basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATIONS/ NATIONAL SENIOR CERTIFICATE EXAMINATIONS
SENIORSERTIFIKAAT-EKSAMEN/ NASIONALE SENIORSERTIFIKAAT-EKSAMEN

PHYSICAL SCIENCES: PHYSICS (P1)
FISIESE WETENSKAPPE: FISIKA (V1)

MAY/JUNE/*MEI/JUNIE* 2026

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 22 pages.
Hierdie nasienriglyne bestaan uit 22 bladsye.

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QUESTION 1/*VRAAG 1*

1.1	C ✓✓	(2)
1.2	B ✓✓	(2)
1.3	D ✓✓	(2)
1.4	B ✓✓	(2)
1.5	C ✓✓	(2)
1.6	D ✓✓	(2)
1.7	C ✓✓	(2)
1.8	D ✓✓	(2)
1.9	D ✓✓	(2)
1.10	A ✓✓	(2)

[20]

QUESTION 2/*VRAAG 2*

2.1

Marking criteria/*Nasienkriteria*
If any of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark/*Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

When a resultant/net force acts on an object, the object will accelerate in the direction of the force. The acceleration is directly proportional to the (resultant/net) force and inversely proportional to the mass of the object. ✓✓

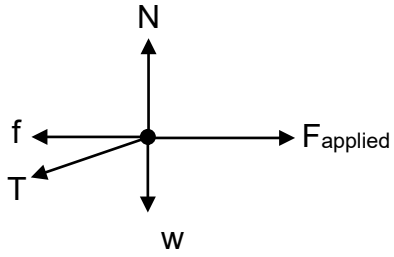
Wanneer 'n resulterende/netto krag op 'n voorwerp inwerk, sal die voorwerp in die rigting van die krag versnel. Die versnelling is direk eweredig aan die netto krag en omgekeerd eweredig aan die massa van die voorwerp

OR/*OF*

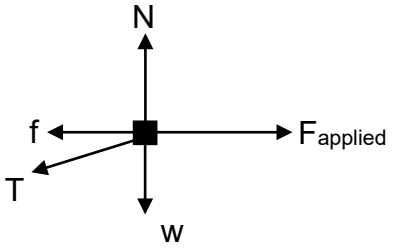
The net force acting on an object is equal to the rate of change of momentum of the object (in the direction of the net force). ✓✓(**2 OR 0**)

Die netto krag wat op 'n voorwerp inwerk is gelyk aan die tempo van verandering in momentum van die voorwerp (in die rigting van die krag) (2)

2.2



Accept/ *Aanvaar:*



Accepted labels/*Aanvaarde benoemings*	
w	F_g /F_w /weight /mg /gravitational force / 58,8 N *F_g /F_w /gewig /mg /gravitasiekrag /* 58,8 N
T	F_T /F_{string} /*F_{tou}* /F_t /tension /*spanning* /*F_s*
f	F_f /f_k /(kinetic) friction /*(kinetiese) wrywing* / 24,5 N /*F_w*
N	F_N /Normal (Force) /F_{normal} /*$F_{normaal}$* /*Normaal*
$F_{applied}$	F_A / F_{app} / 32 N / F / $F_{horizontal}$

Notes/*Aantekeninge*
- Mark awarded for label and arrow./*Punt toegeken vir benoeming en pyltjie.*
- Do not penalise for length of arrows since drawing is not to scale./*Moenie vir die lengte van die pyltjies penaliseer nie aangesien die tekening nie volgens skaal is nie.*
- Any other additional force(s)/*Enige ander addisionele krag(te):* Max/*Maks* $^4/_5$
- If everything correct, but no arrows/*Indien alles korrek, maar geen pyltjies*: Max/*Maks* $^4/_5$
- If force(s) do not make contact with the dot /*Indien krag(te) nie met die kolletjie kontak maak nie*: Max/*Maks* $^4/_5$

(5)

2.3.1

Note: If T is used instead of $T_{horizontal}$ max: $^{3}/_{5}$

OPTION 1/*OPSIE 1*
RIGHT AS POSITIVE/ *REGS AS POSITIEF*
For 2 kg:

$F_{net} = ma$
$T_{horizontal} + f = ma$ } ✓ Any one/*Enige een*

$T_{horizontal} - 3,74$ ✓ $= (2)(0,47)$

$T_{horizontal} = 4,68$ N

T_x **OR** $T_{horizontal}$ **OR** $T\cos\theta$

For 6 kg: ✓ both/*beide*

$F_{net} = ma$
$F_A + f + T_{horizontal} = ma$
$32 - f - 4,68$ ✓ $= (6)(0,47)$

$f = 24,5$ N ✓

OPTION 2/*OPSIE 2*
LEFT AS POSITIVE/ *LINKS AS POSITIEF*
For 2 kg:

$F_{net} = ma$
$T_{horizontal} + f = ma$ } ✓ Any one/*Enige een*

$T_{horizontal} + 3,74$ ✓ $= (2)(-0,47)$

$T_{horizontal} = -4,68$ N

T_x **OR** $T_{horizontal}$ **OR** $T\cos\theta$

For 6 kg: ✓ both/*beide*

$F_{net} = ma$
$F_A + f + T_{horizontal} = ma$
$-32 + f + 4,68$ ✓ $= (6)(-0,47)$

$f = 24,5$ N ✓

(5)

2.3.2

POSITIVE MARKING FROM QUESTION 2.3.1 for 4,68 N /
POSITIEWE NASIEN VANAF VRAAG 2.3.1 vir 4,68 N
RIGHT AS POSITIVE /*REGS AS POSITIEF*

OPTION 1/*OPSIE 1*

$f_k = \mu_k N$

$3,74 = 0,2N$ ✓

$N = 18,7$ N

✓ either / *enige*

$N = mg - T\sin\theta$

$18,7 = 2(9,8) - T\sin\theta$ ✓

$T\sin\theta = 0,9$

OPTION 2/*OPSIE 2*

$f_k = \mu_k N$ ✓

✓ ✓

$3,74 = 0,2\,[2(9,8) - T\sin\theta]$ ✓

$T\sin\theta = 0,9$

OPTION 3/*OPSIE 3*

$T_y = w - N$ ✓

$T_y = (2)(9,8) -$ ✓ $\frac{3,74}{0,2}$ ✓

$T_y = 0,9$ N

$T\cos\theta = 4,68$

$\frac{T\sin\theta}{T\cos\theta} = \frac{0,9}{4,68}$ ✓

$\tan\theta = \frac{0,9}{4,68}$

$\theta = 10,89°$ ✓

OR

$T^2 = T_x^2 + T_y^2$

$T^2 = (4,68)^2 + (0,9)^2$ ✓

$T = 4,77$ N

$T\cos\theta = 4,68$

$4,77\cos\theta = 4,68$

$\theta = 10,89°$ ✓

OPTION 4/*OPSIE 4*

$4,68\tan\theta = T_Y$

$N = w - T_Y$

$= mg - 4,68\tan\theta$

$= (2)(9,8) - 4,68\tan\theta$ ✓

$= 19,6 - 4,68\tan\theta$

✓ either / *enige*

$f_k = \mu_k N$

$3,74 = 0,2$ ✓ $(19,6 - 4,68\tan\theta)$ ✓

$\theta = 10,89°$ ✓

NOTE/*NOTA*: LEFT AS POSITIVE/*LINKS AS POSITIEF*
The values 3,74; 0,9 and 4,68 are negative
Die waardes 3,74; 0,9 en 4,68 is negatief

(5)

2.4 Greater than ✓

- The normal force increases ✓
- Friction is directly proportional to normal force / f α N / when normal force increases friction also increases (For the same μ) ✓

Toeneem

- *Die normaalkrag neem toe*
- *Wrywing is direk eweredig aan die normaalkrag* / f α N / *wanneer normaalkrag toeneem sal wrywing ook toeneem (Vir dieselfde μ)*

(3)
[20]

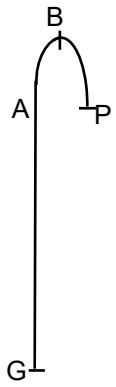
QUESTION 3/*VRAAG 3*

3.1 An object (that has been given an initial velocity and) on which the only force acting is the gravitational force / weight. ✓✓ **(2 or 0)**

'n Voorwerp (waaraan 'n beginsnelheid gegee word en) wat onder die invloed van slegs gravitasiekrag / gewig beweeg.

NOTE: If reference to freefall/gravity : $^{0}/_{2}$
NOTA: *Indien verwys na vryval of gravitasie:* $^{0}/_{2}$ (2)

3.2.1



OPTION 1/*OPSIE 1 G-P*

UPWARDS AS POSITIVE/ *OPWAARTS AS POSITIEF*	**DOWNWARDS AS POSITIVE/ *AFWAARTS AS POSITIEF***
$v_f = v_i + a\Delta t$ ✓ $-6,87 = 20 + (-9,8)\Delta t$ ✓ $\Delta t = 2,74$ s ✓	$v_f = v_i + a\Delta t$ ✓ $6,87 = -20 + (9,8)\Delta t$ ✓ $\Delta t = 2,74$ s ✓

OPTION 2/*OPSIE 2 G-P*

UPWARDS AS POSITIVE/ *OPWAARTS AS POSITIEF*	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $18 = (-6,87)\Delta t + \frac{1}{2}(-9,8)(\Delta t)^2$ ✓ $\Delta t = 2,74$ s ✓
$v_f^2 = v_i^2 + 2a\Delta y$ $(-6,87)^2 = (20)^2 + 2(-9,8)\Delta y$ $\Delta y = 18$ m	$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓ $18 = \left(\frac{20 + (-6,87)}{2}\right)\Delta t$ ✓ $\Delta t = 2,74$ s ✓
DOWNWARDS AS POSITIVE/ *AFWAARTS AS POSITIEF*	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $-18 = (6,87)\Delta t + \frac{1}{2}(9,8)(\Delta t)^2$ ✓ $\Delta t = 2,74$ s ✓
$v_f^2 = v_i^2 + 2a\Delta y$ $(6,87)^2 = (-20)^2 + 2(9,8)\Delta y$ $\Delta y = -18$ m	$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓ $-18 = \left(\frac{(-20) + 6,87}{2}\right)\Delta t$ ✓ $\Delta t = 2,74$ s ✓

OPTION 3/*OPSIE 3*

UPWARDS AS POSITIVE/ ***OPWAARTS AS POSITIEF***	**DOWNWARDS AS POSITIVE/** ***AFWAARTS AS POSITIEF***
$v_f = v_i + a\Delta t$✓	$v_f = v_i + a\Delta t$✓
$0 = (20) + (-9{,}8)\,\Delta t$	$0 = (20) + (9{,}8)\,\Delta t$
$\Delta t = 2{,}04$ s ✓both	$\Delta t = 2{,}04$ s ✓both
$v_f = v_i + a\Delta t$	$v_f = v_i + a\Delta t$
$-6{,}87 = (0) + (-9{,}8)\,\Delta t$	$6{,}87 = (0) + (9{,}8)\,\Delta t$
$\Delta t = 0{,}7$ s	$\Delta t = 0{,}7$ s
$\Delta t = 2{,}04 + 0{,}7 = 2{,}74$ s✓	$\Delta t = 2{,}04 + 0{,}7 = 2{,}74$ s✓

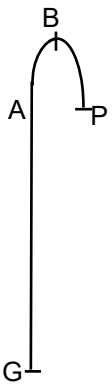
(3)

3.2.2

NOTE: If calculated in Q3.2.1 (Option 2) award 3 marks for answer (18m)
Accept if calculation was done from P - G
NOTA: *Indien reeds bereken in V3.2.1 (opsie 2) gee 3 punte vir antwoord (18 m). Aanvaar indien berekening gedoen is van P - G*
[RANGE/*GEBIED*: 17,96 – 18,01]

OPTION 1/*OPSIE 1 G–P*

UPWARDS AS POSITIVE/ ***OPWAARTS AS POSITIEF***	**DOWNWARDS AS POSITIVE/** ***AFWAARTS AS POSITIEF***
$v_f^2 = v_i^2 + 2a\Delta y$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$(-6{,}87)^2 = (20)^2 + 2(-9{,}8)\Delta y$ ✓	$(6{,}87)^2 = (-20)^2 + 2(9{,}8)\Delta y$ ✓
$\Delta y = 18$ m ✓	$\Delta y = -18$ m $\Delta y = 18$ m ✓



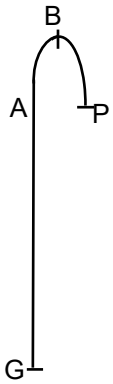
OPTION 2/*OPSIE 2 G–A*

UPWARDS AS POSITIVE/ ***OPWAARTS AS POSITIEF***	**DOWNWARDS AS POSITIVE/** ***AFWAARTS AS POSITIEF***
$v_f^2 = v_i^2 + 2a\Delta y$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$(6{,}87)^2 = (20)^2 + 2(-9{,}8)\Delta y$ ✓	$(-6{,}87)^2 = (-20)^2 + 2(9{,}8)\Delta y$ ✓
$\Delta y = 18$ m ✓	$\Delta y = -18$ m $\Delta y = 18$ m ✓

POSITIVE MARKING FROM QUESTION 3.2.1
POSITIEWE NASIEN VANAF VRAAG 3.2.1

OPTION 3/*OPSIE 3 G-P*

UPWARDS AS POSITIVE/ ***OPWAARTS AS POSITIEF***	**DOWNWARDS AS POSITIVE/** ***AFWAARTS AS POSITIEF***
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$✓	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$✓
$= (20)(2{,}74) + \frac{1}{2}(-9{,}8)(2{,}74)^2$ ✓	$= (-20)(2{,}74) + \frac{1}{2}(9{,}8)(2{,}74)^2$ ✓
$\Delta y = 18{,}01$ m ✓	$\Delta y = -18{,}01$ m $\Delta y = 18{,}01$ m ✓



OPTION 4/*OPSIE 4*

UPWARDS AS POSITIVE/ ***OPWAARTS AS POSITIEF***	**DOWNWARDS AS POSITIVE/** ***AFWAARTS AS POSITIEF***
$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓ $= \left(\frac{20 + (-6{,}87)}{2}\right)2{,}74$ ✓ $\Delta y = 18$ m ✓	$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓ $= \left(\frac{(-20) + 6{,}87)}{2}\right)2{,}74$ ✓ $\Delta y = -18$ m $\Delta y = 18$ m ✓

OPTION 5/*OPSIE 5*

UPWARDS AS POSITIVE/ ***OPWAARTS AS POSITIEF***	**DOWNWARDS AS POSITIVE/** ***AFWAARTS AS POSITIEF***
G-B $v_f = v_i + a\Delta t$ $0 = 20 + (-9{,}8)\Delta t$ $\Delta t = 2{,}04$ s	**G-B** $v_f = v_i + a\Delta t$ $0 = -20 + (9{,}8)\Delta t$ $\Delta t = 2{,}04$ s
B-P $2{,}74 - 2{,}04 = 0{,}7$ s Difference in time: $= 2{,}04 - 0{,}7 = 1{,}34$ s	**B-P** $2{,}74 - 2{,}04 = 0{,}7$ s Difference in time: $= 2{,}04 - 0{,}7 = 1{,}34$ s
G-A $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $= \underline{(20)(1{,}34) + \frac{1}{2}(-9{,}8)(1{,}34)^2}$ ✓ $\Delta y = 18$ m ✓ **OR/*OF*** **P-G** $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $= \underline{(-6{,}87)(1{,}34) + \frac{1}{2}(-9{,}8)(1{,}34)^2}$ ✓ $\Delta y = -18$ m $\Delta y = 18$ m ✓	**G-A** $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $= \underline{(-20)(1{,}34) + \frac{1}{2}(9{,}8)(1{,}34)^2}$ ✓ $\Delta y = -18$ m $\Delta y = 18$ m ✓ **OR/*OF*** **P-G** $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $= \underline{(6{,}87)(1{,}34) + \frac{1}{2}(9{,}8)(1{,}34)^2}$ ✓ $\Delta y = 18$ m ✓

OPTION 6/*OPSIE 6*

UPWARDS AS POSITIVE/ ***OPWAARTS AS POSITIEF***	**DOWNWARDS AS POSITIVE/** ***AFWAARTS AS POSITIEF***
$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $0 = (20)^2 + 2(-9{,}8)\Delta y$ $\Delta y = 20{,}41$ m ✓both $v_f^2 = v_i^2 + 2a\Delta y$ $(-6{,}87)^2 = (0)^2 + 2(-9{,}8)\Delta y$ $\Delta y = -2{,}41$ m Height = 20,41 − 2,41 = 18 m ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $0 = (-20)^2 + 2(9{,}8)\Delta y$ $\Delta y = -20{,}41$ m ✓both $v_f^2 = v_i^2 + 2a\Delta y$ $(6{,}87)^2 = (0)^2 + 2(9{,}8)\Delta y$ $\Delta y = 2{,}41$ m Height = 20,41 − 2,41 = 18 m ✓

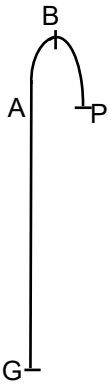
(3)

3.3

POSITIVE MARKING FROM Q3.2.2/*POSITIEWE NASIEN VANAF V3.2.2*

OPTION 1/*OPSIE 1*

UPWARDS AS POSITIVE/ *OPWAARTS AS POSITIEF*	**DOWNWARDS AS POSITIVE/** *AFWAARTS AS POSITIEF*
BALL A	**BALL A**
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$8 = (20)\Delta t + \frac{1}{2}(-9,8)\Delta t^2$ ✓	$-8 = (-20)\Delta t + \frac{1}{2}(9,8)\Delta t^2$ ✓
$\Delta t = 3,63$ s	$\Delta t = 3,63$ s
$3,63 - 2,74$✓ $= 0,89$ s	$3,63 - 2,74$✓ $= 0,89$ s
BALL B	**BALL B**
$y = v_i\Delta t + \frac{1}{2}a\Delta t^2$✓	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$✓
$8 = v_i(0,89) + \frac{1}{2}(-9,8)(0,89)^2$ ✓	$-8 = v_i(0,89) + \frac{1}{2}(9,8)(0,89)^2$ ✓
$v_i = 13,35$ m·s^{-1} ✓	$v_i = -13,35$ m·s^{-1}
	$v_i = 13,35$ m·s^{-1}✓



OPTION 2/*OPSIE 2*

UPWARDS AS POSITIVE/ *OPWAARTS AS POSITIEF*	**DOWNWARDS AS POSITIVE/** *AFWAARTS AS POSITIEF*
BALL A	**BALL A**
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$8 - 18$✓$=(-6,87)\Delta t + \frac{1}{2}(-9,8)\Delta t^2$ ✓	$-8 + 18$✓ $= (6,87)\Delta t + \frac{1}{2}(9,8)\Delta t^2$ ✓
$-10 = (-6,87)\Delta t + \frac{1}{2}(-9,8)\Delta t^2$	$10 = (6,87)\Delta t + \frac{1}{2}(9,8)\Delta t^2$
$\Delta t = 0,89$ s	$\Delta t = 0,89$ s
BALL B	**BALL B**
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$✓	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$✓
$8 = v_i(0,89) + \frac{1}{2}(-9,8)(0,89)^2$ ✓	$-8 = v_i(0,89) + \frac{1}{2}(9,8)(0,89)^2$ ✓
$v_i = 13,35$ m·s^{-1}✓	$v_i = -13,35$ m·s^{-1}
	$v_i = 13,35$ m·s^{-1}✓

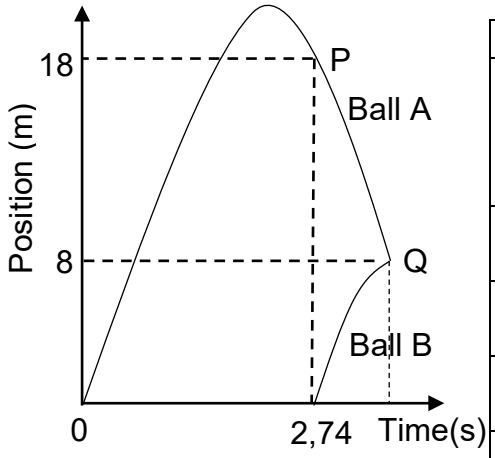
OPTION 3/*OPSIE 3*

UPWARDS AS POSITIVE/ *OPWAARTS AS POSITIEF*	**DOWNWARDS AS POSITIVE/** *AFWAARTS AS POSITIEF*
BALL A	**BALL A**
$v_f^2 = v_i^2 + 2a\Delta x$	$v_f^2 = v_i^2 + 2a\Delta x$
$v_f^2 = (-6,87)^2 + 2(-9,8)\boxed{(8 - 18)}$ ✓	$v_f^2 = (6,87)^2 + 2(9,8)\boxed{(18 - 8)}$ ✓
$v_f = -15,59$ m·s^{-1}	$v_f = 15,59$ m·s^{-1}
$v_f = v_i + a\Delta t$	$v_f = v_i + a\Delta t$
$-15,59 = -6,87 + (-9,8)\Delta t$ ✓	$15,59 = 6,87 + 9,8\Delta t$ ✓
$\Delta t = 0,89$ s	$\Delta t = 0,89$ s
BALL B	**BALL B**
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$✓	$y = v_i\Delta t + \frac{1}{2}a\Delta t^2$✓
$8 = v_i(0,89) + \frac{1}{2}(-9,8)(0,89)^2$ ✓	$-8 = v_i(0,89) + \frac{1}{2}(9,8)(0,89)^2$ ✓
$v_i = 13,35$ m·s^{-1} ✓	$v_i = 13,35$ m·s^{-1} ✓



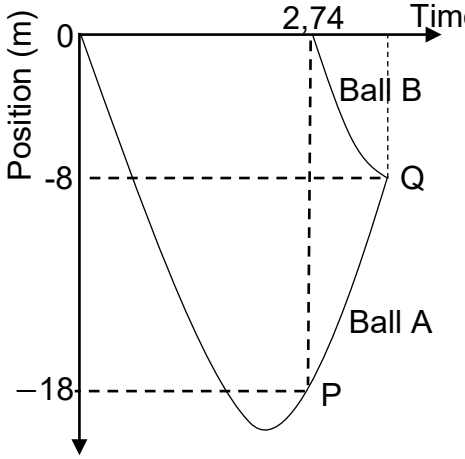
(5)

3.4 **POSITIVE MARKING FROM QUESTION 3.2.1, 3.2.2 AND 3.3**
POSITIEWE NASIEN VANAF VRAAG 3.2.1, 3.2.2 EN 3.3
<u>OPTION 1/*OPSIE 1*</u> UPWARDS AS POSITIVE/*OPWAARTS AS POSITIEF*



Criteria for graph/*Kriteria vir grafiek*	
Total time taken for ball A to reach P on its way down (2,74 s) *Totale tyd vir bal A om P te bereik op pad ondertoe (2,74 s)*	✓
Height of point P (18 m) *Hoogte van punt P (18 m)*	✓
The two graphs meet at point Q (8 m and t > 2,74 s) *Twee grafieke ontmoet by punt Q (8 m en t > 2,74 s)*	✓
Correct shape of the graph for ball A up to point Q *Korrekte vorm vir grafiek van bal A tot by punt Q*	✓
Correct shape of the graph for ball B starting at 2,74 s up to point Q *Korrekte vorm vir grafiek van bal B begin by 2,74 s tot by punt Q*	✓
NOTE: No labels max $^4/_5$ ***NOTA**: Geen benoeming maks $^4/_5$*	

<u>OPTION 2/*OPSIE 2*</u> DOWNWARDS AS POSITIVE/*OPWAARTS AS POSITIEF*



Criteria for graph/*Kriteria vir grafiek*	
Total time taken for ball A to reach P on its way down (2,74 s) *Totale tyd vir bal A om P te bereik op pad ondertoe (2,74 s)*	✓
Height of point P (18 m) *Hoogte van punt P (18 m)*	✓
The two graphs meet at point Q (8 m and t > 2,74 s) *Twee grafieke ontmoet by punt Q (8 m en t > 2,74 s)*	✓
Correct shape of the graph for ball A up to point Q *Korrekte vorm vir grafiek van bal A tot by punt Q*	✓
Correct shape of the graph for ball B starting at 2,74 s up to point Q *Korrekte vorm vir grafiek van bal B begin by 2,74 s tot by punt Q*	✓
NOTE: No labels max $^4/_5$ ***NOTA**: Geen benoeming maks $^4/_5$*	

(5)
[18]

QUESTION 4/*VRAAG 4*

4.1

Marking criteria/*Nasienkriteria*
If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark./*Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

The total (linear) momentum in an isolated system remains constant/is conserved. ✓✓
Totale (lineêre) momentum in 'n geïsoleerde sisteem bly konstant/behoue (2)

NOTE: If "closed" instead of "isolated" indicated max: $^1/_2$
Any reference to mechanical energy $^0/_2$

NOTA: *Indien geslote in plaas van geïsoleerde sisteem maks:* $^1/_2$
Enige verwysing na meganiese energie $^0/_2$

4.2 Right / *Regs* ✓✓ (2)

4.3

OPTION 1/*OPSIE 1*

$\Sigma p_i = \Sigma p_f$
$-\Delta p_A = \Delta p_B$ ✓Any one/*Enige een*
$-(m_A v_{fA} - m_A v_{iA}) = m_B v_{fB} - m_B v_{iB}$
$\underline{-(2,4)}$ ✓ $= \underline{(0,3)v_f - (0,3)(15)}$ ✓
$-2,4 = (0,3)v_f - 4,5$
$v_f = 7\ m{\cdot}s^{-1}$ ✓ left / *links* ✓ (5)

OPTION 2/*OPSIE 2*

$\Delta p_B = mv_f - mv_i$ ✓
$\underline{-(2,4)}$ ✓ $= \underline{(0,3)v_f - (0,3)(15)}$ ✓
$v_f = 7\ m{\cdot}s^{-1}$ ✓ left / *links* ✓

NOTE: Mark for the formula is ONLY awarded if in reference to ball B
NOTA: *Punt vir die formule word SLEGS toegeken indien verwys word na bal B*

[9]

QUESTION 5/*VRAAG 5*

5.1

$W_{net} = \Delta E_K$
$W_{nc} = \Delta E_K + \Delta E_p$
$W_f = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$
✓Any one/*Enige een*

$\underline{(3)(4)\cos 180^\circ}$ ✓ $= \underline{\frac{1}{2}M[v_Y^2 - (8)^2]}$ ✓ + 0

$$v_Y^2 = 64 - \frac{24}{M}$$

(3)

5.2

OPTION 1/*OPSIE 1*

$W_{net} = \Delta E_K$
$W_f + W_{Fg} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$
$f\Delta x\cos\theta + F_{g//}\Delta x\cos\theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$
$f\Delta x\cos\theta + mg\Delta x\sin\varphi\cos\theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$
✓Anyone/*Enige een*

$\underline{(2)(5,03)\cos 180^\circ}$✓ + $\underline{M(9,8)(5,03)\sin 30^\circ\cos 180^\circ}$✓ $= \boxed{\frac{1}{2}M[0^2 - (64 - \frac{24}{M})]}$✓

M = 3 kg✓

OR

$\boxed{M(9,8)(5,03)\cos 120^\circ}$

OR

$\underline{2)(5,03)\cos 180^\circ}$✓ + $\underline{M(9,8)(2,515)\cos 180^\circ}$✓ $= \boxed{\frac{1}{2}M[0^2 - (64 - \frac{24}{M})]}$✓

M = 3 kg ✓

OPTION 2/*OPSIE 2*

$W_{nc} = \Delta E_K + \Delta E_p$
$W_f = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 + mg(h_f - h_i)$
$f\Delta x\cos\theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 + mg(h_f - h_i)$
✓Anyone/*Enige een*

$\underline{(2)(5,03)\cos 180^\circ}$✓ $= \boxed{\frac{1}{2}M[0^2 - (64 - \frac{24}{M})]}$✓ + $\underline{M(9,8)(2,515 - 0)}$ ✓

M = 3 kg✓

OPTION 3/*OPSIE 3*

$W_{net} = \Delta E_K$
$W_f + W_{Fg} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$
$f\Delta x\cos\theta + F_g\Delta x\cos\theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$
$f\Delta x\cos\theta + mg\Delta x\sin\varphi\cos\theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$
✓Anyone/*Enige een*

$\underline{(2)(5,03)\cos 180^\circ}$✓ + $\underline{M(9,8)(5,03)\sin 30^\circ\cos 180^\circ}$✓ $= \boxed{\frac{1}{2}M[0^2 - (v_Y^2)]}$✓

M = 3 kg✓

OR

$\underline{M(9,8)(5,03)\cos 120^\circ}$

OPTION 4/*OPSIE 4*

$F_{net} = f + F_{g//}$

$F_{net} = 2 + M(9,8)\sin 30^o$

$W_{net} = \Delta E_K$
$W_{net} = ½ m(v_f^2 - v_i^2)$ ✓Anyone/*Enige een*

$2 + M(9,8)\sin 30°$ ✓ $(5,03)\cos 180^o$ ✓ $= ½ M(0 - (64 - \frac{24}{M}))$ ✓

$M = 3$ kg ✓ (5)

[8]

QUESTION 6/*VRAAG 6*

6.1.1

Marking criteria/*Nasienkriteria*
If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark./*Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

The change in frequency/pitch (of the sound) detected by a listener, because the (sound) source and the listener have different velocities relative to the medium of (sound) propagation. ✓✓

Die verandering in frekwensie/toonhoogte (van 'n klank) waargeneem deur 'n luisteraar omdat die (klank)bron en luisteraar verskillende snelhede het relatief tot die medium waarin die (klank) voortplant.

OR / *OF*

An (apparent) change in (observed/detected) frequency/pitch as a result of the relative motion between a (sound) source and an observer.

Die (skynbare) verandering in (waargenome) frekwensie/toonhoogte as gevolg van relatiewe beweging tussen die (klank)bron en die luisteraar. (2)

6.1.2 (a) Increase / *Neem toe* ✓ (1)

6.1.2 (b) Remain the same / *Bly dieselfde* ✓ (1)

6.1.3

$f_L = \frac{v \pm v_L}{v \pm v_s} f_s$

$f_L = \frac{v + v_L}{v} f_s$

✓ Any one/*Enige een*

$x/f_L = \frac{340 + 12}{340}$ ✓ (170) ✓

$= 176$ Hz

NOTE: 170 substitution is only awarded with the 12 $m.s^{-1}$
***NOTA**: 170 vervanging slegs met 12 $m.s^{-1}$*

$f_L = \frac{v + v_L}{v} f_s$

✓

$176 = \frac{340 + 24}{340} f_s$ ✓

$f_s = 164{,}4$ Hz ✓

(6)

6.2 Y✓

- The spectral lines are shifted towards the red end of the spectrum/the spectral lines are red shifted, ✓
- Indicating longer wavelengths / lower frequencies. ✓

Y

- *Die spektrumlyne is verskuif na die rooi punt van die spektrum/die spektrumlyne ondergaan rooiverskuiwing,*
- *Wat 'n langer golflengte / kleiner frekwensie aandui*

ACCEPT: The spectral lines are shifted away from the blue end of the spectrum, ✓ indicating longer wavelengths / lower frequencies. ✓
***AANVAAR:** Die spektrumlyne verskuif weg van die blou kant van die spektrum, wat 'n langer golflengte / kleiner frekwensie aandui*

(3)
[13]

QUESTION 7/*VRAAG 7*

7.1

Marking criteria/*Nasienkriteria*
If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark./*Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

The magnitude of the electrostatic force (exerted by one point charge on another point charge) is directly proportional to the product (of the magnitudes) of the charges and inversely proportional to the square of the distance between them. ✓✓

Die grootte van die elektrostatiese krag (wat een puntlading op 'n ander puntlading uitoefen) is direk eweredig aan die produk van die (groottes van die) ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen die ladings

NOTE: If reference to masses $^0/_2$
***NOTA:** Indien verwysing na massas $^0/_2$*

(2)

7.2

$$F = \frac{kQ_1Q_2}{r^2} \checkmark$$

$$F = \frac{(9 \times 10^9)(4 \times 10^{-6})(9 \times 10^{-6})}{(0,1)^2} \checkmark$$

$$F = 32,4 \text{ N} \checkmark$$

(3)

7.3

Marking criteria/*Nasienkriteria*
If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark./*Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

The electric field at a point is the electrostatic force experienced per unit positive charge placed at that point. ✓✓

Die elektriese veld by 'n punt is die elektrostatiese krag wat per eenheidspositiewe-lading wat by daardie punt geplaas is, ondervind word (2)

7.4

OPTION 1/*OPSIE 1*

$$E_P = \frac{kQ}{r^2} \checkmark$$

$$= \frac{(9 \times 10^9)(4 \times 10^{-6})}{(r)^2} \checkmark$$

$$E_S = \frac{kQ}{r^2}$$

$$= \frac{(9 \times 10^9)(9 \times 10^{-6})}{(0,1 - r)^2} \checkmark$$

$$\frac{(9 \times 10^9)(4 \times 10^{-6})}{(r)^2} \overset{\checkmark}{=} \frac{(9 \times 10^9)(9 \times 10^{-6})}{(0,1 - r)^2} \qquad [E_P = E_S]$$

$$\sqrt{\frac{(9 \times 10^9)(4 \times 10^{-6})}{(r)^2}} = \sqrt{\frac{(9 \times 10^9)(9 \times 10^{-6})}{(0,1 - r)^2}}$$

$$r = 0,04 \text{ m} \checkmark$$

OPTION 2/*OPSIE 2*

$$F = \frac{kQ_1Q_2}{r^2} \checkmark$$

$$\frac{(9 \times 10^9)(4 \times 10^{-6})(1)}{(r)^2} \checkmark \overset{\checkmark}{=} \frac{(9 \times 10^9)(9 \times 10^{-6})(1)}{(0,1 - r)^2} \checkmark$$

$$r = 0,04 \text{ m} \checkmark$$

NOTE: mark for the formula is ONLY awarded provided 1 or q is substituted as a test charge.
***NOTA**: punt vir formule SLEGS toegeken indien 1 of q vervang is as die toetslading*

(5)

7.5.1 P to/*na* S ✓ (1)

7.5.2 0,05 m ✓ **ACCEPT/*AANVAAR***: $\frac{0,1}{2}$ m (1)

[14]

QUESTION 8/*VRAAG 8*

8.1.1 A maximum of 24 J of energy is transferred per unit/coulomb charge by the battery. ✓✓ (**2 or 0**)
24 J maksimum energie word per eenheidslading oorgedra deur die battery (2)

8.1.2

OPTION 1/*OPSIE 1*

$P = I^2R$ ✓
$46,08 = I^2(8)$ ✓
$I = 2,4$ A
$2,4 - 0,6$ ✓ $= 1,8$ A
$V_p = IR_p$
$V_P = (0,6)(7)$ ✓
$V_p = 4,2$ V
$R = \frac{V}{I}$
$= \frac{4,2}{1,8}$ ✓
$= 2,33\ \Omega$ ✓

OPTION 2/*OPSIE 2*

$P = I^2R$ ✓
$46,08 = I^2(8)$ ✓
$I = 2,4$ A
$0,6$ ✓ $= \frac{R}{R+7}$ ✓$(2,4)$ ✓
$R = 2,33\ \Omega$ ✓

NOTE: 2,4 is awarded a mark in conjunction with the specific ratio used
***NOTA**: 2,4 se punt toegeken saam met spesifieke verhouding*

OPTION 3/*OPSIE 3*

$P = I^2R$ ✓
$46,08 = I^2(8)$ ✓
$I = 2,4$ A
$2,4 - 0,6$ ✓ $= 1,8$ A
$IR = I_TR_p$
$(1,8)R$ ✓ $= (2,4)\left(\frac{7R}{R+7}\right)$ ✓
$1,8R(7 + R) = (2,4)(7R)$
$R = 2,33\ \Omega$ ✓

$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$
$\frac{1}{R_p} = \frac{1}{R} + \frac{1}{7}$
$R_P = \frac{7R}{7+R}$

$V = IR$
$V_P = I_T R_p$

(6)

8.1.3

POSITIVE MARKING FROM QUESTION 8.1.2
POSITIEWE NASIEN VANAF VRAAG 8.1.2

OPTION 1/*OPSIE 1*

$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ **OR/*OF*** $R_p = \frac{R_1 R_2}{R_1 + R_2}$

$\frac{1}{R_p} = \frac{1}{2,33} + \frac{1}{7}$ ✓ **OR /*OF*** $R_p = \frac{(2,33)(7)}{2,33 + 7}$

$R_p = 1,75\ \Omega$

$R_{ext} = 1,75 + 8$
$= 9,75\ \Omega$ ✓ Any one/*Enige een*

OPTION 2/*OPSIE 2*

$V = IR$

$4,2 = 2,4R$ ✓

$R = 1,75\ \Omega$

$R_{ext} = 1,75 + 8$
$= 9,75\ \Omega$ ✓ Any one/*Enige een*

$\varepsilon = I(R + r)$ ✓
$\underline{24 = 2,4(9,75 + r)}$ ✓
$r = 0,25\ \Omega$ ✓

OPTION 3/*OPSIE 3*

$\varepsilon = I(R + r)$ ✓
$\underline{24 = 2,4([8 + R_P] + r)}$ ✓
$2 = Rp + r$

$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ **OR/*OF*** $R_p = \frac{R_1 R_2}{R_1 + R_2}$

$\frac{1}{R_p} = \frac{1}{2,33} + \frac{1}{7}$ ✓ **OR /*OF*** $R_p = \frac{(2,33)(7)}{2,33 + 7}$

$R_p = 1,75\ \Omega$

$R_T = R_P + r$
$\underline{2 = 1,75 + r}$ ✓
$r = 0,25\ \Omega$ ✓

OPTION 4/*OPSIE 4*

$R_{8\Omega} = \frac{V_{8\Omega}}{I_T}$

$8 = \frac{V_{8\Omega}}{2,4}$ ✓

$V_{8\Omega} = 19,2$ V

$V_{ext} = 19,2 + 4,2$

$= 23,4$ V

$\varepsilon = I(R + r)$ ✓ **OR** $\varepsilon = V_{ext} + V_{int}$

$24 = 23,4 + V_{int}$ ✓

$V_{int} = 0,6$ V

$r = \frac{V_{int}}{I_T}$

$= \frac{0,6}{2,4}$ ✓

$= 0,25\ \Omega$ ✓

NOTE: If r is calculated in Q8.1.2, allocate marks for Q8.1.3 in Q8.1.2
NOTA: *Indien r reeds bereken is in V8.1.2, ken punte toe vir V8.1.3 in V8.1.2*

(5)

8.1.4 Less than ✓
The sum of the potential difference across the 4 Ω and 3 Ω resistors is equal to the potential difference across R. ✓ **OR** $V_{4\Omega} + V_{3\Omega} = V_R$

Kleiner as
Die som van die potensiaalverskil oor die 4 Ω en 3 Ω resistors is gelyk aan die potensiaalverskil oor weerstand R. ***OF*** $V_{4\Omega} + V_{3\Omega} = V_R$ (2)

8.1.5 Decreases ✓ *Neem af* (1)

8.2.1 C ✓
- V_x has the highest voltage / is the same as the emf of the battery ✓
- Power is directly proportional to voltage / P α V^2 (R_X remains constant) ✓

OR
- I_X is the highest
- Power is directly proportional to current / P α I^2 (R_X remains constant)

NOTE: The third mark can only be awarded provided the second mark is awarded. (3)

C
- *V_x het die hoogste potensiaalverskil/ is dieselfde as die emk van die battery*
- *Drywing is direk eweredig aan die potensiaalverskil / P α V^2 (R_x bly konstant)*

OF
- *I_X is die hoogste*
- *Drywing is direk eweredig aan stroom / P α I^2 (R_x bly konstant)*

NOTA*: Die derde punt kan slegs toegeken indien die tweede punt toegeken is*

8.2.2 REMAINS THE SAME ✓ *BLY DIESELFDE*
- V_X / I_X does not change ✓ *V_p / I_X verander nie*

(2)
[21]

QUESTION 9/*VRAAG 9*

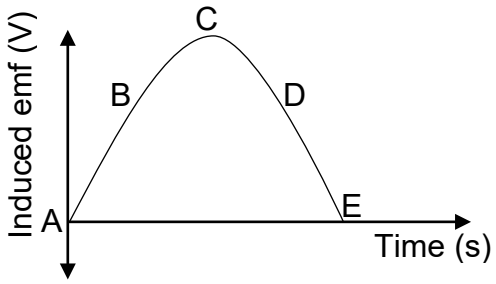
9.1

Marking criteria/*Nasienkriteria*
If any of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark./*Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

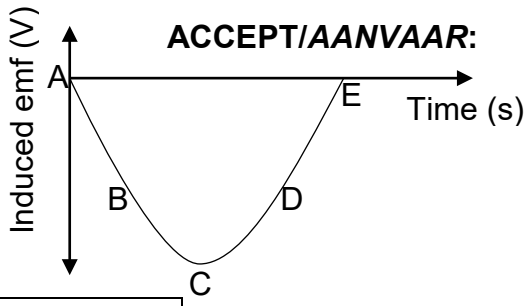
A change in magnetic flux linkage/linked to the coil induces an emf/current in the coil. ✓✓
'n Verandering in magnetiese vloedkoppeling/koppeling tussen magneetveld en spoel induseer 'n emk/stroom. (2)

9.2 C ✓✓ **(2 OR 0)**
NOTE/*NOTA*: Accept/*Aanvaar* 90° (2)

9.3



ACCEPT/*AANVAAR*:



Criteria for marking/*Kriteria vir nasien*	
Correct shape (sine graph)/*Korrekte vorm (singrafiek)*	✓
Positions A, C, E correct/*Posisies A, C en E korrek*	✓
Positions B, D correct/*Posisies B en D korrek*	✓
NOTE: If DC graph drawn max $^2/_3$ ***NOTA**: Indien GS grafiek geteken maks $^2/_3$*	

(3)

9.4

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$V_{rms} = \frac{V_{max}}{\sqrt{2}}$ $= \frac{170}{\sqrt{2}}$ ✓ $= 120{,}21$ V $R = \frac{V}{I}$ ✓ $100 = \frac{120{,}21}{I}$ ✓ $I_{rms} = 1{,}2$ A ✓	$R = \frac{V}{I}$ $100 = \frac{170}{I_{max}}$ ✓ $I_{max} = 1{,}7$ A $I_{rms} = \frac{I_{max}}{\sqrt{2}}$ ✓ $= \frac{1{,}7}{\sqrt{2}}$ ✓ $= 1{,}2$ A ✓

$V_{rms} = \frac{V_{max}}{\sqrt{2}}$ $= \frac{170}{\sqrt{2}}$ ✓ $= 120,21$ V $P_{ave} = \frac{V_{rms}^2}{R}$ $= \frac{(120,21)^2}{100}$ $= 144,5$ W	**OPTION 3/*OPSIE 3*** $P = I_{rms}^2 R$ ✓ $144,5 = I_{rms}^2 (100)$ ✓ $I_{rms}^2 = 1,2$ A ✓ **OPTION 4/*OPSIE 4*** $P_{ave} = V_{rms} I_{rms}$ ✓ $144,5 = 120,2 \times I_{rms}$ ✓ $I_{rms} = 1,20$ A ✓

(4)

9.5.1 Replace the slip rings with a split ring/ commutator ✓
Vervang die sleepringe met 'n splitring/ kommutator (1)

9.5.2 Mechanical/Kinetic (energy) to electrical (energy) ✓
Meganiese/Kinetiese na elektriese (energie) (1)

9.5.3 Yes✓
Ja (1)
[14]

QUESTION 10/*VRAAG 10*

10.1

Marking criteria/*Nasienkriteria*
If any of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark./*Indien enige van die onderstreepte sleutelwoorde/frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*

The minimum energy that an electron in the metal needs to be emitted /ejected from the metal surface. ✓✓

Die minimum energie benodig vir 'n elektron in 'n metaal om vanaf die oppervlak vrygestel te word.

NOTE: If frequency is referred to $^0/_2$
***NOTA**: Indien na frekwensie verwys word $^0/_2$* (2)

10.2

OPTION 1/*OPSIE 1*

$E = W_0 + E_{k(max)}$ ✓

$7 \times 10^{-19} = W_0 + ½(9,11 \times 10^{-31})(6,59 \times 10^{11})$ ✓✓

$W_0 = 4 \times 10^{-19}$J

Barium ✓

OPTION 2/*OPSIE 2* (if X was calculated first/*Indien X eerste bereken is*)**

$$\text{Gradient} = \frac{\Delta v_{max}^2}{\Delta\text{Energy of the incident light}}$$

$$\frac{2}{m} = \frac{6{,}59 \times 10^{11} - X}{7 \times 10^{-19} - 5{,}4 \times 10^{-19}}$$

$$\frac{2}{9{,}11 \times 10^{-31}} = \frac{6{,}59 \times 10^{11} - X}{7 \times 10^{-19} - 5{,}4 \times 10^{-19}}$$

$X = 3{,}08$ Accept/*Aanvaar* $3{,}08 \times 10^{11}$ ($m^2 \cdot s^{-2}$)

$E = W_0 + E_{k(max)}$ ✓

$5{,}4 \times 10^{-19} = W_0 + ½(9{,}11 \times 10^{-31})(3{,}08 \times 10^{11})$ ✓✓

$W_0 = 4{,}0 \times 10^{-19}$ J

Barium ✓ (4)

10.3

POSITIVE MARKING FROM 10.2/POSITIEWE NASIEN VANAF 10.2

Range/*Gebied*: [3,07 – 3,08]

NOTE: If 10.3 is answered in 10.2, allocate marks as per 10.3

***NOTA:** Indien 10.3 reeds beantwoord is in 10.2, ken punte toe soos by 10.3*

OPTION 1/*OPSIE 1*

$E = W_0 + E_{k(max)}$
$E = W_0 + ½mv_{max}^2$ } ✓ Any one/*Enige een*

$5{,}4 \times 10^{-19}$ ✓ $= 4 \times 10^{-19}$ ✓ + $\boxed{½(9{,}11 \times 10^{-31})v_{max}^2}$ ✓

$X = 3{,}07$ ✓ **ACCEPT:** $3{,}07 \times 10^{11}$ ($m^2 \cdot s^{-2}$)

OPTION 2/*OPSIE 2*

$E = W_0 + E_{k(max)}$ ✓

$7 \times 10^{-19} = W_0 + ½(9{,}11 \times 10^{-31})(6{,}59 \times 10^{11})$ ✓.... Eq1

$5{,}4 \times 10^{-19} = W_0 + ½(9{,}11 \times 10^{-31})(X \times 10^{11})$ ✓ Eq2

$1{,}6 \times 10^{-19} = ½(9{,}11 \times 10^{-31})(6{,}59 \times 10^{11} - X \times 10^{11})$ ✓ **[Subtract Eq1 – Eq2]**

$X = 3{,}08$ ✓ **ACCEPT:** $3{,}08 \times 10^{11}$ ($m^2 \cdot s^{-2}$)

OPTION 3/*OPSIE 3*

$$\text{Gradient} = \frac{\Delta v^2}{\Delta\text{Energy of the incident light}}$$

$$\frac{2}{m} \checkmark = \frac{6{,}59 \times 10^{11} - X}{7 \times 10^{-19} - 5{,}4 \times 10^{-19}} \checkmark$$

$$\frac{2}{9{,}11 \times 10^{-31}} \checkmark = \frac{6{,}59 \times 10^{11} - X}{7 \times 10^{-19} - 5{,}4 \times 10^{-19}}$$

$X = 3{,}08$ ✓ **ACCEPT:** $3{,}08 \times 10^{11}$ ($m^2 \cdot s^{-2}$)

OPTION 4/*OPSIE 4*

$$\text{Gradient} = \frac{\Delta v^2}{\Delta \text{Energy of the incident light}}$$

$$\frac{6{,}59 \times 10^{11} - 0 \ \checkmark}{7 \times 10^{-19} - 4 \times 10^{-19} \checkmark} = \frac{X \times 10^{11} - 0 \ \checkmark}{5{,}4 \times 10^{-19} - 4 \times 10^{-19} \checkmark}$$

$$X = 3{,}08 \ \checkmark \quad \textbf{ACCEPT:} \ 3{,}08 \times 10^{11} \ (m^2 \cdot s^{-2})$$

(5)

10.4 Remains the same ✓

- The intensity only affects the number of photoelectrons emitted per second. ✓
  OR
- Light intensity has no effect on kinetic energy/ velocity of the emitted electrons.
  OR
- The kinetic energy of the emitted photoelectrons remains the same.
  OR
- Only the frequency/ wavelength/ energy of the incident light affects the maximum kinetic energy.

Bly dieselfde

- *Die intensiteit beïnvloed slegs die aantal foto-elektrone vrygestel per sekonde.*
  OF
- *Die ligintensiteit het geen effek op kinetiese energie /spoed van vrygestelde elektrone nie*
  OF
- *Die kinetiese energie van die vrygestele foto-elektrone bly dieselfde*
  OF
- *Slegs die frekwensie/golflengte/energie van die invallende lig beïnvloed die maksimum kinetiese energie*

(2)
[13]

TOTAL/*TOTAAL*: 150

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