,63$ m

6. a) $v_f^2 = v_i^2 + 2a\Delta x$
$(0)^2 = (-3)^2 + 2(9,8)\Delta x$
$0 = 9 + 19,6\Delta x$
$\Delta x = -0,46$ m
$\therefore$ height $= 70 + 0,46 = 70,46$ m

b) $v_f^2 = v_i^2 + 2a\Delta x$
$v_f^2 = (-3)^2 + 2(9,8)(70)$
$v_f = 37,16$ m.s^{-1}

$v_f = v_i + a\Delta t$
$(37,16) = (-3) + (9,8)\Delta t$
$\Delta t = 4,10$ s

7. a) $v_f = v_i + a\Delta t$
$v_f = (7) + (9,8)(4)^2$
$v_f = 46,2$ m.s^{-1} down

b) $\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$\Delta x = (7)(4) + \frac{1}{2}(9,8)(4)^2$
$\Delta x = 106,4$ m

Recommended experiment for informal assessment *Learner's Book page no 68*

Investigating the motion of a falling body

Divide learners into groups in order to perform this practical activity. Although groups of up to 4 learners per group is ideal, this may depend on the equipment available.

In order to share ticker tape results, it may be necessary for one set of ticker tape results to be put together and then photocopied for the group. Otherwise, there must be ample opportunity given for learners to share the results.

Use Rubric 5 at the back of the *Teacher's Guide* to assess this practical task.

Checkpoint 6

Learner's Book page no 76

a) i) Freefall. Acceleration = 9,8 m.s^{-2} down
ii) Air resistance causes the acceleration to decrease. Acceleration < 9,8 m.s^{-2}.
iii) Terminal velocity. Acceleration = 0.

b) $x = area = \frac{1}{2}bh = \frac{1}{2}(15)(147) = 1\ 102{,}5$ m

c) $a = gradient = \frac{\Delta y}{\Delta x} = \frac{(147-0)}{(15-0)} = 9{,}8$ m.s^{-2} down

d) $x = area = lb = (15)(210) = 3150$ m

Exercise 2.4

Learner's Book page no 76

Cognitive levels of questions

Recall	Comprehension	Analysis, application	Evaluation, synthesis
	5a-b)	1a), 2a-b), 3, 4a), 5c-d), 6a-b)	1b), 2c), 4b), 6c-d), 7

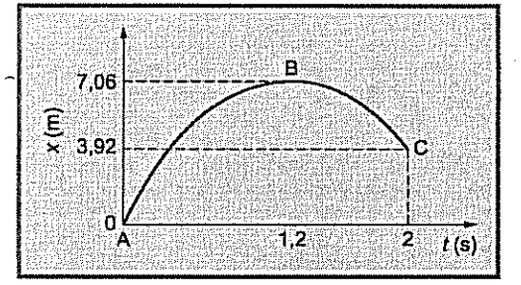
1. a) i) $x = area$
$= \frac{1}{2}bh$
$= \frac{1}{2}(1{,}2)(11{,}76)$
$= 7{,}06$ m

ii) $x = area$
$= \frac{1}{2}bh$
$= \frac{1}{2}(0{,}8)(7{,}84)$
$= 3{,}14$ m

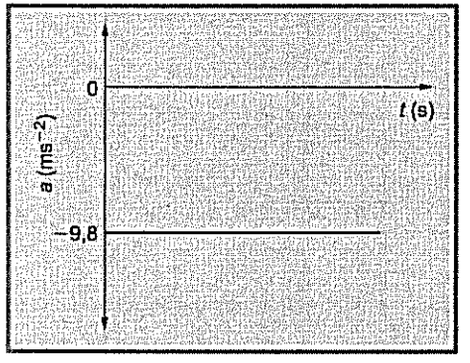
iii) $x = 7{,}06 - 3{,}14$
$= 3{,}92$ m

iv) $a = gradient$
$= \frac{\Delta y}{\Delta x}$
$= \frac{11{,}76-0}{1{,}2-0}$
$= 9{,}8$ m.s^{-2}

b) i) Position versus time graph



ii) Acceleration versus time graph



2. a) i) $x = area$
$= \frac{1}{2}bh$
$= \frac{1}{2}(0{,}8)(7{,}84)$
$= 3{,}14$ m

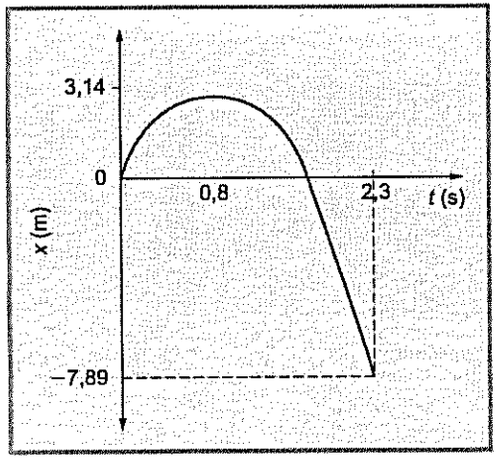
ii) $x = area$
$= \frac{1}{2}bh$
$= \frac{1}{2}(1{,}5)(14{,}7)$
$= 11{,}03$ m

iii) height = 11,03 – 3,14 = 7,89 m

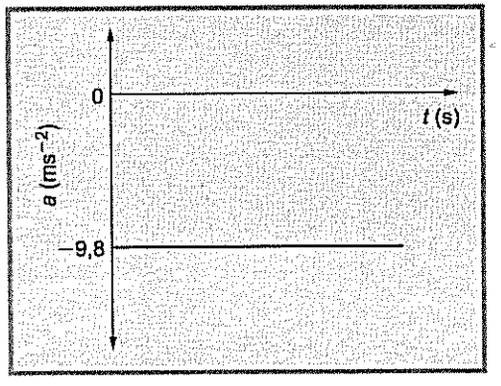
iv) $a = gradient$
$= \frac{\Delta y}{\Delta x}$
$= \frac{0-7{,}84}{0{,}8-0}$
$= -9{,}8$ m.s$^{-2} = 9{,}8$ m.s^{-2} downwards

b) –9,8 m.s^{-2} = 9,8 m.s^{-2} downwards

c) i)



ii)



3. a) $-9{,}8\ \text{m.s}^{-2}$

b) $a = \frac{\Delta y}{\Delta x}$

$-9{,}8 = \frac{0 - 5{,}88}{(t_1 - 0)}$

$-9{,}8 = \frac{-5{,}88}{t_1}$

$t_1 = 0{,}6\ \text{s}$

c) $t_1 = 2 \times 0{,}6 = 1{,}2\ \text{s}$

d) $-5{,}88\ \text{m.s}^{-1}$

4. a) i) $x = \textit{area}$

$= \frac{1}{2}\,bh$

$= \frac{1}{2}(0{,}9)(8{,}82)$

$= 3{,}97\ \text{m}$

ii) $a = \textit{gradient}$

$= \frac{\Delta y}{\Delta x}$

$= \frac{8{,}82 - 0}{0{,}9 - 0}$

$= 9{,}8\ \text{m.s}^{-2}$

iii) $x = \textit{area}$

$= \frac{1}{2}\,bh$

$= \frac{1}{2}(0{,}6)(5{,}88)$

$= 1{,}76\ \text{m}$

iv) $x = 3{,}97 - 1{,}76 = 2{,}21\ \text{m}$

v) $x_{CD} = \textit{area}$

$= \frac{1}{2}\,bh$

$= \frac{1}{2}(0{,}6)(5{,}88)$

$= 1{,}76\ \text{m}$

$x_{DE} = \textit{area}$

$= \frac{1}{2}\,bh$

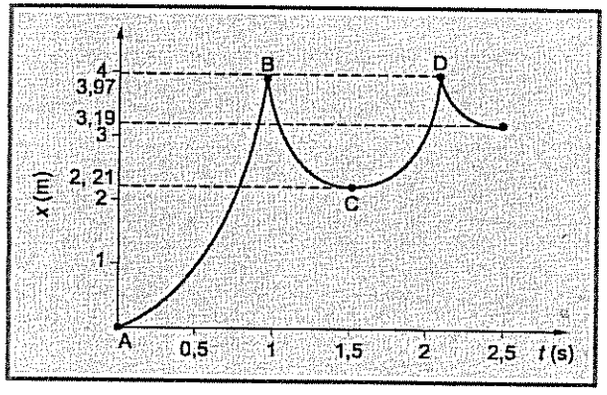
$= \frac{1}{2}(0{,}4)(3{,}92)$

$= 0{,}78\ \text{m}$

$\therefore$ total $x = 3{,}97 + 1{,}76 + 1{,}76 + 0{,}78$

$= 8{,}27\ \text{m}$

b) Displacement vs time graph



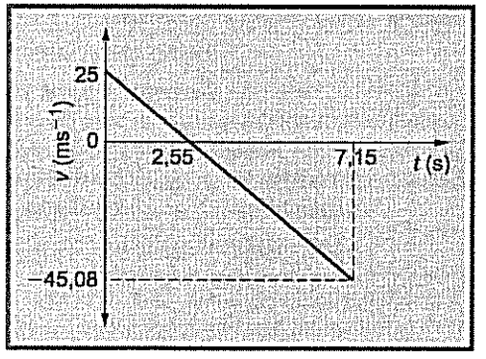
- Co-ordinates:
  (0,9 ; 3,97)
  (1,5 ; 2,21)
  (2,1 ; 3,97)
  (2,5 ; 3,19)

5. a) A-B = freefall ; $a = 9{,}8\ m.s^{-2}$
   B-C = air resistance ; acceleration steadily decreases
   C-D = terminal velocity ; $a = 0$
   b) Parachutist opens parachute
   c) i) $a = gradient$
   $= \frac{\Delta y}{\Delta x}$
   $= \frac{49 - 0}{(5 - 0)}$
   $= 9{,}8\ m.s^{-2}$
   ii) $x = area$
   $= \frac{1}{2} bh$
   $= \frac{1}{2}(5)(49)$
   $= 122{,}5\ m$
   iii) constant velocity $\therefore a = 0$
   iv) $x = area$
   $= l \times b$
   $= 18 \times 70$
   $= 1\ 260\ m$
   d) Parachute is open from E to F
   $\therefore$ surface area much greater
   $\therefore$ air resistance much greater
   $\therefore$ lower terminal velocity

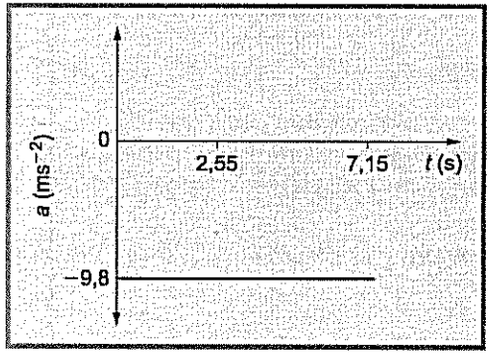
6. a) i) $v_f^2 = v_i^2 + 2a\Delta x$
   $(0)^2 = (-25)^2 + 2(9{,}8)\Delta x$
   $\Delta x = -31{,}89\ m$ $\therefore$ distance AB = 31,89 m
   ii) $v_f = v_i + 2a\Delta t$
   $v_f = (0) + (9{,}8)(4{,}6)$
   $v_f = 45{,}08\ m.s^{-1}$
   b) i) 31,89 m
   ii) $\Delta x = v_i \Delta t + \frac{1}{2} a\Delta t^2$
   $\Delta x = (0)(4{,}6) + \frac{1}{2}(9{,}8)(4{,}6)^2$
   $\Delta x = 103{,}68\ m$

   $\therefore x_2 = 31{,}89 - 103{,}68 = -71{,}79\ m$

   c)

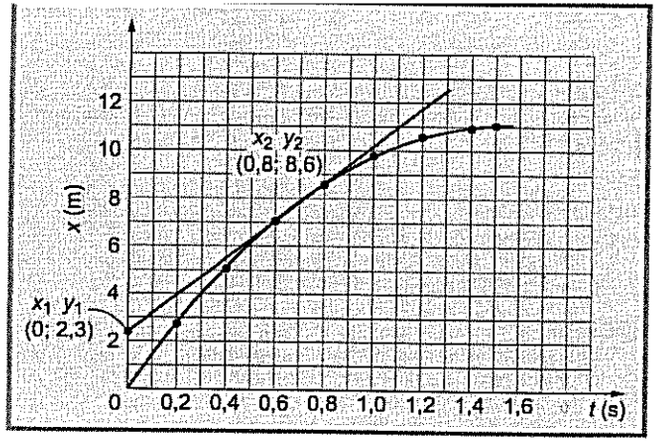


   d)



7. Draw tangent to curve and calculate gradient using co-ordinates

   $v = gradient$
   $= \frac{\Delta y}{\Delta x}$
   $= \frac{8{,}6 - 2{,}3}{0{,}8 - 0}$
   $= 7{,}88\ m.s^{-1}$



Extend yourself

Learner's Book page no 81

Cognitive levels of questions

Recall	Comprehension	Analysis, application	Evaluation, synthesis
	1d-e), 3b)	1a-b), 2a-b), 3c-d)	1c), 1f-g), 2c), 3a)

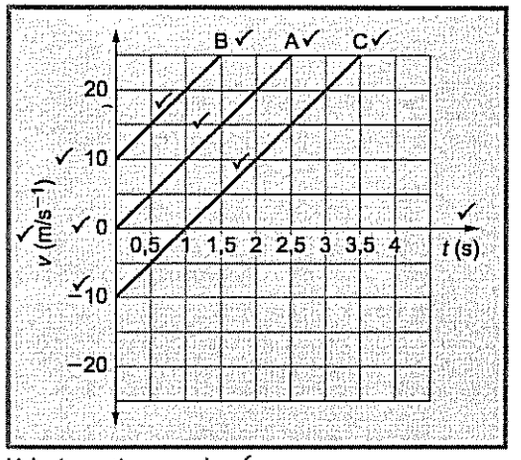
1. a) $\Delta x = v_i \Delta t + \frac{1}{2} a\Delta t^2$
$20 = (0)(\Delta t) + \frac{1}{2}(9{,}8)\Delta t^2$ ✓✓
$\Delta t = 2{,}02$ s ✓ (3)

b) i) A: $v_f^2 = v_i^2 + 2a\Delta x$ ✓
$v_f^2 = (0)^2 + 2(9{,}8)(20)$ ✓✓
$v_f = 19{,}80$ m.s^{-1} ✓ (4)

ii) B: $v_f^2 = v_i^2 + 2a\Delta x$
$v_f^2 = (10)^2 + 2(9{,}8)(20)$ ✓✓
$v_f = 22{,}18$ m.s^{-1} ✓ (3)

iii) C: $v_f^2 = v_i^2 + 2a\Delta x$
$v_f^2 = (-10)^2 + 2(9{,}8)(20)$ ✓✓
$v_f = 22{,}18$ m.s^{-1} ✓ (3)

c)



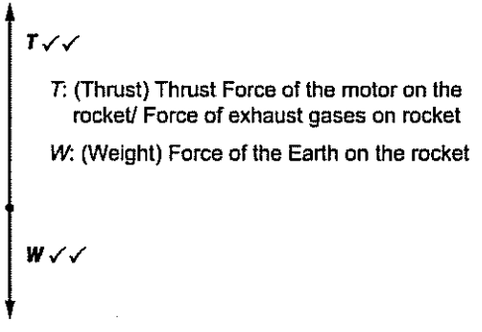
(4 ×

Velocity vs time graphs ✓

d) They experience the same acceleration (9,8 m.s^{-2}).✓
e) They take a different amount of time to reach the riverbed below. ✓
f) The depth of the crater will increase with an increased impact velocity. ✓
g) Dependent Variable = Depth of crater; ✓
Independent variable = Impact velocity. ✓
Measurement of both variables clearly indicated. Repeating the fair test ✓ recording. Graphing results and interpreting ✓

2. a) i) The rocket accelerated uniformly from rest in an upwards direc

ii)



T: (Thrust) Thrust Force of the motor on the rocket/ Force of exhaust gases on rocket

W: (Weight) Force of the Earth on the rocket

b) i) −9,8 m.s^{-2}

ii)

$$a = gradient$$

$$a = \frac{y_2 - y_1}{x_2 - x_1}$$

$$-9{,}8 = \frac{0 - 12}{x_2 - 3} \checkmark \checkmark$$

$$-9{,}8\,(x_2 - 3) = -12$$

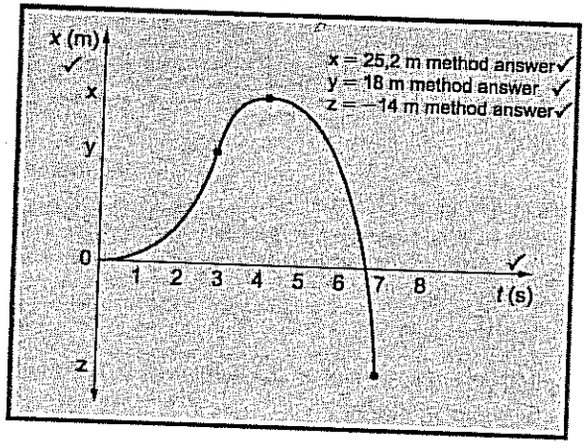
$$-9{,}8x_2 + 29{,}4 = -12$$

$$-9{,}8x_2 = 17{,}4$$

$$x_2 = 1{,}77 \checkmark\checkmark$$

$$\therefore t = 3 + 1{,}77 = 4{,}77 \text{ s} \checkmark\checkmark$$

c) (6)



(5)

3. a) (2)

Attempts	Maximum height (m)	Time to reach floor (s)
1	1,54	0,61
2	1,60	0,65
3	1,58	0,64
Average	**1,57** ✓	**0,63** ✓

(4)

b) $9{,}8 \text{ m.s}^{-2}$ ✓ (1)

c) $v_f = v_i + a\Delta t$

$v_f = (0) + (9{,}8)(0{,}63)$ ✓✓

$v_f = 6{,}17 \text{ m.s}^{-1}$ ✓ (3)

d) $v_f^2 = v_i^2 + 2a\Delta x$

$(0)^2 = v_i^2 + 2(9{,}8)(-1{,}57)$ ✓✓

$v_i = -5{,}55$

$\therefore v_i = 5{,}55 \text{ m.s}^{-1}$ ✓ (3)