



MSI

PHYSICAL SCIENCES

MATERIAL FOR GRADE 12

FIRST TERM

VERTICAL PROJECTILE MOTION

MEMORANDA

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QUESTION 6/VRAAG 6

6.1

[12.1.2] (3)

$$\text{Gradient/gradient} = \frac{\Delta v}{\Delta t} \checkmark = \frac{-20 - (-10)}{3 - 2} \checkmark = \frac{-10}{1} = -10 \text{ m}\cdot\text{s}^{-2} \checkmark \text{ or } 10 \text{ m}\cdot\text{s}^{-2} \text{ downwards}$$

Accept / Aanvaar $\frac{\Delta y}{\Delta x}$

Upwards/Opwaarts+
 $v_f = v_i + a \Delta t \checkmark$
 $-20 = -10 + a(1) \checkmark$
 $a = -10 \text{ m}\cdot\text{s}^{-2} \checkmark$

[12.1.2] (3)

6.2 0,5 s $\checkmark$ and/en 1,5 s $\checkmark$

[12.1.2] (2)

6.3 1 s $\checkmark$

[12.1.2] (1)

6.4

DETERMINING AREAS/ BEPALING VAN OPPERVLAKTE

Option 1 / Opsie 1 :Area of trapezium / Oppervlakte van trapesium

Height of cliff/ Hoogte van krans = area of trapezium/area of trapezium
 $= \frac{1}{2} (\text{sum of parallel sides/som van ewewydige sye})h \checkmark$
 $= \frac{1}{2} (10 + 25) \checkmark (1,5) \checkmark$
 $= 26,25 \text{ m} \checkmark$

Option 2 / Opsie 2 :Difference between areas of two triangles / Verskil tussen die oppervlaktes van twee driehoeke

Height of cliff /Hoogte van krans
 $= \text{area of larger triangle/van groter driehoek} - \text{area of smaller triangle/van kleiner driehoek}$
 $= \frac{1}{2} bh - \frac{1}{2} bh \checkmark$
 $= \frac{1}{2} (2,5)(25) \checkmark - \frac{1}{2} (1)(10) \checkmark = 31,25 - 5$
 $= 26,25 \text{ m} \checkmark$

Option 3 / Opsie 3 :The sum of areas of rectangle and triangle / Die som van die oppervlaktes van reghoek en driehoek

Height of cliff /Hoogte van krans
 $= \text{area of rectangle/van reghoek} + \text{area of triangle/van driehoek}$
 $= (l \times b) + \frac{1}{2} bh \checkmark$
 $= (1,5)(10) \checkmark + \frac{1}{2} (1,5)(15) \checkmark = 15 + 11,25$
 $= 26,25 \text{ m} \checkmark$

USING EQUATIONS OF MOTION / GEBRUIK VAN BEWEGINGSVERGLYKINGS

Option 1 / Opsie 1: Initial velocity $10 \text{ m}\cdot\text{s}^{-1}$ upwards and total time $3,5 \text{ s}$ / *Beginsnelheid $10 \text{ m}\cdot\text{s}^{-1}$ opwaarts en totale tyd $3,5 \text{ s}$*

Consider upward motion as positive / *Beskou opwaartse beweging as positief:*

$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$\therefore \Delta y = (10)(3,5) \checkmark + \frac{1}{2} (-10)(3,5)^2 \checkmark$$

$$\Delta y = -26,25 \text{ m}$$

Height of cliff/*hoogte van krans* = $26,25 \text{ m}$ ✓

Option 2 / Opsie 2: Initial velocity $10 \text{ m}\cdot\text{s}^{-1}$ upwards and final velocity of $25 \text{ m}\cdot\text{s}^{-1}$ downwards / *Beginsnelheid $10 \text{ m}\cdot\text{s}^{-1}$ opwaarts en eindsnelheid $25 \text{ m}\cdot\text{s}^{-1}$ afwaarts*

Consider upward motion as positive/*Beskou opwaartse beweging as positief*

$$v_f^2 = v_i^2 + 2a\Delta y \checkmark$$

$$\therefore (-25)^2 \checkmark = (10)^2 + 2(-10) \Delta y \checkmark$$

$$\therefore \Delta y = -26,25 \text{ m}$$

Height of cliff/*hoogte van krans* = $26,25 \text{ m}$ ✓

Option 3 / Opsie 3: Initial velocity $10 \text{ m}\cdot\text{s}^{-1}$ upwards and final velocity of $25 \text{ m}\cdot\text{s}^{-1}$ downwards / *Beginsnelheid $10 \text{ m}\cdot\text{s}^{-1}$ opwaarts en eindsnelheid $25 \text{ m}\cdot\text{s}^{-1}$ afwaarts*

Consider upward motion as positive/*Beskou opwaartse beweging as positief*

$$\Delta y = \frac{(v_i + v_f)}{2} \Delta t \checkmark$$

$$= \frac{(-10 - 25)}{2} (1,5) \checkmark$$

$$= -26,25 \text{ m}$$

Height of cliff/*hoogte van krans* = $26,25 \text{ m}$ ✓

Option 4 / Opsie 4: Initial velocity $10 \text{ m}\cdot\text{s}^{-1}$ downwards and total time of $1,5 \text{ s}$ / *Beginsnelheid $10 \text{ m}\cdot\text{s}^{-1}$ en totale tyd van $1,5 \text{ s}$*

Consider upward motion as positive/*Beskou opwaartse beweging as positief:*

$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$\therefore \Delta y = (-10)(1,5) \checkmark + \frac{1}{2} (-10)(1,5)^2 \checkmark = -15 - 11,25$$

$$\Delta y = -26,25 \text{ m}$$

Height of cliff/*hoogte van krans* = $26,25 \text{ m}$ ✓

Option 5 / Opsie 5: Initial velocity $0 \text{ m}\cdot\text{s}^{-1}$ and final velocity $25 \text{ m}\cdot\text{s}^{-1}$ downwards / Beginsnelheid $0 \text{ m}\cdot\text{s}^{-1}$ en eindsnelheid van $25 \text{ m}\cdot\text{s}^{-1}$ afwaarts

Consider upward motion as positive/Beskou opwaartse beweging as positief:
Maximum height above the ground/Maksimum hoogte bokant grond:

$$v_f^2 = v_i^2 + 2a\Delta y \checkmark$$

$$(-25)^2 = (0)^2 + 2(-10)\Delta y \checkmark$$

$$\therefore \Delta y = -31,25 \text{ m}$$

From cliff to maximum height/vanaf rots tot maksimum hoogte:

$$v_f^2 = v_i^2 + 2a\Delta y$$

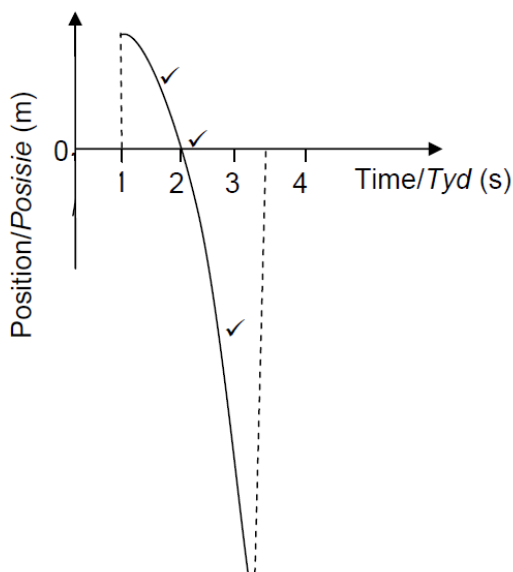
$$0^2 = (-10)^2 + 2(-10)\Delta y \checkmark$$

$$\therefore \Delta y = 5 \text{ m}$$

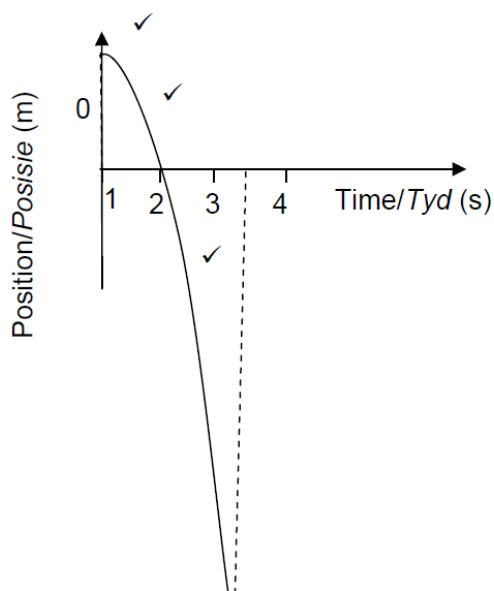
$$\text{Height of cliff/hoogte van rots} = 31,25 - 5 = 26,25 \text{ m} \checkmark$$

[12.1.2] (4)

6.5

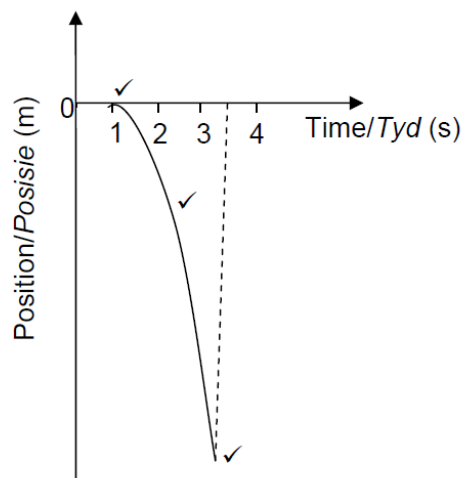


Height of cliff as zero position
Hoogte van krans as nulposisie



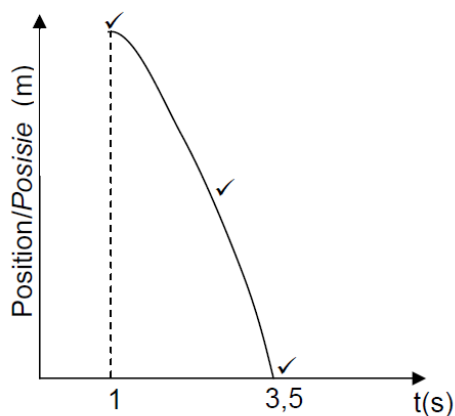
Height of cliff as zero position
Hoogte van krans as nulposisie

Checklist/Kontrolelys	
Criteria for graph/Kriteria vir grafiek	Marks/Punte
t = 1s – 3,5 s: shape of curve representing constant acceleration / Verplasing neem af (kurwe stel konstante versnelling voor)	✓
At 2 s: Displacement is 0 (intersects time axis) / Verplasing is 0 (sny tydass)	✓
Curve stops at 3,5 s/ Kurwe eindig by 3,5 s	✓



Checklist/Kontrolelys	Marks/Punte
Criteria for graph/Kriteria vir grafiek	
t = 1s Displacement is 0 (intersects with x-axis)/ Verplasing is 0 (snij x-as)	✓
From 1 – 3,5 s: Curve representing constant acceleration / kurwe stel konstante versnelling voor	✓
Graph stops at 3,5 s/ Grafiek eindig by 3,5 s	✓

Maximum position zero, upward positive / Maksimum posisie nul , opwaarts positief



Checklist/Kontrolelys	Marks/Punte
Criteria for graph/Kriteria vir grafiek	
t = 1s: maximum displacement/maksimum verplasing	✓
t = 1 s – 3,5 s: curve representing constant acceleration/ kurwe stel konstante versnelling voor	✓
t = 3,5 s: Displacement is zero/Verplasing is nul	✓

Height of cliff at t = 0 s / Hoogte van krans by 0 s

[12.1.2] (3)
[13]

QUESTION 5/VRAAG 5

5.1 $v_f^2 = v_i^2 + 2a \Delta x$ ✓
 $v_f^2 = (0)^2 + 2(-9,8)(25)$ ✓
 $v_f = -22,13 \text{ or } 22,13 \text{ m}\cdot\text{s}^{-1} \text{ down/afwaarts}$ ✓

OR/OF

$E_t(\text{top/bo}) = E_t(\text{bottom/onder})$
 $E_p + E_k = E_p + E_k$
 $mgh + 0 = 0 + \frac{1}{2}mv_f^2$ ✓
 $(0,3)(9,8)(25) + 0 = 0 + \frac{1}{2}(0,3)v_f^2$ ✓
 $v_f = 22,13 \text{ m}\cdot\text{s}^{-1} \text{ downward/afwaarts}$ ✓

[12.2.3] (3)

5.2 Consider upward motion as positive: / *Beskou opwaartse beweging as positief:*

$v_f^2 = v_i^2 + 2a \Delta x$ ✓
 $0 = v_i^2 + 2(-9,8)(6)$ ✓
 $v_i = 10,84 \text{ m}\cdot\text{s}^{-1}$ ✓

Impulse/Impuls $\rightarrow \Delta p$ ✓
 $= [(0,3)(10,84) - (0,3)(-22,13)]$ ✓
 $= +9,89 \text{ N}\cdot\text{s}$ ✓ i.e. 9,89 N·s upward/opwaarts ✓

OR/OF

Consider upward motion as negative: / *Beskou opwaartse beweging as negatief*

$v_f^2 = v_i^2 + 2a \Delta x$ ✓
 $0 = v_i^2 + 2(9,8)(-6)$ ✓
 $v_i = -10,84 \text{ m}\cdot\text{s}^{-1}$ ✓

Impulse/Impuls $\rightarrow \Delta p$ ✓
 $= [(0,3)(-10,84) - (0,3)(22,13)]$ ✓
 $= -9,89 \text{ N}\cdot\text{s}$ ✓ i.e. 9,89 N·s upward/opwaarts ✓

OR/OF

$E_t(\text{top/bo}) = E_t(\text{bottom/onder})$
 $E_p + E_k = E_p + E_k$
 $mgh + 0 = 0 + \frac{1}{2}mv_f^2$ ✓
 $(0,3)(9,8)(6) + 0 = 0 + \frac{1}{2}(0,3)v_f^2$ ✓
 $v_f = 10,84 \text{ m}\cdot\text{s}^{-1} \text{ upward/opwaarts}$ ✓

Impulse/Impuls $= \Delta p$ ✓
 $= [(0,3)(10,84) - (0,3)(-22,13)]$ ✓
 $= +9,89 \text{ N}\cdot\text{s}$ ✓ i.e. 9,89 N·s upward/opwaarts ✓

[12.1.3] (7)

5.3 Take upward as positive:/Neem opwaarts as positief:

$$F_{\text{net}}\Delta t = \Delta p \checkmark$$

$$F_{\text{net}} = \frac{\Delta p}{\Delta t} = \frac{+9,89}{0,9} \checkmark = +10,99 \text{ N} \checkmark \text{ i.e. } 10,99 \text{ N (11 N) upward/opwaarts}$$

Take upward as negative:/Neem opwaarts as negatief:

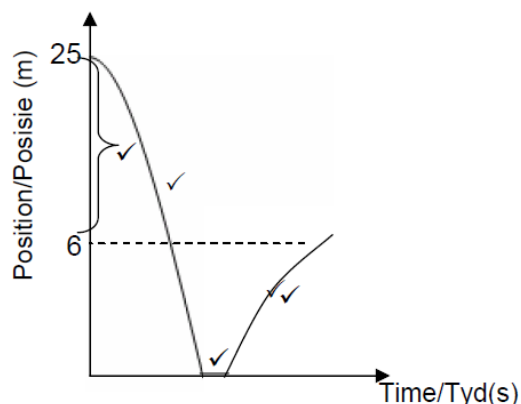
$$F_{\text{net}}\Delta t = \Delta p \checkmark$$

$$F_{\text{net}} = \frac{\Delta p}{\Delta t} = \frac{-9,89}{0,9} \checkmark = -10,99 \text{ N} \checkmark \text{ i.e. } 10,99 \text{ N (11 N)}$$

upward/opwaarts

[12.2.3] (3)

5.4



Checklist/Kontrolelys	
Criteria for graph/Kriteria vir grafiek	Marks/Punte
Maximum original height indicated as 25 m and height of 2 nd bounce as 6 m Maksimum oorspronklike hoogte aangedui as 25 m en hoogte van tweede hop as 6 m	✓
Correct shape between 25 m and 0 m Korrekte vorm tussen 25 m en 0 m	✓
Graph on x-axis between first reaching the floor and 2 nd bounce Grafiek op x-as wanneer dit die vloer tref en die 2de hop	✓
Correct shape between 0 m and 6 m. Korrekte vorm van grafiek tussen 0 m en 6 m.	✓

[12.1.2] (4)

5.5 Smaller ✓

Contact time for softer ball is longer ✓ than for rigid ball

According to $F_{\text{net}}\Delta t = \Delta p$, the force exerted by floor on softer ball is smaller than on the rigid ball. ✓.

Kleiner

Kontak tyd vir sagter bal is langer ✓ as vir stewige bal

Volgens $F_{\text{net}}\Delta t = \Delta p$, is die krag deur die vloer op sagter bal uitgeoefen kleiner as die op die stewige bal. ✓.

[12.3.2] (3)
[20]

QUESTION 4/VRAAG 4

- 4.1 $t = 0$ s:
ball starts from rest/bal begin uit rus ✓
OR/OF
ball starts at $0 \text{ (m} \cdot \text{s}^{-1})$ /bal begin teen $0 \text{ (m} \cdot \text{s}^{-1})$

$t = 0$ s – $0,4$ s:
Falls at constant acceleration/val teen konstante versnelling ✓

OR/OF
no change in acceleration/geen verandering in versnelling nie

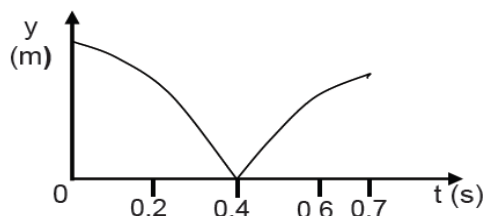
OR/OF
constant increase in velocity/konstante toename in snelheid

$t = 0,4$ s: Reaches the floor at $4 \text{ m} \cdot \text{s}^{-1}$ (or $4 \text{ m} \cdot \text{s}^{-1}$ downwards)/bereik die vloer teen $4 \text{ m} \cdot \text{s}^{-1}$ (of $4 \text{ m} \cdot \text{s}^{-1}$ afwaarts) ✓

$t = 0,4$ s: Bounces back at $-3 \text{ m} \cdot \text{s}^{-1}$ (or $3 \text{ m} \cdot \text{s}^{-1}$ upwards)/Bons terug teen $-3 \text{ m} \cdot \text{s}^{-1}$ (of $3 \text{ m} \cdot \text{s}^{-1}$ opwaarts) ✓ [12.1.2] (4)

- 4.2 $\Delta y = \text{area of triangle} = \text{oppervlakte van driehoek} = \frac{1}{2}bh$ ✓
 $= \frac{1}{2}((0,4)) \checkmark ((4)) \checkmark$
 $= 0,8 \text{ m}$ ✓ [12.1.2] (4)

4.3



Checklist/Kontrolelys	
Criteria for graph/Kriteria vir grafiek	Marks/Punte
Correct shape (as shown on graph) Korrekte vorm (soos op grafiek aangetoon)	✓
Zero position at $0,4$ s Nulposisie by $0,4$ s	✓
Maximum position of 2 nd bounce smaller than that of 1 st bounce Maksimum posisie van 2de bons is kleiner as dié van 1 ^{ste} bons	✓

[12.1.2] (3)

- 4.4 Inelastic/Onelasties ✓
Decrease/change in speed (from $4 \text{ m} \cdot \text{s}^{-1}$ to $3 \text{ m} \cdot \text{s}^{-1}$) ✓
Afname/verandering in speed (vanaf $4 \text{ m} \cdot \text{s}^{-1}$ tot $3 \text{ m} \cdot \text{s}^{-1}$)

OR/OF
Decrease/change in kinetic energy during collision
Afname/verandering in kinetiese energie tydens botsing

[12.1.2] (2)
[13]

QUESTION 5/VRAAG 5

5.1 Velocity after / snelheid na 30 m:

$$v_f^2 = v_i^2 + 2a\Delta y \checkmark$$

$$= 0 + 2(9,8)(50 - 20) \checkmark$$

$$v_f = 24,25 \text{ m}\cdot\text{s}^{-1} \checkmark$$

Accept / Aanvaar:

$$v^2 = u^2 + 2as/v = u + at/s = ut + \frac{1}{2}at^2$$

A mixture of the two allowed formulae is not accepted. / 'n Mengsel van die twee erkende formules word nie aanvaar nie.

+

OR/OF

$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$30 = (0) \Delta t + \frac{1}{2} (9,8) \Delta t^2$$

$$\therefore \Delta t = 2,47 \text{ s}$$

$$v_f = v_i + a \Delta t = 0 + (9,8)(2,47) \checkmark = 24,25 \text{ m}\cdot\text{s}^{-1} \checkmark$$

[12.2.3]

(3)

5.2 Velocity after a further / snelheid na 'n verdere 18,2 m:

$$v_f^2 = v_i^2 + 2a\Delta y \checkmark$$

$$= 24,25^2 + 2(9,8)(20 - 1,8) \checkmark$$

$$\therefore v_f = 30,74 \text{ m}\cdot\text{s}^{-1}$$

Accept / Aanvaar:

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

A mixture of the two allowed formulae is not accepted.

'n Mengsel van die twee erkende formules word nie aanvaar nie.

$$v_f = v_i + a \Delta t \checkmark$$

$$30,74 = 24,25 + 9,8t \checkmark$$

$$\therefore t = 0,66 \text{ s} \checkmark$$

He will not be struck – reaction time is shorter than the time for the brick to reach his head. / Hy sal nie getref word nie – reaksietyd is korter as die tyd wat dit die baksteen neem om sy kop te bereik. ✓

OR/OF

Distance fallen in 0,4 s / Afstand geval in 0,4 s:

$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark = (24,25)(0,4) + \frac{1}{2} (9,8)(0,4)^2 \checkmark = 10,45 \text{ m} \checkmark$$

Distance above head of supervisor after 0,4 s / Afstand bo kop van toesighouer na 0,4 s: $20 - 1,8 - 10,45 = 7,75 \text{ m} \checkmark \checkmark$

He will not be struck – the brick is still 7,75 m above his head. / Hy sal nie getref word nie – die baksteen is steeds 7,75 m bokant sy kop. ✓

[12.1.3]

(6)

[9]

QUESTION 3

3.1 3 seconds / 3 s ✓

[12.1.2] (1)

3.2

Accept the equations:	
$v = u + at$	$s = ut + \frac{1}{2}at^2$
$s = \left(\frac{v + u}{2}\right)t$	$v^2 = u^2 + 2as$

OPTION 1

Area between graph and time axis

$$\Delta y = (\text{area of triangle}) / \frac{1}{2}bh \checkmark$$

$$= \frac{1}{2}(3)(29,4) \checkmark$$

$$= 44,1 \text{ m}$$

Maximum height above ground:

$$100 + \checkmark 44,1 = 144,1 \text{ m} \checkmark$$

OPTION 2

$$\Delta y = \left(\frac{v_f + v_i}{2}\right)\Delta t \checkmark \text{ OR } \Delta y = \left(\frac{v_f + v_i}{2}\right)\Delta t$$

$$= \left(\frac{0 + 29,4}{2}\right)(3) \checkmark$$

$$= 44,1 \text{ m (43,22m)}$$

Maximum height above ground:

$$100 + \checkmark 44,1 = 144,1 \text{ m} \checkmark (143,22\text{m})$$

OPTION 3

From edge of cliff to max height

(Upward positive)

$$v_f^2 = v_i^2 + 2a\Delta y \checkmark$$

$$\therefore 0^2 = 29,4^2 + 2(-9,8)\Delta y \checkmark$$

$$\therefore \Delta y = 44,1 \text{ m}$$

Maximum height above ground:

$$100 + \checkmark 44,1 = 144,1 \text{ m} \checkmark$$

From edge of cliff to max height)

(Downward positive)

$$v_f^2 = v_i^2 + 2a\Delta y \checkmark$$

$$\therefore 0^2 = (-29,4)^2 + 2(9,8)\Delta y \checkmark$$

$$\therefore \Delta y = -44,1 \text{ m}$$

Maximum height above ground:

$$100 + \checkmark 44,1 = 144,1 \text{ m} \checkmark$$

OPTION 4

From edge of cliff to max height
(Upward positive)

$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$= (29,4)(3) + \frac{1}{2}(-9,8)(3)^2 \checkmark$$

$$= 44,1 \text{ m}$$

Maximum height above ground:
 $100 + \checkmark 44,1 = 144,1 \text{ m} \checkmark (143,2 \text{ m})$

From edge of cliff to max height)
(Downward positive)

$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$= (-29,4)(3) + \frac{1}{2}(9,8)(3)^2 \checkmark$$

$$= -44,1 \text{ m}$$

Maximum height above ground:
 $100 + \checkmark 44,1 = 144,1 \text{ m} \checkmark$

OPTION 5

From max height to edge of cliff
Downward positive

$$v_f^2 = v_i^2 + 2a\Delta y \checkmark$$

$$(29,4)^2 = 0^2 + 2(9,8)\Delta y \checkmark$$

$$\therefore \Delta y = 44,1 \text{ m}$$

Maximum height above ground:
 $100 + \checkmark 44,1 = 144,1 \text{ m} \checkmark$

OPTION 6

From max height to edge of cliff
Downward positive

$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$= (0)(3) + \frac{1}{2}(9,8)(3)^2 \checkmark$$

$$= 44,1 \text{ m}$$

Maximum height above ground:
 $100 + \checkmark 44,1 = 144,1 \text{ m} \checkmark$

OPTION 7

$$\left. \begin{aligned} E_{\text{mech (edge of cliff)}} &= E_{\text{mech (max height)}} \\ (mgh + \frac{1}{2}mv^2)_A &= (mgh + \frac{1}{2}mv^2)_B \end{aligned} \right\} \checkmark \text{ any equation}$$

$$m(gh + \frac{1}{2}v^2)_A = m(gh + \frac{1}{2}v^2)_B$$

$$(9,8)(100) + \frac{1}{2}(29,4)^2 \checkmark = (9,8)h + 0 \checkmark$$

$$h = 144,1 \text{ m} \checkmark$$

OPTION 8

$$\left. \begin{aligned} W_{\text{net}} &= \Delta E_k \\ mgh \cos \theta &= \frac{1}{2}m(v_f^2 - v_i^2) \end{aligned} \right\} \checkmark \text{ any equation}$$

$$m(gh \cos \theta) = \frac{1}{2}m(v_f^2 - v_i^2)$$

$$(9,8)h \cos 180^\circ = \frac{1}{2}(0^2 - (29,4)^2) \checkmark$$

$$h = 44,1 \text{ m} (43,22 \text{ m})$$

Maximum height above ground:
 $100 + \checkmark 44,1 = 144,1 \text{ m} \checkmark$

OPTION 9

$$\left. \begin{aligned} E_{\text{mech (edge of cliff)}} &= E_{\text{mech (max height)}} \\ (mgh + \frac{1}{2}mv^2)_A &= (mgh + \frac{1}{2}mv^2)_B \end{aligned} \right\} \checkmark \text{ any equation}$$

$$m(gh + \frac{1}{2}v^2)_A = m(gh + \frac{1}{2}v^2)_B$$

$$0 + \frac{1}{2}(29,4)^2 = (9,8)h + 0 \checkmark$$

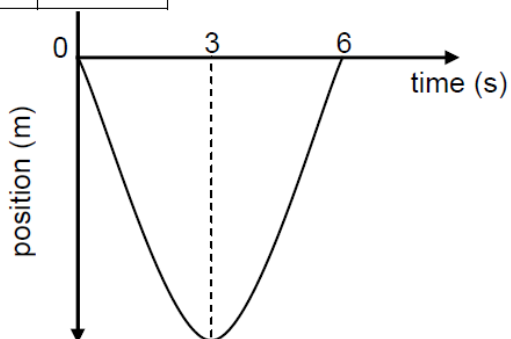
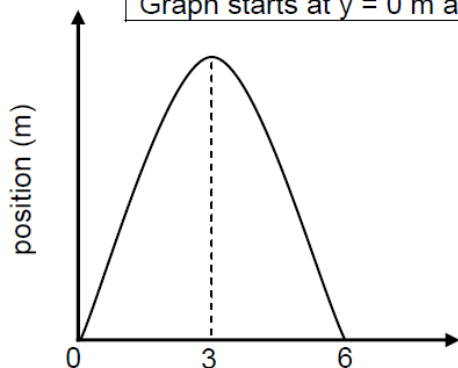
$$h = 44,1 \text{ m}$$

Maximum height above ground:
 $100 + \checkmark 44,1 = 144,1 \text{ m} \checkmark$

[12.1.2]
[12.2.3] (4)

3.3

Checklist: Criteria for graph	Marks
Correct shape	✓
$t = 3$ s at maximum height	✓
$t = 6$ s at $y = 0$ m	✓
Graph starts at $y = 0$ m at $t = 0$ s	✓



[12.1.2] (4)

3.4.1

OPTION 1: Upward positive: $v_f = v_i + a\Delta t$ ✓ $= 29,4 \checkmark + (-9,8)(5,23) \checkmark$ $= -21,85 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards} \checkmark$ OR $v_f = 21,85 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards} \checkmark$	Downward positive: $v_f = v_i + a\Delta t$ ✓ $= -29,4 \checkmark + (9,8)(5,23) \checkmark$ $= 21,85 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards} \checkmark$
OPTION 2 $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $= 29,4(5,23) + \frac{1}{2}(-9,8)(5,23)^2$ $= 19,73 \text{ m}$ $v_f^2 = v_i^2 + 2a\Delta y$ ✓ (for both formulae) $= 29,4^2 \checkmark + 2(-9,8)(19,73) \checkmark$ $\therefore v_f = 21,85 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards} \checkmark$	Downward positive: $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $= (-29,4)(5,23) + \frac{1}{2}(9,8)(5,23)^2$ $= -19,73 \text{ m}$ $v_f^2 = v_i^2 + 2a\Delta y$ ✓ (for both formulae) $= (-29,4)^2 \checkmark + 2(9,8)(-19,73) \checkmark$ $\therefore v_f = 21,85 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards} \checkmark$
POSITIVE MARKING FROM 3.1	OPTION 4 Downward positive: Time for downward motion: $(5,23 - 3) \checkmark = 2,23 \text{ s}$ $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ (for both formulae) $= (0)(2,23) + \frac{1}{2}(9,8)(2,23)^2$ $= 24,36721 \text{ m}$ $v_f^2 = v_i^2 + 2a\Delta y$ ✓ (for both formulae) $= (0)^2 + 2(9,8)(24,36721) \checkmark$ $\therefore v_f = 21,85 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards} \checkmark$

[12.2.3] (5)

3.4.2 POSITIVE MARKING FROM QUESTION 3.4.1

OPTION 1

Upward positive:

$$\Delta t = (5,23 - 1) \checkmark = 4,23 \text{ s}$$

$$v_f = v_i + a\Delta t \checkmark$$

$$= 49 + (-9,8)(4,23) \checkmark$$

$$v_f = 7,55 \text{ m}\cdot\text{s}^{-1} \text{ upwards}$$

$$\Delta v_{XY} = v_X - v_Y \text{ (vector difference)}$$

$$= -21,85 - 7,55$$

$$= -29,40 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards} \checkmark$$

OR

$$v_{XY} = 29,40 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards} \checkmark$$

$$v_{XY} = v_{XG} + v_{GY}$$

$$= -21,85 + (-7,55)$$

$$= -29,40 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards} \checkmark$$

OR

$$v_{XY} = 29,40 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards} \checkmark$$

$$v_{XG} = v_{XY} + v_{YG}$$

$$-21,85 = v_{XY} + (7,55)$$

$$= -29,40 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards} \checkmark$$

OR

$$v_{XY} = 29,40 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards} \checkmark$$

Downward positive:

$$\begin{aligned}\Delta t &= (5,23 - 1) \checkmark = 4,23 \text{ s} \\ v_f &= v_i + a\Delta t \checkmark \\ &= -49 + (9,8)(4,23) \checkmark \\ &= -7,55 \text{ m}\cdot\text{s}^{-1} \\ v_f &= 7,55 \text{ m}\cdot\text{s}^{-1} \text{ upwards}\end{aligned}$$

$$\begin{aligned}v_{XY} &= v_{XG} + v_{GY} \\ &= 21,85 + (7,55) \\ v_{XY} &= 29,40 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards}\end{aligned}$$

$$\begin{aligned}v_{XY} &= v_X - v_Y \text{ (vector difference)} \\ &= 21,85 - (-7,55) \\ &= 29,40 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards}\end{aligned}$$

$$\begin{aligned}v_{XG} &= v_{XY} + v_{YG} \\ 21,85 &= v_{XY} + (-7,55) \\ v_{XY} &= 29,40 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards}\end{aligned}$$

OPTION 2

Upward positive:

$$\begin{aligned}\Delta t &= (5,23 - 1) \checkmark = 4,23 \text{ s} \\ \Delta y &= v_i \Delta t + \frac{1}{2} a \Delta t^2 \\ &= 49(4,23) + \frac{1}{2} (-9,8)(4,23)^2 \\ &= 119,59 \text{ m (upwards)} \\ v_f^2 &= v_i^2 + 2a\Delta y \checkmark \text{ (for both equations)} \\ &= (49)^2 + 2(-9,8)(119,59) \checkmark \\ \therefore v_f &= 7,55 \text{ m}\cdot\text{s}^{-1} \text{ upwards}\end{aligned}$$

$$\begin{aligned}v_{XY} &= v_{XG} + v_{GY} \\ &= -21,85 + (-7,55) \\ &= -29,40 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards}\end{aligned}$$

OR

$$v_{XY} = 29,40 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards}$$

$$\begin{aligned}v_{XY} &= v_X - v_Y \text{ (vector difference)} \\ &= -21,85 - 7,55 \\ &= -29,40 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards}\end{aligned}$$

OR

$$v_{XY} = 29,40 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards}$$

$$\begin{aligned}v_{XG} &= v_{XY} + v_{YG} \\ -21,85 &= v_{XY} + (7,55) \\ v_{XY} &= -29,40 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards}\end{aligned}$$

OR

$$v_{XY} = 29,40 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards}$$

Downward positive:

$$\begin{aligned}\Delta t &= (5,23 - 1) \checkmark = 4,23 \text{ s} \\ \Delta y &= v_i \Delta t + \frac{1}{2} a \Delta t^2 \\ &= (-49)(4,23) + \frac{1}{2} (9,8)(4,23)^2 \\ &= -119,59 \text{ m (upwards)} \\ v_f^2 &= v_i^2 + 2a\Delta y \checkmark \text{ (for both equations)} \\ &= (-49)^2 + 2(9,8)(-119,59) \checkmark \\ \therefore v_f &= 7,55 \text{ m}\cdot\text{s}^{-1} \text{ upwards}\end{aligned}$$

$$\begin{aligned}v_{XY} &= v_{XG} + v_{GY} \\ &= 21,85 + (7,55) \\ &= 29,40 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards}\end{aligned}$$

$$\begin{aligned}v_{XY} &= v_X - v_Y \text{ (vector difference)} \\ &= 21,85 - (-7,55) \\ &= 29,40 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards}\end{aligned}$$

$$\begin{aligned}v_{XG} &= v_{XY} + v_{YG} \\ 21,85 &= v_{XY} + (-7,55) \\ v_{XY} &= 29,40 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ downwards}\end{aligned}$$

[12.1.3] (5)
[19]

QUESTION 3

- PENALISE ONLY ONCE FOR NOT ROUNDING OFF FINAL ANSWERS TO TWO DECIMAL PLACES.

3.1 Gradient of the graph is constant. ✓✓ [12.1.2] (2)

3.2 At $t = 1 \text{ s}$ ✓ and $t = 3 \text{ s}$ ✓ [12.1.2] (2)

3.3 $V_{AB} = V_{AC} + V_{CB}$
 $= -10 + (-10)$
 $= -20 \text{ m} \cdot \text{s}^{-1}$
 $= 20 \text{ m} \cdot \text{s}^{-1}$ ✓✓ downwards ✓

OR

$$V_{AB} = V_{AC} - V_{BC}$$

$$= -10 - 10$$

$$= -20 \text{ m} \cdot \text{s}^{-1}$$

$$= 20 \text{ m} \cdot \text{s}^{-1}$$
 ✓✓ downwards ✓

OR

$$V_{AB} = V_A - V_B \text{ (vector difference)}$$

$$= -10 - (10)$$

$$= -20 \text{ m} \cdot \text{s}^{-1}$$

$$= 20 \text{ m} \cdot \text{s}^{-1}$$
 ✓✓ downwards ✓

[12.1.2] (3)

3.4

OPTION 1

$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \quad \checkmark$$

$$= (0)(4) + \frac{1}{2} (10)(4)^2 \checkmark$$

$$= 80 \text{ m} \checkmark \quad (78,4 \text{ m if } a = 9,8 \text{ m} \cdot \text{s}^{-2})$$

OPTION 2

$$v_f^2 = v_i^2 + 2a\Delta y \quad \checkmark$$

$$(40)^2 = (0)^2 + 2(10)\Delta y \checkmark$$

$$\Delta y = 80 \text{ m} \checkmark \quad (81,63 \text{ m if } a = 9,8 \text{ m} \cdot \text{s}^{-2})$$

OPTION 3

$$\Delta y = \left(\frac{v_f + v_i}{2} \right) \Delta t \quad \checkmark$$

$$= \left(\frac{40 + 0}{2} \right) (4) \checkmark$$

$$= 80 \text{ m} \checkmark$$

Accept:

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

$$v = u + at$$

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

$$s = \left(\frac{v + u}{2} \right) t$$

Accept formulae if a is replaced with g

[12.2.3] (3)

3.5 Displacement ✓✓ / Change in position
 Accept: distance

[12.2.1] (2)

3.6

(Accept: $y / \Delta x / x$ for distance)

Distance covered by object B

$$\begin{aligned}\Delta y &= \frac{1}{2}bh + lb \checkmark \\ &= \frac{1}{2}(1)(10) + (10)(1) \checkmark \\ &= 15 \text{ m}\end{aligned}$$

Distance covered by object A

$$\begin{aligned}\Delta y &= \frac{1}{2}bh \checkmark \\ &= \frac{1}{2}(1)(-10) \checkmark \text{ Accept: } \frac{1}{2}(1)(10) \\ &= -5 \text{ m} \quad \quad \quad = 5 \text{ m}\end{aligned}$$

Distance between A and B = $15 - (-5) = 20 \text{ m} \checkmark$

Accept:

Distance between A and B = $15 + (5) = 20 \text{ m} \checkmark$

[12.1.3]

(5)
[17]

QUESTION 3 / VRAAG 3

- 3.1 The initial velocity / speed of the camera is the same ✓
(as that of the balloon).

Die beginsnelheid / spoed van die kamera is dieselfde ✓ (as dié van die ballon).

(1)

- 3.2 **Downward positive:**

Afwaarts positief:

$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \quad \checkmark$$

$$\therefore 92,4 \checkmark = v_i(6) + \frac{1}{2}(9,8)(6)^2 \quad \checkmark$$

$$\therefore v_i = -14 \text{ m} \cdot \text{s}^{-1}$$

$$\therefore v_i = 14 \text{ m} \cdot \text{s}^{-1} \quad \checkmark$$

Downward negative:

Afwaarts negatief:

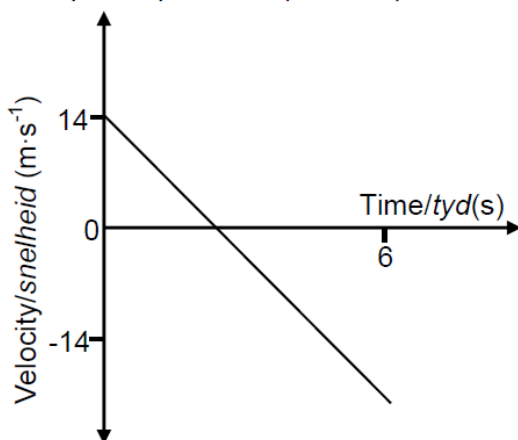
$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \quad \checkmark$$

$$\therefore -92,4 \checkmark = v_i(6) + \frac{1}{2}(-9,8)(6)^2 \quad \checkmark$$

$$\therefore v_i = 14 \text{ m} \cdot \text{s}^{-1} \quad \checkmark$$

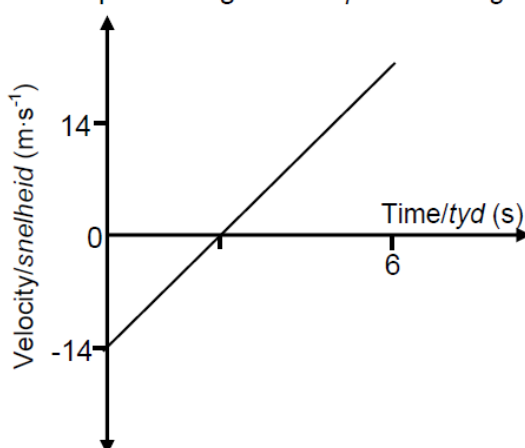
(4)

- 3.3 Upward positive/Opwaarts positief:



Criteria for graph/Kriteria vir grafiek:	Marks/Punte
Correct shape as shown.(straight line with gradient) Korrekte vorm soos getoon.(reguitlyn met gradient)	✓
Graph starts at $v = 14 \text{ m} \cdot \text{s}^{-1}$ / v_i at $t = 0 \text{ s}$. Grafiek begin by $v = 14 \text{ m} \cdot \text{s}^{-1}$ / v_i by $t = 0 \text{ s}$.	✓
Graph extends below t axis until $t = 6 \text{ s}$. Grafiek verleng onder t -as tot $t = 6 \text{ s}$.	✓
Section of graph below t axis longer than section above t axis. Gedeelte van grafiek onderkant t -as langer as gedeelte bokant t -as.	✓

Upward negative / Opwaarts negatief:



Criteria for graph/Kriteria vir grafiek:	Marks/Punte
Correct shape as shown. Korrekte vorm soos getoon.	✓
Graph starts at $v/v_i = -14 \text{ m} \cdot \text{s}^{-1}$ at $t = 0 \text{ s}$. Grafiek begin by $v/v_i = -14 \text{ m} \cdot \text{s}^{-1}$ by $t = 0 \text{ s}$.	✓
Graph extends above t axis until $t = 6 \text{ s}$. Grafiek verleng bokant t -as tot $t = 6 \text{ s}$.	✓
Section of graph above t axis longer than section below t axis. Gedeelte van grafiek bokant t -as langer as gedeelte onderkant t -as.	✓

(4)

3.4

Option 1 / Opsie 1:

$$\Delta x = v \Delta t \checkmark$$

$$\therefore 10 \checkmark = (2) \Delta t \checkmark$$

$$\therefore \Delta t = 5 \text{ s} \checkmark$$

Yes/ Will catch the camera, time is less than

6 s. ✓

Ja / Sal die kamera vang, tyd is kleiner as 6 s. ✓

Option 2/Opsie 2:

$$\Delta x = v \Delta t \checkmark$$

$$= (2) \checkmark (6) \checkmark$$

$$= 12 \text{ m} \checkmark$$

Yes / Will catch the camera, distance covered is greater than 10 m. ✓

Ja / Sal die kamera vang, afstand afgelê is groter as 10 m. ✓

Option 3 / Opsie 3:

$$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$\therefore 10 \checkmark = (2) \Delta t \checkmark + \frac{1}{2} (0) \Delta t$$

$$\therefore \Delta t = 5 \text{ s} \checkmark$$

Yes/ will catch the camera, time is less than 6 s. ✓

Ja / Sal die kamera vang, tyd is kleiner as 6 s. ✓

Option 4 / Opsie 4:

$$\Delta x = \left(\frac{v_i + v_f}{2} \right) \Delta t \checkmark \therefore 10 \checkmark = \left(\frac{2+2}{2} \right) \Delta t \checkmark \therefore \Delta t = 5 \text{ s} \checkmark$$

Yes / Will catch the camera, time is less than 6 s. ✓

Ja / Sal die kamera vang, tyd is kleiner as 6 s. ✓

Option 5 / Opsie 5:

$$\Delta x = \left(\frac{v_i + v_f}{2} \right) \Delta t \checkmark = \left(\frac{2+2}{2} \right) \checkmark 6 \checkmark = 12 \text{ m} \checkmark$$

Yes / Will catch the camera, distance covered is greater than 10 m. ✓

Ja / Sal die kamera vang, afstand afgelê is groter as 10 m. ✓

(5)

[14]

QUESTION/VRAAG 3

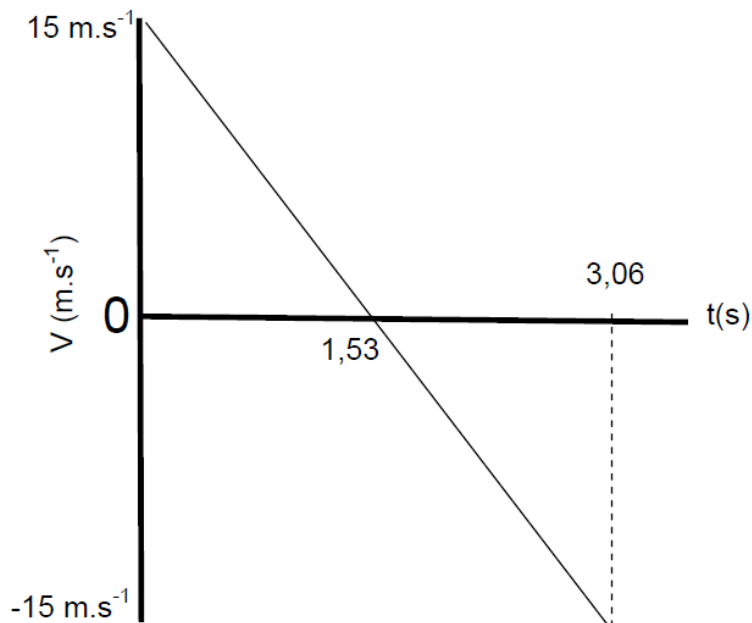
3.1 $v_f = v_i + a\Delta t$ ✓
 $0 = 15 + (-9,8)\Delta t$ ✓
 $\Delta t = 1,53 \text{ s}$ ✓ (3)

3.2 $v_f^2 = v_i^2 + 2a\Delta y$ ✓ or/of $\Delta y = \frac{(v_f + v_i)}{2} \Delta t$ or/of $\Delta y = (v_i t + \frac{1}{2} a \Delta t^2)$
 $(0)^2 = (15)^2 + 2(-9,8)\Delta y$ ✓ or/of $\Delta y = \left(\frac{(0+15)}{2}\right) 1,53$ or/of $\Delta y = (0)(1,53) + \frac{1}{2}(-9,8)(1,53)^2$
 $\Delta y = 11,48 \text{ m}$ ✓ = 11,48 m = 11,47 m (3)

3.3 Time taken to rise is equal to time taken to fall.
Tyd boontoe is gelyk aan tyd ondertoe.
 $t_{\text{total/totaal}} = 2 \times 1,53 \text{ s}$ ✓
 $= 3,06 \text{ s}$ ✓ (2)

3.4 The graph of velocity vs time/Die grafiek vir snelheid vs. tyd

X axis (labeled with values as indicated in the graph) ✓
X-as (byskrifte met waardes soos aangedui in grafiek)
 Y axis (labeled with values as indicated in the graph) ✓
Y-as (byskrifte met waardes soos aangedui in grafiek)
 shape/vorm ✓



(3)
[11]

QUESTION 3/VRAAG 3

3.1

Accepted Labels/Aanvaarde benoemings	
W	F_g / F_w / force of Earth on stone/weight/mg/gravitational force F_g / F_w / krag van Aarde op klip/gewig/mg/gravitasiekrag



(1)

3.2.1

Option 1/Opsie 1: Upward positive/Opwaarts positief: $v_f = v_i + a \Delta t$ ✓ $0 = 10 + (-9,8) \Delta t$ ✓ $\therefore \Delta t = 1,02 \text{ s}$ ✓	
Option 2/Opsie 2: Upward positive/Opwaarts positief: $v_f^2 = v_i^2 + 2a\Delta y$ $0^2 = 10^2 + 2(-9,8) \Delta y$ ✓ $\therefore y = 5,1 \text{ m}$ $\Delta y = \left(\frac{v_i + v_f}{2} \right) \Delta t$ $5,1 = \left(\frac{10 + 0}{2} \right) \Delta t$ ✓ $\therefore \Delta t = 1,02 \text{ s}$ ✓	
Upward negative/Opwaarts negatief: $v_f = v_i + a \Delta t$ ✓ $0 = -10 + 9,8 \Delta t$ ✓ $\therefore \Delta t = 1,02 \text{ s}$ ✓	
Upward negative/Opwaarts negatief: $v_f^2 = v_i^2 + 2a\Delta y$ $0^2 = (-10)^2 + 2(9,8) \Delta y$ ✓ $\therefore y = -5,1 \text{ m}$ $\Delta y = \left(\frac{v_i + v_f}{2} \right) \Delta t$ $-5,1 = \left(\frac{-10 + 0}{2} \right) \Delta t$ ✓ $\therefore \Delta t = 1,02 \text{ s}$ ✓	

(4)

3.2.2

POSITIVE MARKING FROM QUESTION 3.2.1 TO QUESTION 3.2.2 POSITIEWE NASIEN VAN VRAAG 3.2.1 NA VRAAG 3.2.2

Option 1/Opsie 1: Upward positive/Opwaarts positief: $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $0^2 = 10^2 + 2(-9,8) \Delta y$ ✓ $\therefore \Delta y = 5,1 \text{ m}$ Height/Hoogte = $50 + \checkmark 5,1$ = $55,1 \text{ m}$ ✓	
Upward negative/Opwaarts negatief: $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $0^2 = (-10)^2 + 2(9,8) \Delta y$ ✓ $\therefore \Delta y = -5,1 \text{ m}$ Height/Hoogte = $50 + \checkmark 5,1$ = $55,1 \text{ m}$ ✓	

Option 2/Opsie 2:

Upward positive/Opwaarts positief:

$$\Delta y = \left(\frac{v_i + v_f}{2} \right) \Delta t \checkmark$$

$$\Delta y = \left(\frac{10 + 0}{2} \right) 1,02 \checkmark$$

$$\therefore = 5,1 \text{ m}$$

$$\begin{aligned} \text{Height} &= 50 + \checkmark 5,1 \\ &= 55,1 \text{ m } \checkmark \end{aligned}$$

Upward negative/Opwaarts negatief:

$$\Delta y = \left(\frac{v_i + v_f}{2} \right) \Delta t \checkmark$$

$$\Delta y = \left(\frac{-10 + 0}{2} \right) 1,02 \checkmark$$

$$\therefore \therefore \Delta y = -5,1 \text{ m}$$

$$\begin{aligned} \text{Height/Hoogte} &= 50 + \checkmark 5,1 \\ &= 55,1 \text{ m } \checkmark \end{aligned}$$

Option 3/Opsie 3:

**Consider downward motion/
Beskou afwaartse beweging:**

$$\Delta y = \left(\frac{v_i + v_f}{2} \right) \Delta t \checkmark$$

$$\Delta y = \left(\frac{-10 + 0}{2} \right) 1,02 \checkmark$$

$$\therefore = -5,1 \text{ m}$$

$$\begin{aligned} \text{Height} &= 50 + \checkmark 5,1 \\ &= 55,1 \text{ m } \checkmark \end{aligned}$$

Upward negative/Opwaarts negatief:

$$\Delta y = \left(\frac{v_i + v_f}{2} \right) \Delta t \checkmark$$

$$\Delta y = \left(\frac{-10 + 0}{2} \right) 1,02 \checkmark$$

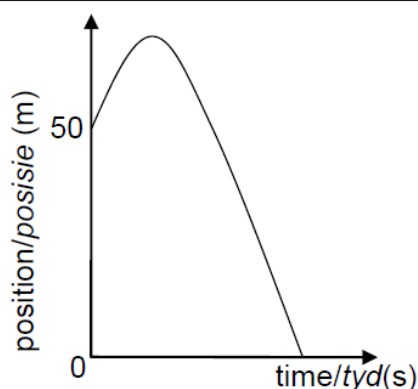
$$\therefore = -5,1 \text{ m}$$

$$\begin{aligned} \text{Height/Hoogte} &= 50 + \checkmark 5,1 \\ &= 55,1 \text{ m } \checkmark \end{aligned}$$

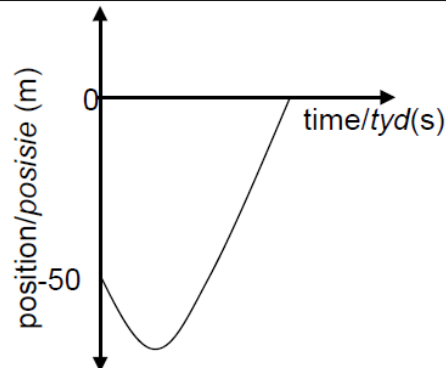
(4)

Criteria for graph/Kriteria vir grafiek	Marks/ Punte
Correct shape/Korrekte vorm	✓
Final position lower than initial position.	✓
Graph ends on x axis./Grafiek eindig op x-as.	✓

Upward positive/Opwaarts positief



Upward negative/Opwaarts negatief



3.4

Option 1/Opsie 1

$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$1,5 \checkmark = v_i(0,1) + \frac{1}{2}(9,8)(0,1)^2 \checkmark$$

$$\therefore v_i = 14,51 \text{ m} \cdot \text{s}^{-1}$$

From maximum height/Van maksimum hoogte:

$$v_f^2 = v_i^2 + 2a\Delta y \checkmark$$

$$14,51^2 \checkmark = (0)^2 + 2(9,8)\Delta y \checkmark$$

$$\therefore \Delta y = 10,74 \text{ m}$$

$$\text{Height/Hoogte} = 55,1 - 10,74 \\ = 44,36 \text{ m} \checkmark$$

Option 2/Opsie 2

$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$1,5 \checkmark = v_i(0,1) + \frac{1}{2}(9,8)(0,1)^2 \checkmark$$

$$\therefore v_i = 14,51 \text{ m} \cdot \text{s}^{-1}$$

Downwards from top of tower to top of window:/Afwarts van bopunt van toring tot bopunt van venster

$$v_f^2 = v_i^2 + 2a\Delta y \checkmark$$

$$14,51^2 \checkmark = (10)^2 + 2(9,8)\Delta y \checkmark$$

$$\therefore \Delta y = 5,64 \text{ m}$$

$$\text{Height/Hoogte} = 50 - 5,64 \\ = 44,36 \text{ m} \checkmark$$

Option 4/Opsie 4

$$\bar{v} = \frac{\Delta y}{\Delta t} = \frac{1,5}{0,1} = 15 \text{ m} \cdot \text{s}^{-1}$$

$$\bar{v} = \frac{v_i + v_f}{2} = 15$$

$$\therefore v_i + v_f = 30 \text{ m} \cdot \text{s}^{-1}$$

$$\therefore v_f = 30 - v_i$$

$$v_f = v_i + a \Delta t \checkmark$$

$$30 - v_i \checkmark = v_i + 9,8(0,1) \checkmark$$

$$\therefore v_i = 14,51 \text{ m} \cdot \text{s}^{-1}$$

$$v_f^2 = v_i^2 + 2a\Delta y \checkmark$$

$$14,51^2 \checkmark = (0)^2 + 2(9,8)\Delta y \checkmark$$

$$\therefore \Delta y = 10,74 \text{ m}$$

$$\text{Height/Hoogte} = 55,1 - 10,74 \\ = 44,36 \text{ m} \checkmark$$

Option 3/Opsie 3

$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$1,5 \checkmark = v_i(0,1) + \frac{1}{2}(9,8)(0,1)^2 \checkmark$$

$$\therefore v_i = 14,51 \text{ m} \cdot \text{s}^{-1}$$

From original point of projection:/Van oorspronklike punt van projeksie

$$v_f^2 = v_i^2 + 2a\Delta y \checkmark$$

$$14,51^2 \checkmark = (-10)^2 + 2(9,8)\Delta y \checkmark$$

$$\therefore \Delta y = 5,64 \text{ m}$$

$$\text{Height/Hoogte} = 50 - 5,64 \\ = 44,36 \text{ m} \checkmark$$

(7)
[19]

QUESTION 3/VRAAG 3

3.1 Downward/afwaarts ✓ (1)

3.2

3.2.1 Upwards positive/Opwaarts positief:

$$\begin{aligned} v_f &= v_i + a\Delta t \checkmark \\ &= 8 \checkmark + (-9,8)(4) \checkmark \\ &= -31,2 \text{ m}\cdot\text{s}^{-1} \\ \therefore v_f &= 31,2 \text{ m}\cdot\text{s}^{-1} \checkmark \end{aligned}$$

Downwards positive/Afwaarts positief:

$$\begin{aligned} v_f &= v_i + a\Delta t \checkmark \\ &= -8 \checkmark + (9,8)(4) \checkmark \\ \therefore v_f &= 31,2 \text{ m}\cdot\text{s}^{-1} \checkmark \end{aligned} \quad (4)$$

3.2.2

OPTION 1/OPSIE 1

Upwards positive/Opwaarts positief:

$$\begin{aligned} \Delta y &= v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark \\ &= (8)(4) \checkmark + \frac{1}{2}(-9,8)(4)^2 \checkmark \\ &= -46,4 \text{ m} \end{aligned}$$

Height of balcony/Hoogte van balkon:

$$60 - 46,4 \checkmark = 13,6 \text{ m} \checkmark$$

Downwards positive/Afwaarts positief:

$$\begin{aligned} \Delta y &= v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark \\ &= (-8)(4) \checkmark + \frac{1}{2}(9,8)(4)^2 \checkmark \\ &= 46,4 \text{ m} \end{aligned}$$

Height of balcony/Hoogte van balkon:

$$60 - 46,4 \checkmark = 13,6 \text{ m} \checkmark$$

OPTION 2/OPSIE 2

Upwards positive/Opwaarts positief:

$$\begin{aligned} \Delta y &= v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark \\ &= (27,13) \checkmark (6) \checkmark + \frac{1}{2}(-9,8)(6)^2 \checkmark \\ &= -13,62 \text{ m} \end{aligned}$$

Height of balcony/Hoogte van balkon:

$$= 13,62 \text{ m} \checkmark$$

Downwards positive/Afwaarts positief:

$$\begin{aligned} \Delta y &= v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark \\ &= (-27,13) \checkmark (6) \checkmark + \frac{1}{2}(9,8)(6)^2 \checkmark \\ &= 13,62 \text{ m} \end{aligned}$$

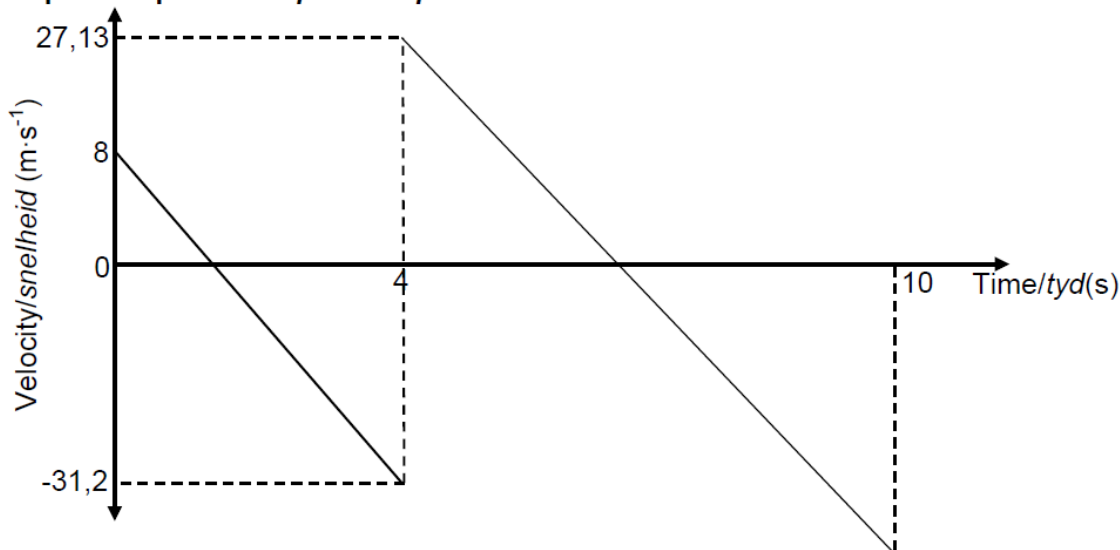
Height of balcony/Hoogte van balkon:

$$= 13,62 \text{ m} \checkmark \quad (5)$$

3.3

OPTION 1/OPSIE 1

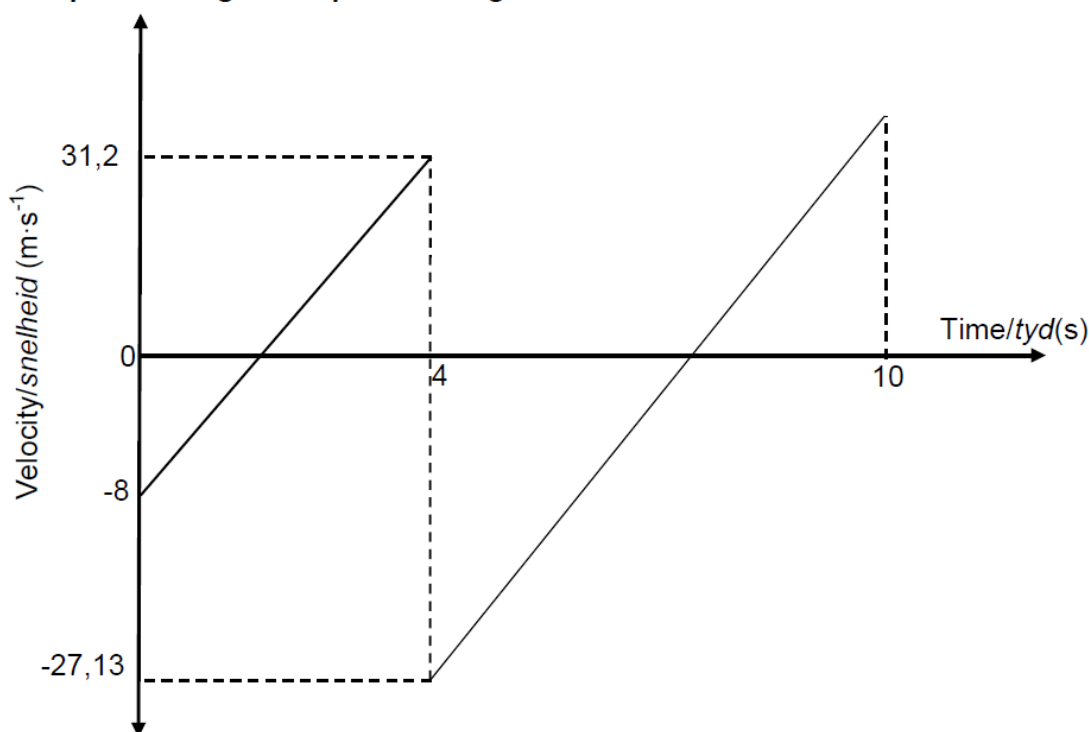
Upwards positive/Opwaarts positief:



Criteria for graph/Kriteria vir grafiek:	Marks/ Punte
Shape has two parallel lines with a gradient. <i>Vorm het twee ewewydige lyne met gradient.</i>	✓
First part of graph starts at $v = 8 \text{ m}\cdot\text{s}^{-1}$ at $t = 0 \text{ s}$ <i>Eerste deel van grafiek begin by $v = 8 \text{ m}\cdot\text{s}^{-1}$ by $t = 0 \text{ s}$.</i>	✓
Positive marking from QUESTION 3.2.1: Positiewe nasien vanaf VRAAG 3.2.1: First part of the graph extends below the x axis until $v = -31,2 \text{ m}\cdot\text{s}^{-1}$ at $t = 4 \text{ s}$. <i>Eerste deel van die grafiek verleng onder x-as tot $v = -31,2 \text{ m}\cdot\text{s}^{-1}$ by $t = 4 \text{ s}$.</i>	✓
Graph is discontinuous and object changes direction at 4 s. <i>Grafiek is nie kontinu nie en voorwerp verander van rigting by 4 s.</i>	✓
Second part of graph starts at $v = 27,13 \text{ m}\cdot\text{s}^{-1}$ at $t = 4 \text{ s}$. <i>Tweede deel van grafiek begin by $v = 27,13 \text{ m}\cdot\text{s}^{-1}$ by $t = 4 \text{ s}$.</i>	✓
Second part of graph extends below the x axis until $t = 10 \text{ s}$. <i>Tweede deel van grafiek verleng onder x-as tot $t = 10 \text{ s}$.</i>	✓

OPTION 2/OPSIE 2

Upwards negative/Opwaarts negatief:



Criteria for graph/Kriteria vir grafiek:	Marks Punte
Correct shape as shown (two parallel lines). <i>Korrekte vorm soos aangetoon (twee ewewydige lyne).</i>	✓
First part of graph starts at $v = -8 \text{ m} \cdot \text{s}^{-1}$ at $t = 0 \text{ s}$ <i>Eerste deel van grafiek begin by $v = -8 \text{ m} \cdot \text{s}^{-1}$ by $t = 0 \text{ s}$</i>	✓
Positive marking from QUESTION 3.2.1. Positiewe nasien vanaf VRAAG 3.2.1. First part of the graph extends above the x axis until $v = 31,2 \text{ m} \cdot \text{s}^{-1}$ at $t = 4 \text{ s}$. <i>Eerste deel van die grafiek verleng bokant x-as tot $v = 31,2 \text{ m} \cdot \text{s}^{-1}$ by $t = 4 \text{ s}$.</i>	✓
Graph is discontinuous and object changes direction at 4 s. <i>Grafiek is nie kontinu en voorwerp verander van rigting by 4 s.</i>	✓
Second part of graph starts at $v = -27,13 \text{ m} \cdot \text{s}^{-1}$ at $t = 4 \text{ s}$. <i>Tweede deel van grafiek begin by $v = -27,13 \text{ m} \cdot \text{s}^{-1}$ by $t = 4 \text{ s}$.</i>	✓
Second part of graph extends above the x axis until $t = 10 \text{ s}$. <i>Tweede deel van grafiek verleng bokant x-as tot $t = 10 \text{ s}$.</i>	✓

(6)
[16]

QUESTION 3/VRAAG 3

3.1 $15 \text{ m}\cdot\text{s}^{-1}$ ✓

(1)

3.2

OPTION 1/OPSIE 1

Inelastic ✓

The speed/velocity at which the ball leaves the floor is less / different than that at which it strikes the floor. OR The speed/velocity of the ball changes during the collision. ✓

Therefore the kinetic energy changes/is not conserved. ✓

Onelasties

Die speed/snelheid waarteen die bal die vloer verlaat is kleiner / verskillend as dit waarteen dit die vloer tref. OF Die speed / snelheid van die bal verander gedurende die botsing.

Die kinetiese energie verander/bly nie behoue nie.

OPTION 2/OPSIE 2

Collision is inelastic. ✓

Botsing is onelasties

$$\begin{aligned}\Delta K &= \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 \\ &= \frac{1}{2}(0,15)(15)^2 - \frac{1}{2}(0,15)(20)^2 \checkmark \\ &= -13,13 \text{ J}\end{aligned}$$

$$K_i \neq K_f / \Delta K \neq 0 \checkmark$$

OPTION 3/OPSIE 3

Collision is inelastic. ✓

Botsing is onelasties. ✓

$$\begin{aligned}K_f &= \frac{1}{2}mv_f^2 \\ &= \frac{1}{2}(0,15)(15)^2 \\ &= 16,88 \text{ J}\end{aligned}$$

$$\begin{aligned}K_i &= \frac{1}{2}mv_i^2 \\ &= \frac{1}{2}(0,15)(20)^2 \\ &= 30 \text{ J}\end{aligned}$$

$$K_f \neq K_i / \Delta K \neq 0 \checkmark$$

(3)

3.3

OPTION 1/OPSIE 1

$$v_f^2 = v_i^2 + 2a\Delta y \checkmark$$

$$(20)^2 \checkmark = (10)^2 + 2(9,8)\Delta y \checkmark$$

$$\therefore \Delta y = 15,31 \text{ m} \checkmark$$

OPTION 2/OPSIE 2

$$W_{\text{net}} = \Delta K \checkmark$$

$$F_{\text{net}}\Delta y \cos \theta = \frac{1}{2}m(v_f^2 - v_i^2)$$

$$m(9,8)\Delta y \cos 0^\circ \checkmark = \frac{1}{2}m(20^2 - 10^2) \checkmark$$

$$\Delta y = 15,31 \text{ m} \checkmark$$

OPTION 3/OPSIE 3

$$\begin{aligned}(E_p + E_k)_{\text{top}} &= (E_p + E_k)_{\text{bottom}} \\ (mgh + \frac{1}{2}mv^2)_{\text{top}} &= (mgh + \frac{1}{2}mv^2)_{\text{bottom}} \quad \left. \vphantom{\begin{aligned} (E_p + E_k)_{\text{top}} &= (E_p + E_k)_{\text{bottom}} \\ (mgh + \frac{1}{2}mv^2)_{\text{top}} &= (mgh + \frac{1}{2}mv^2)_{\text{bottom}} \end{aligned}} \right\} \checkmark \text{ any one/enige een} \\ m(9,8)h + \frac{1}{2}m(10)^2 \checkmark &= m(9,8)(0) + \frac{1}{2}m(20)^2 \checkmark \\ h &= 15,31 \text{ m} \checkmark\end{aligned}$$

OPTION 4/OPSIE 4

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

$$20 = 10 + (9,8)(\Delta t)$$

$$\therefore \Delta t = 1,02 \text{ s}$$

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

$$= (10)(1,02) \checkmark + \frac{1}{2}(9,8)(1,02)^2 \checkmark$$

$$\therefore \Delta y = 15,3 \text{ m} \checkmark$$

OPTION 5/OPSIE 5

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

$$20 = 10 + (9,8)(\Delta t)$$

$$\therefore \Delta t = 1,02 \text{ s}$$

$$\Delta y = \left(\frac{v_i + v_f}{2} \right) \Delta t$$

$$\Delta y = \left(\frac{10 + 20}{2} \right) \checkmark (1,02) \checkmark$$

$$\therefore \Delta y = 15,3 \text{ m} \checkmark$$

OPTION 6/OPSIE 6

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

$$20 = 10 + (9,8)(\Delta t)$$

$$\therefore \Delta t = 1,02 \text{ s}$$

Height = area between graph & t axis

Hoogte = opperv. tussen grafiek & t -as

$$= \frac{1}{2}(\text{sum || sides})h_{\perp}$$

$$= \frac{1}{2}(10 + 20) \checkmark 1,02 \checkmark$$

$$= 15,3 \text{ m} \checkmark$$

$$= 15,3 \text{ m} \checkmark$$

OPTION 7/OPSIE 7

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

$$20 = 10 + (9,8)(\Delta t)$$

$$\therefore \Delta t = 1,02 \text{ s}$$

Height = area between graph & t axis

Hoogte = opperv. tussen grafiek & t -as

$$= lb + \frac{1}{2}bh = \frac{1}{2}(10 + 20)1,02$$

$$= (1,02)(10) \checkmark + \frac{1}{2}(1,02)(10) \checkmark$$

$$= 15,3 \text{ m} \checkmark$$

OPTION 8/OPSIE 8

$$F_{\text{net}} = ma$$

$$mg = m \left(\frac{v_f^2 - v_i^2}{2\Delta x} \right) \checkmark$$

$$(0,15)(9,8) \checkmark = (0,15) \left(\frac{20^2 - 10^2}{2\Delta x} \right) \checkmark$$

$$\Delta x = 15,31 \text{ m} \checkmark$$

(4)

3.3.2

$$F_{\text{net}}\Delta t = \Delta p$$

$$F_{\text{net}}\Delta t = mv_f - mv_i \quad \left. \begin{array}{l} F_{\text{net}}\Delta t = \Delta p \\ \Delta p = mv_f - mv_i \end{array} \right\} \checkmark \text{Any one/Enige een}$$

$$\Delta p = mv_f - mv_i$$

$$= 0,15(-15 - 20) \checkmark$$

$$= -5,25 \text{ N}\cdot\text{s} \text{ (or } -5,25 \text{ kg}\cdot\text{m}\cdot\text{s}^{-1})$$

$$\text{Magnitude/Grootte} = 5,25 \text{ N}\cdot\text{s} \text{ or } 5,25 \text{ kg}\cdot\text{m}\cdot\text{s}^{-1} \checkmark$$

(3)

3.3.3

OPTION 1 / OPSIE 1

Displacement from floor to max. height/ Verplasing van vloer na maks. hoogte:

$$v_f^2 = v_i^2 + 2a\Delta y \checkmark$$

$$(0)^2 = (-15)^2 + 2(9,8)\Delta y \checkmark$$

$$\therefore \Delta y = -11,48 \text{ m}$$

Total displacement / Totale verplasing

$$= -11,48 + 15,3 \checkmark$$

$$= 3,82 \text{ m} \checkmark / 3,83 \text{ m}$$

OPTION 2 / OPSIE 2

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

$$0 = -15 + (9,8)\Delta t$$

$$\Delta t = 1,53 \text{ s}$$

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

$$= (-15)(1,53) + \frac{1}{2}(9,8)(1,53)^2 \checkmark$$

$$= -11,48 \text{ m}$$

Total displacement / Totale verplasing

$$= -11,48 + 15,3 \checkmark$$

$$= 3,82 \text{ m} \checkmark$$

OPTION 3 / OPSIE 3

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

$$0 = -15 + (9,8)\Delta t$$

$$\Delta t = 1,53 \text{ s}$$

$$\Delta y = \left(\frac{v_f + v_i}{2} \right) \Delta t$$

$$= \left(\frac{0 + (-15)}{2} \right) (1,53) \checkmark$$

$$= -11,48 \text{ m}$$

Total displacement / Totale verplasing

$$= -11,48 + 15,3 \checkmark$$

$$= 3,82 \text{ m} \checkmark$$

OPTION 4 / OPSIE 4

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

$$0 = -15 + (9,8)\Delta t$$

$$\Delta t = 1,53 \text{ s}$$

$$\text{Area} = \frac{1}{2}bh$$

$$= \frac{1}{2}(1,53)(-15) \checkmark$$

$$= -11,48 \text{ m}$$

Total displacement / Totale verplasing

$$= -11,48 + 15,3 \checkmark$$

$$= 3,82 \text{ m} \checkmark$$

OPTION 5 / OPSIE 5

$$\left. \begin{aligned} E_{M(\text{initial})} &= E_{M(\text{final})} \\ (E_p + E_k)_{\text{initial}} &= (E_p + E_k)_{\text{final}} \\ (mgh + \frac{1}{2}mv^2)_{\text{initial}} &= (mgh + \frac{1}{2}mv^2)_{\text{final}} \end{aligned} \right\} \checkmark \text{ Any one / Enige een}$$

$$(0,15)(9,8)(0) + \frac{1}{2}(0,15)(15)^2 = (0,15)(9,8)h + \frac{1}{2}(0,15)(0)^2 \checkmark$$

$$h = 11,48 \text{ m}$$

Total displacement / Totale verplasing
 $= 15,31 - 11,48 \checkmark = 3,83 \text{ m} \checkmark$

OPTION 6 / OPSIE 6

$$W_{\text{net}} = \Delta K \checkmark$$

$$F_{\text{net}} \Delta y \cos \theta = \frac{1}{2} m(v_f^2 - v_i^2)$$

$$m(9,8) \Delta y \cos 180^\circ = \frac{1}{2} m(0^2 - 15^2) \checkmark$$

$$\Delta y = 11,48 \text{ m}$$

Total displacement / Totale verplasing
 $= 15,31 - 11,48 \checkmark$
 $= 3,83 \text{ m} \checkmark$

OPTION 7 / OPSIE 7

$$F_{\text{net}} = ma$$

$$mg = m \left(\frac{v_f^2 - v_i^2}{2\Delta x} \right) \checkmark$$

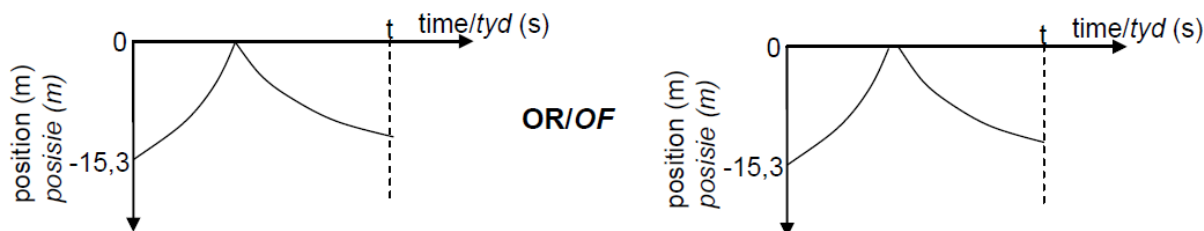
$$(0,15)(9,8) = (0,15) \left(\frac{0^2 - (-15)^2}{2\Delta x} \right) \checkmark$$

$$\Delta x = -11,48 \text{ m}$$

Total displacement / Totale verplasing
 $= 15,31 - 11,48 \checkmark$
 $= 3,83 \text{ m} \checkmark$

(4)

3.4



Marking criteria for graph: / Nasienriglyne vir grafiek:

Correct shape as shown for first part. / Korrekte vorm soos aangetoon vir eerste deel.	✓
Correct shape as shown for the second part up to $t / 2,55 \text{ s}$. Korrekte vorm soos aangetoon vir tweede deel $t / 2,55 \text{ s}$.	✓
Graph starts at $-15,3 \text{ m}$ at $t = 0 \text{ s}$. / Grafiek begin by $-15,3 \text{ m}$ by $t = 0 \text{ s}$.	✓
Maximum height after bounce at time $t / 2,55 \text{ s}$. / Maksimum hoogte na bons by tyd $t / 2,55 \text{ s}$.	✓
Maximum height after bounce less than $15,3 \text{ m}$. / Maksimum hoogte na bons kleiner as $15,3 \text{ m}$.	

(4)

[19]

QUESTION/VRAAG 3

3.1 Gravitational acceleration (g)/gravitasieversnelling (g) ✓ [12.2.1] (1)

3.2 12 m.s⁻¹ up / op ✓ [12.1.3] (1)

3.3 3.3.1 It is at its highest position/by sy hoogste punt ✓ [12.1.3] (1)

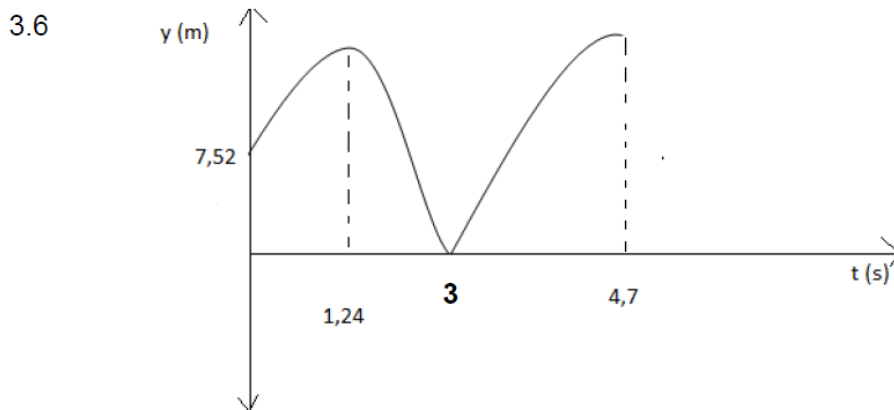
3.3.2 on the ground/op die grond ✓ [12.1.3] (1)

3.3.3 maximum height after it has bounced/maksimum hoogte na die bons ✓ [12.2.2] (1)

3.4 3.4.1 Area under the graph/Area onder grafiek = $\frac{1}{2} b \times h$ ✓
 $= \frac{1}{2} (3 - 1,24)(17)$ ✓ - $\frac{1}{2} (1,24)(12)$ ✓
 $= 14,96 - 7,44$
 $= 7,52 \text{ m}$ ✓ [12.1.3] (4)

3.4.2 Area under the graph/Area onder grafiek = $\frac{1}{2} b \times h$
 $= \frac{1}{2} (4,7 - 3) \sqrt{(17)}$ ✓
 $= 14,45 \text{ m}$ ✓ [12.1.3] (3)

3.5 $F_{\text{net}} \Delta t = \Delta p$ ✓
 $= m (v_f - v_i)$
 $= 150 \times 10^{-3} (17 - (-17))$ ✓
 $= 150 \times 10^{-3} (34)$
 $= 5,1 \text{ kg.m.s}^{-1}$ ✓ up / op [12.1.3] (3)



1 mark for the shape of the graph (going up then bouncing back up)/1 punt vir die vorm van die grafiek (gaan op, bons dan terug op)

1 mark for the height of the bounce equal the height of throw/
 1 punt vir die hoogte van die bons gelyk aan die hoogte van die gooi

1 mark for **not** starting at $y = 0$ ($y = 7,52$)
 1 punt in die **nie** begin by $y = 0$ ($y = 7,52$)

(-1 mark if both axes are not labelled)
 (-1 punt indien beide asse nie benoem nie)

[12.1.3] (3)
[18]

QUESTION 3/VRAAG 3

3.1 Free fall/Vrye val

ACCEPT/AANVAAR

Vertically accelerated motion/projectile motion.
 Vertikale versnelde beweging /projektielbeweging

(1)

3.2.1 Downward motion as positive
 Afwaartse beweging as positief

$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$30 \checkmark = v_i (1,5) + \frac{1}{2} (9,8) (1,5)^2 \checkmark$$

$$v_i = 12,65 \text{ m} \cdot \text{s}^{-1} \checkmark$$

Upward motion as positive
 Opwaartse beweging as positief

$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$$

$$-30 \checkmark = v_i (1,5) + \frac{1}{2} (-9,8) (1,5)^2 \checkmark$$

$$v_i = 12,65 \text{ m} \cdot \text{s}^{-1} \checkmark$$

Notes / Aantekeninge

Accept/Aanvaar
 g or/of a
 $\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$
 $s = ut + \frac{1}{2} at^2$

(4)

3.2.2 **OPTION 1/OPSIE 1**
 Positive marking from QUESTION 3.2.1
 Positiewe nasien vanaf VRAAG 3.2.1

Downward motion as positive
 Afwaartse beweging as positief

$$v_f^2 = v_i^2 + 2a\Delta y \checkmark$$

$$12,65^2 \checkmark = 0 + 2(9,8) \Delta y \checkmark$$

$$\Delta y = 8,16 \text{ m} \checkmark$$

Height/Hoogte $XC = XB + BC$
 $(30 + 8,16) = 38,16 \text{ m}$
 Height is/Hoogte is $38,16 \text{ m} \checkmark$

Notes / Aantekeninge

For/Vir XB

Accept/Aanvaar
 g or/of a
 $v^2 = u^2 + 2as$

The height must be written down in order to score the final mark.
 Die hoogte moet neergeskryf word om die finale punt te kry.

Upward motion as positive
Opwaartse beweging as positief

$$v_f^2 = v_i^2 + 2a\Delta y \checkmark$$

$$(-12,65)^2 \checkmark = 0 + 2(-9,8) \Delta y \checkmark$$

$$\Delta y = -8,16 \text{ m} \checkmark$$

Height/Hoogte **XC = XB + BC**

$$(-30) + (-8,16) = -38,16 \text{ m}$$

Height is /Hoogte is 38,16 m) $\checkmark$

(5)

OPTION / OPSIE 2

Positive marking from QUESTION 3.2.1

Positiewe nasien vanaf VRAAG 3.2.1

Downward motion as positive

Afwaartse beweging as positief

$$v_B = v_X + a\Delta t \checkmark$$

$$12,65 = 0 + 9,8\Delta t \checkmark$$

$$\Delta t = 1,29 \text{ s}$$

$$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark$$

$$= 0 + \frac{1}{2}(9,8)(1,29)^2 \checkmark$$

$$\Delta y = 8,15 \text{ m}$$

Height/Hoogte **XC = XB + BC**

$$(30 + 8,15) = 38,15 \text{ m} \checkmark$$

Upward motion as positive

Opwaartse beweging as positief

$$v_B = v_X + a\Delta t \checkmark$$

$$-12,65 = 0 + (-9,8)\Delta t \checkmark$$

$$\Delta t = 1,29 \text{ s}$$

$$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark$$

$$= 0 + \frac{1}{2}(-9,8)(1,29)^2 \checkmark$$

$$\Delta y = -8,15 \text{ m}$$

Height/Hoogte **XC = XB + BC**

$$(-30) + (-8,15) = 38,15 \text{ m} \checkmark$$

Notes / Aantekeninge

Start with time for XB

Begin met tyd vir XB

Accept/Aanvaar

g or/of a

$$v=u+at$$

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

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

(5)

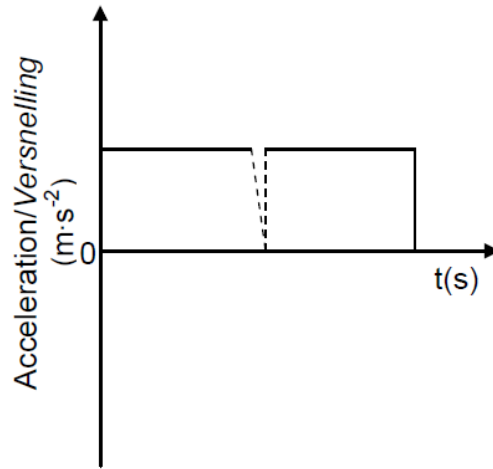
OPTION 3/OPSIE 3 Positive marking from QUESTION 3.2.1 Positiewe nasien vanaf VRAAG 3.2.1 Downward motion as positive Afwaartse beweging as positief $v_C = v_B + a\Delta t \checkmark$ $= 12,65 + 9,8 (1,5) \checkmark$ $= 27,35 \text{ m}\cdot\text{s}^{-1}$ $v_C^2 = v_x^2 + 2a\Delta y \checkmark$ $(27,35)^2 = 0 + 2(9,8) \Delta y \checkmark$ $\therefore \Delta y = 38,16 \text{ m}$ Height is /Hoogte is 38,16 m ✓ Upward motion as positive Opwaartse beweging as positief $v_C = v_B + a\Delta t \checkmark$ $= -12,65 + (-9,8) (1,5) \checkmark$ $= -27,35 \text{ m}\cdot\text{s}^{-1}$ $v_C^2 = v_x^2 + 2a\Delta y \checkmark$ $(-27,35)^2 = 0 + 2(-9,8) \Delta y \checkmark$ $\therefore \Delta y = -38,16 \text{ m}$ Height/Hoogte = 38,16m ✓	Notes / Aantekeninge start with velocity at C Accept/Aanvaar g or/of a $v = u + at$ $v^2 = u^2 + 2as$ The height must be written down in order to score the final mark. Die hoogte moet neergeskryf word om die finale punt te kry.
OPTION 4/OPSIE 4 Positive marking from QUESTION 3.2.1 Positiewe nasien vanaf VRAAG 3.2.1 $\Delta U + \Delta K = 0 \checkmark$ $(mgh + 0) \checkmark = 0 + (\frac{1}{2} m(12,65)^2) \checkmark$ $h = 8,16 \text{ m} \checkmark$ $XC = h + 30$ $= (30 + 8,16)$ $= 38,16 \text{ m} \checkmark$	Notes / Aantekeninge Accept/Aanvaar $mgh_i + \frac{1}{2} mv_i^2 = mgh_f + \frac{1}{2} mv_f^2$ Take point B as the zero position and $XH = h$ Neem punt B is nul posisie en $XH = h$

(5)

(5)

3.3

OPTION 1/OPSIE 1

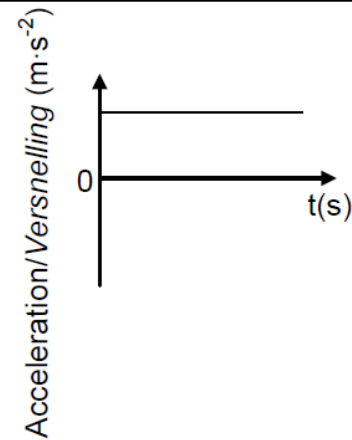


Notes / Aantekeninge

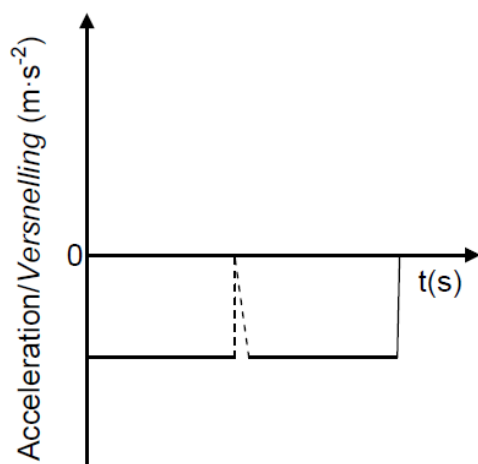
Criteria/Kriteria	Mark/Punt
For each line correctly drawn as shown <i>Vir elke lyn korrek geteken soos getoon</i>	✓✓
Both axes correctly labelled <i>Beide asse korrek benoem</i>	✓

Accept/Aanvaar

Only 2 marks for this answer/Slegs 2 punte vir hierdie antwoord



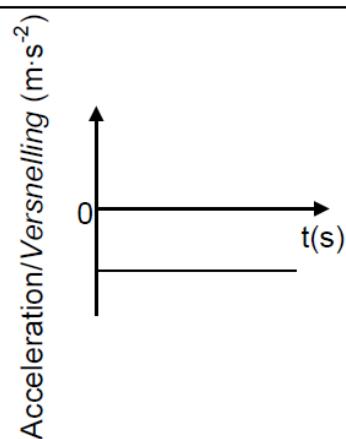
OPTION 2/OPSIE 2



Notes / Aantekeninge

Criteria/Kriteria	Mark/Punt
For each line correctly drawn as shown <i>Vir elke lyn korrek geteken soos getoon</i>	✓✓
Both axes correctly labelled <i>Beide asse korrek benoem</i>	✓

Only 2 marks for this answer/Slegs 2 punte vir hierdie antwoord



(3)
[13]