education

MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE NASIONALE SENIOR SERTIFIKAAT

GRADE/GRAAD 12

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

SEPTEMBER 2025

MARKING GUIDELINES/MERKRIGLYNE

MARKS/PUNTE: 150

These marking guidelines consists of 17 pages.
Hierdie Merkriglyne bestaan uit 17 bladsye.

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QUESTION/VRAAG 1

1.1 A✓✓ (2)

1.2 C✓✓ (2)

1.3 B✓✓ (2)

1.4 A✓✓ (2)

1.5 B✓✓ (2)

1.6 B✓✓ (2)

1.7 C✓✓ (2)

1.8 D✓✓ (2)

1.9 C✓✓ (2)

1.10 B✓✓ (2)

[20]

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QUESTION/VRAAG 2

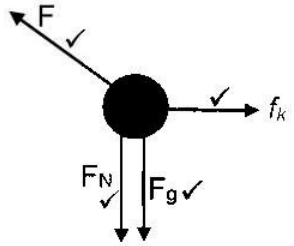
2.1

Marking criteria/*Nasienkriteria*
If any one 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 net force acts on an object, the object will accelerate in the direction of the force and the acceleration is directly proportional to the force and inversely proportional to the mass of the object ✓✓

Wanneer 'n resulterende/netto krag op 'n voorwerp inwerk, versnel die voorwerp in die rigting van die krag teen 'n versnelling direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp (2)

2.2



(4)

Accepted labels / Aanvaarde benoemings	
w	F_g / F_w / force of earth on block / weight / mg / gravitational force / VALUE / gravitasiekrag / krag van aarde op die blok / gewig/WAARDE
f_k	$F_{friction}$ / F_f / frictional force / wrywing / $F_{wrywing}$
F	F/$F_{applied}$/$F_{toegepas}$
N	Normal force / F_N / Normaalkrag

Notes/Aantekeninge:

- Mark awarded for label and arrow/Punt toegeken vir benoem en pyltjie
- Any additional forces/Enige addisionele kragte: deduct 1 mark/trek 1 punt af: max/maks $^3/_4$
- No labels/Geen benoeming: deduct 1 mark/trek 1 punt af: max/maks $^3/_4$
- If everything correct, but no arrows/As alles reg is maar geen pyltjies nie: deduct 1 mark/trek 1 punt af: $^3/_4$
- Force(s) not touching object/Krag(te) nie die voorwerp raak nie: deduct 1 mark/trek 1 punt af: max/maks $^3/_4$

Ignore relative sizes of the vectors/Ignoreer relatiewe groottes van die vektore

2.3.1

$F_y = F\sin\theta = (50)\sin30°$ ✓ $= 25$ N

$F_N = F_y + (-F_g)$

$F_N = 25 - (2)(9,8)$ ✓

$F_N = 5,4$ N ✓ (3)

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2.3.2 **POSITIVE MARKING FROM QUESTION 2.3.1.**
POSITIEWE MERK VANAF VRAAG 2.3.1

$F_x = F\cos\theta = (50)\cos30° = 43{,}301$ N

$F_{net} = ma$

$F_x + f_k = ma$

$43.301 - f_k = 2(20)$ ✓

$f_k = 3,301$ N

$f_k = \mu_k N$ ✓

$3{,}301 = \mu_k (5.4)$ ✓

$\mu_k = 0{,}61$ ✓ (4)

2.4.1 REMAINS THE SAME/BLY DIESELFDE ✓ (1)

2.4.2 DECREASES/AFNEEM ✓
The magnitude of the normal force will decrease ✓ with a decrease in the size of the angle.
Die grootte van die normaalkrag sal afneem met 'n afname in die grootte van die hoek. (2)
[16]

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QUESTION/VRAAG 3

3.1 An object that has been given an initial velocity and then it moves under the influence of the gravitational force only ✓✓ (2 or/of 0)

'n Voorwerp waaraan 'n beginsnelheid gegee is en wat dan slegs onder die invloed van die gravitasiekrag beweeg. (2)

3.2.1 (Gravitational) acceleration /(Gravitasie) versnelling ✓ (1)

3.2.2 2 (Twice) / (Twee keer) ✓ (1)

3.2.3 9,8 $m \cdot s^{-1}$ ✓ (1)

3.3.

NOTE:
If the learners do not show h – give a mark for Δy

Option/Opsie 1
Δy =area of Δ + area of □ ✓
Δy =½ bh + L × B
Δy =½ (3)(4) + (3 × 29,4) ✓
Δy = 56,1 m
∴ h= 56,1 m✓

Option/Opsie 2	
Upwards/Opwaarts (positive/positief)	Upwards/Opwaarts (negative/negatief)
$v_f^2 = v_i^2 + 2a\Delta y$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$(-33,4)^2 = (-4)^2 + 2(-9,8)\Delta y$✓	$(33,4)^2 = (4)^2 + 2(9,8)\Delta y$✓
Δy = 56,1 m	Δy = 56,1 m
∴ h= 56,1 m✓	∴ h= 56,1 m✓

Option/Opsie 3	
Upwards/Opwaarts (positive/positief)	Upwards/Opwaarts (negative/negatief)
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$✓	$\Delta y = v\Delta t + \frac{1}{2}a\Delta t^2$✓
$\Delta y = (-4)(3) + \frac{1}{2}(-9,8)(3)^2$✓	$\Delta y = (4)(3) + \frac{1}{2}(9,8)(3)^2$✓
Δy = - 56,1 m	Δy = 56,1 m
∴Δy = 56,1 m	∴ h= 56,1 m✓
∴ h= 56,1 m✓	

(3)

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3.4.1

$\Delta t = \frac{5,86 - 3}{2}$ ✓ = 1,43 s

$\therefore \Delta t = \underline{3} + 1,43$ ✓

Δt = 4,43 s ✓ (3)

3.4.2

$b_{triangle}$ = 4,43 – 3✓ = 1,43 and $h_{triangle}$ = 14

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

$= \frac{1}{2}(1,43)(14)$ ✓

= 10,01 m✓ (3)

[14]

QUESTION/VRAAG 4

4.1 Is a system on which the net external force is zero ✓
Is 'n sisteem waar die netto eksterne krag nul is (1)

4.2.1

Right as positive Regs as positief	Right as negative Regs as negatief
$\Delta p = m(v_f - v_i)$ ✓	$\Delta p = m(v_f - v_i)$ ✓
$-6,5 = 65(v_f - 0)$ ✓	$6,5 = 65(v_f - 0)$ ✓
$V_f = -0,1\ m \cdot s^{-1}$	$V_f = 0,1\ m \cdot s^{-1}$ left/links ✓
$\therefore V_f = 0,1\ m \cdot s^{-1}$ left/links ✓	

(3)

4.2.2 **POSITIVE MARKING FROM QUESTION 4.2.1.**
POSITIEWE MERK VANAF VRAAG 4.2.1

Option/Opsie 1	
Right as positive Regs as positief	**Right as negative Regs as negatief**
$\Delta p = m(v_f - v_i)$ ✓	$\Delta p = m(v_f - v_i)$ ✓
6,5 ✓= $\underline{m\ (13 - 0)}$ ✓	-6,5 ✓= $\underline{m\ (-13 - 0)}$ ✓
m = 0,5 kg ✓	m = 0,5 kg ✓

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Option/Opsie 2	
Right as positive **Regs as positief**	**Right as negative** **Regs as negatief**
$\Sigma p_{before} = \Sigma p_{after}$ ✓	$\Sigma p_{before} = \Sigma p_{after}$ ✓
$v_i (m_1 + m_2 + m_3) = v_f (m_1 + m_2) + m_3 v_f$	$v_i (m_1 + m_2 + m_3) = v_f (m_1 + m_2) + m_3 v_f$
$(0)(60 + 5 + m)$ ✓ $= (-0,1)(65) + m(13)$ ✓	$(0)(60 + 5 + m)$ ✓ $= (-0,1)(65) + m(13)$ ✓
$m = 0,5$ kg ✓	$m = 0,5$ kg ✓

(4)

4.3 **ANY ONE/ENIGE EEN**

Seat belts/Air bags/Crumple zones/Sitplekgordels/Lugsakke/Frommelsones ✓ (1)

4.4 $F_{net} = \frac{\Delta p}{\Delta t}$

They increase the time ✓taken for the momentum of the object to change, and reduce the force ✓ of impact during collision.

Hulle verhoog die tyd wat dit neem vir die momentum van die voorwerp om te verander, en verminder die krag van impak tydens 'n botsing.

(2)
[11]

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QUESTION/VRAAG 5

5.1 The total mechanical energy (sum of gravitational potential energy and kinetic energy) in an isolated system remains constant ✓✓ (2 or/of 0)

Die totale meganiese energie (som van gravitasie- potensiële energie en kinetiese energie) in 'n geslote sisteem bly konstant. (2)

5.2 NOT CONSERVED ✓
The system is not isolated/the net external force acting on the object is not zero/the net work done on the object is not zero/kinetic energy increases whilst the potential energy remains the same/mechanical energy increases/friction is present/velocity increases ✓

NIE BEHOUE NIE
Die stelsel is nie geïsoleerd nie/die netto eksterne krag wat op die voorwerp inwerk, is nie nul nie/die netto arbeid wat op die voorwerp verrig word, is nie nul nie/kinetiese energie neem toe terwyl die potensiële energie dieselfde bly/meganiese energie neem toe/wrywing is teenwoordig/snelheid neem toe. (2)

5.3.1

Option 1 of calculating the speed at point Q
Opsie 1 om die spoed by punt Q te bereken

$$(E_k+E_p)_Q=(E_k+E_p)_R \checkmark$$

$$\left(\frac{1}{2}mv^2 + mgh\right)_Q = \left(\frac{1}{2}mv^2 + mgh\right)_R$$

$$\left(\frac{1}{2}(20)v^2 + (20)(9,8)(0)\right)_Q \checkmark = \left(\frac{1}{2}(20)(0)^2 + (3)(9,8)(2)\right)_R \checkmark$$

$$v_Q = 2,8\ m\cdot s^{-1}$$

Option 2 of calculating the speed at point Q
Opsie 2 om die spoed by punt Q te bereken

$$W_{net} = \Delta E_k$$

$$W_{Fg} + W_{FN} = \frac{1}{2}m\left(v_f^2 - v_i^2\right)$$

$$-mg(h_f-h_i) + W_{FN} = \frac{1}{2}m\left(v_f^2 - v_i^2\right)$$

$$-(20)(9,8)(0,4-0)+0 = \frac{1}{2}(20)\left((0)^2 - v_i^2\right) \checkmark$$

$$V_i = 2,8\ m\cdot s^{-1}$$

Calculating θ/Berekening van θ

$$W_{net} = \Delta E_k \checkmark$$

$$(80)(4)\cos\theta + (45)(4)\cos 180° \checkmark = \frac{1}{2}(20)\left((2,8)^2 - (0)^2\right) \checkmark$$

$$\theta = 36,15° \checkmark$$

(5)

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5.3.2 **POSITIVE MARKING FROM QUESTION 5.3.1.**
POSITIEWE MERK VANAF VRAAG 5.3.1

$W_F = F\Delta x\cos\theta$

$W_F = (80)(4)\cos 36{,}15°$

$W_F = 258{,}392\ J$

$\therefore P = \frac{W}{\Delta t}$ ✓

$P = \frac{258{,}392}{2{,}86}$ ✓ $= 90{,}35\ W$ ✓

(3)

[12]

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QUESTION/VRAAG 6

6.1

Marking criteria/*Nasienkriteria*
If any one 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 (or 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 (of toonhoogte) van die klank waargeneem deur 'n luisteraar omdat die klankbron en die luisteraar verskillende snelhede relatief tot die medium waarin die klank voortgeplant word, het.

OR/OF
A change in observed/detected frequency (pitch), as a result of the relative motion *between* a source and an observer (listener).

'n Verandering in waargenome frekwensie (toonhoogte), as gevolg van die relatiewe beweging tussen die bron en 'n waarnemer (luisteraar).

(2)

6.2.1 $f_L = \frac{1}{T}$

$f_L = \frac{1}{6{,}25\times10^{-4}}$ ✓

$f_L = 1\,600$ Hz ✓

(2)

6.2.2 $v = f\lambda$ ✓

$340 = 1\,836\,\lambda$ ✓

$\lambda = 0{,}185$ m ✓

(3)

6.2.3

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

$1\,600$ ✓ $= \left(\frac{340 - 0}{340 + v_s}\right)$ ✓ $(1\,836)$ ✓

$v_s = 50{,}15$ m·s^{-1} ✓

(5)

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6.3 EQUAL TO/GELYK AAN✓
The siren (source) and the driver (listener) are moving at the same speed/the source and the listener have same speed/there is no relative motion between the siren and the listener.✓

Die sirene (bron) en die bestuurder (luisteraar) beweeg teen dieselfde spoed/die bron en die luisteraar het dieselfde spoed/daar is geen relatiewe beweging tussen die sirene en die luisteraar nie. (2)

6.4 **Any ONE/Enige EEN**
To measure the rate of blood flow ✓ using a Doppler flow meter
To detect the heartbeat/monitor the development of a fetus in the uterus using a sonar

Om die tempo van bloedvloei te meet met behulp van 'n Doppler-vloeimeter
Om die hartklop op te spoor/die ontwikkeling van 'n fetus in die baarmoeder te monitor met behulp van 'n sonar (1)
[15]

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QUESTION/VRAAG 7

7.1

Marking criteria/*Nasienkriteria*
If any one 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.*

If masses is used 0/2 / As massa gebruik is 0/2

The magnitude of the electrostatic force exerted by one point charge (Q_1) on another point charge (Q_2) is directly proportional to the product of the (magnitudes of the) charges and inversely proportional to the square of the distance (r) between them.✓✓

Die grootte van die elektrostatiese krag wat een puntlading (Q_1) op 'n ander puntlading (Q_2) uitoefen, is direk eweredig aan die produk van die groottes van die ladings en omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle. (2)

7.2



(3)

Accepted labels / Aanvaarde benoemings	
F_E	Electrostatic force between charges **X** and **Y**/Elektrostatiese krag tussen ladings **X** en **Y**
w	Fg / Gravitational force on **X**/ Gravitasiekrag op **X**
T	Tension / Spanning

Notes/Aantekeninge:

- Any additional forces/Enige addisionele kragte: deduct 1 mark/trek 1 punt af: max/maks $^2/_3$
- No labels/Geen benoeming: deduct 1 mark/trek 1 punt af: max/maks $^2/_3$
- No arrows/Geen pyltjies: $0/3$
- Force(s) not touching object/Krag(te) raak nie aan die voorwerp nie: deduct 1 mark/trek 1 punt af: max/maks $^2/_3$

Ignore relative sizes of the vectors/Ignoreer relatiewe groottes van die vektore

7.3.1

$F_{E(BA)} = 2{,}72 \times 10^{-4} \sin 83{,}91° $ ✓ $= 2{,}705 \times 10^{-4}$ N

$F_{E(BA)} = 2{,}72 \times 10^{-4} \cos 6{,}09° = 2{,}705 \times 10^{-4}$ N

$F_{net} = ma$

$T - (0{,}02)(9{,}8) - 2{,}705 \times 10^{-4} = 0$ ✓

$T = 0{,}196$ N ✓

(3)

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7.3.2

OPTION/OPSIE 1	OPTION/OPSIE 2
$F_{E(CB)} = 2,72 \times 10^{-4} \cos 83,91°$ $= 2,89 \times 10^{-5}$ N $F = \frac{kQ_1Q_2}{r^2}$ ✓ $2,89\times10^{-5} = \frac{(9\times10^9)(Q_C)(20\times10^{-9})}{(0,5)^2}$ ✓ $Q_c = +4,01 \times 10^{-8}$ C ✓ Range/Reeks: $3,96 \times 10^{-7}$ to $4,01 \times 10^{-8}$	$F_{net}^2 = AB^2 + BC^2$ $(2,72 \times 10^{-4})^2 = (2,705 \times 10^{-4})^2 + BC^2$ $BC = 2,85 \times 10^{-5}$ N $F = \frac{kQ_1Q_2}{r^2}$ ✓ $2,85\times10^{-5} = \frac{(9\times10^9)(Q_C)(20\times10^{-9})}{(0,5)^2}$ ✓ $Q_c = +3,96 \times 10^{-7}$ C ✓ Range/Reeks: $3,96 \times 10^{-7}$ to $4,01 \times 10^{-8}$

(3)

7.4 UPWARDS/OPWAARTS ✓ (1)

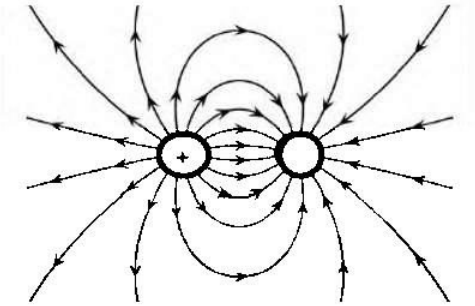
[12]

QUESTION/VRAAG 8

8.1 The electric field at a point is the (electrostatic) force experienced per unit positive charge placed at that point ✓✓ (2 or/of 0)

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

8.2



Criteria for sketch/Kriteria vir skets	Marks/Punte
Correct shape as shown. Korrekte vorm soos getoon.	✓
Direction away from positive to negative. Rigting weg van positief na negatief.	✓
Field lines start on spheres and do not cross for correct diagram. Veldlyne begin op elke sfeer en kruis nie vir korrekte diagram.	✓

(3)

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8.3.1

$$n = \frac{Q}{q_e} \checkmark$$

$$7,5\times10^{12} = \frac{Q}{-1,60\times10^{-19}} \checkmark$$

$Q = -1,20\times10^{-6}C$ ✓ (Answer must be negative/Antwoord moet negatief wees) (3)

8.3.2

POSITIVE MARKING FROM QUESTION 8.3.1.
POSITIEWE MERK VANAF VRAAG 8.3.1

$$E_{at\ P} = \frac{kQ}{r^2} \checkmark$$

$$E_{at\ P} = \frac{(9\times10^{9})(0,7\times10^{-6})}{(0,04)^2} \checkmark$$

$E_{at\ P\ by\ R}$ = 3 937 500 N·C^{-1} to the right/na regs

$$E_{at\ P} = \frac{kQ}{r^2}$$

$$E_{at\ P} = \frac{(9\times10^{9})(1,2\times10^{-6})}{(0,08)^2} \checkmark$$

$E_{at\ P\ by\ S}$ = 1 687 500 N·C^{-1} to the right/na regs

E_{net} = 3 937 500 + 1 687 500 ✓ (adding/bymekaar tel)

E_{net} = 5 625 000 N·C^{-1} to the right/na regs ✓
E_{net} = 5,63 x10^{6} N·C^{-1} to the right/na regs (5)

[13]

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QUESTION/VRAAG 9

9.1

Marking criteria/*Nasienkriteria*
If any one 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 potential difference across a conductor is directly proportional to the current in the conductor at constant temperature✓✓

Die potensiaalverskil oor 'n geleier is direk eweredig aan die stroom in die geleier by konstante temperatuur. (2)

9.2.1 4,5 V ✓ (1)

9.2.2 4,5 V ✓ (1)

9.2.3 0 V (Zero) ✓ (1)

9.3.1

$V_P = I_t \cdot R_P$ ✓

$V_P = (1,8)(1)$ ✓

$V_P = 1,8$ V

$\therefore V_2 = 1,8$ V ✓

V=IR
Subscript not needed for formula mark
Onderskrif nie nodig vir formule punt nie

(3)

9.3.2

OPTION/OPSIE 1	**OPTION/OPSIE 2**
$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓ $\frac{1}{1} = \frac{1}{R} + \frac{1}{2R}$ ✓ $2R = 2 + 1$ $2R = 3$ $R = 1,5\ \Omega$ $\therefore R_2 = 2R = 2(1,5) = 3\ \Omega$ ✓	Using ratio/Gebruik verhoudings Resistors/Weerstande 1:2 ✓ 3:2 of 1Ω ✓ R = 1,5Ω $\therefore R_2 = 2R = 2(1,5) = 3\ \Omega$ ✓

(3)

9.4 DECREASES/AFNEEM✓

- Total resistance increases/Totale weerstand neem toe ✓
- Total current decreases/Totale stroom neem af ✓

(3)

[14]

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QUESTION/VRAAG 10

10.1 MOTOR ✓
It has an electrical source/Het 'n elektriese bron ✓ (2)

10.2.1 Motor effect/Motoreffek ✓ (1)

10.2.2 AC Source/WS bron✓
Provides alternating current/provides electrical energy ✓
Verskaf wisselstroom/verskaf elektriese energie (2)

10.2.3 **Y** = South pole/Suidpool
X = North pole/Noordpool ✓ (1)

10.3

$V_{rms} = \frac{V_{max}}{\sqrt{2}}$ $V_{rms} = \frac{311}{\sqrt{2}}$ ✓ V_{rms} = 219,91 V	$R = \frac{V_{rms}}{I_{rms}}$ $50 = \frac{219,91}{I_{rms}}$ ✓ I_{rms} = 4,3982 A

POSITIVE MARKING FROM PART 1/POSITIEWE MERK VANAF DEEL1
(if Option 1 is used, only one mark either V or I)
(As Opsie 1 gebruik is, slegs een punt vir V of vir I)

Option/Opsie 1
$W = V_{rms} \cdot I_{rms} \cdot \Delta t$ ✓ $9\,672,1 = (219,91)(4,3982)(\Delta t)$ ✓ Δt = 10 s ✓
Option/Opsie 2
$W = \frac{V_{rms}^2}{R} \cdot \Delta t$ ✓ $9\,672,1 = \frac{(219,91)^2}{50}(\Delta t)$ ✓ Δt = 10 s ✓
Option/Opsie 3
$W = I_{rms}^2 \cdot R \cdot \Delta t$ ✓ $9\,672,1 = (4,3982)^2(50)(\Delta t)$ ✓ Δt = 10 s ✓

(4)
[10]

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QUESTION/VRAAG 11

11.1

Marking criteria/*Nasienkriteria*
If any one 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 from the metal surface ✓✓

Die minimum energie benodig om 'n elektron uit die oppervlak van 'n metaal vry te stel.

(2)

11.2 Emission (spectrum)✓
Emissie (spektrum) (1)

11.3.1

$E = W_o + E_{k(max)}$ ✓

$-3\times10^{-19}-(-7\times10^{-19})$ ✓ $= (1\times10^{-19})+\frac{1}{2}(9{,}11\times10^{-31})v_{max}^2$ ✓

v_{max} = 811 552,16 $m\cdot s^{-1}$ ✓

$v_{max} = 8{,}12\times10^{5}\ m\cdot s^{-1}$

(4)

11.3.2

E=hf

$-x-(-3\times10^{-19})$ ✓ = $(6{,}63\times10^{-34})(3{,}0166\times10^{14})$ ✓

$X = -10\times10^{-20}$ ✓

(3)

11.4.1 REMAINS THE SAME/BLY DIESELFDE ✓ (1)

11.4.2 INCREASES/TOENEEM ✓
The energy of the photon of light increases ✓
Die energie van die foton van lig neem toe.

OR/OF

Frequency is inversely proportional to wavelength, frequency is directly proportional to energy.
Frekwensie is omgekeerd eweredig aan golflengte, frekwensie is direk eweredig aan energie.

OR/OF

E=hf; $\lambda \propto \frac{1}{f}$

(2)
[13]

TOTAL/TOTAAL: 150

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