



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 2024

MARKING GUIDELINES/NASIENRIGLYNE

MARKS/PUNTE: 150

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QUESTION 1 / VRAAG 1

- | | | |
|------|------|-------------|
| 1.1 | C ✓✓ | (2) |
| 1.2 | D ✓✓ | (2) |
| 1.3 | C ✓✓ | (2) |
| 1.4 | B ✓✓ | (2) |
| 1.5 | A ✓✓ | (2) |
| 1.6 | D ✓✓ | (2) |
| 1.7 | B ✓✓ | (2) |
| 1.8 | B ✓✓ | (2) |
| 1.9 | A ✓✓ | (2) |
| 1.10 | A ✓✓ | (2) |
| | | [20] |

QUESTION 2 / 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 resultant/net 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 resultante/netto krag en omgekeerd eweredig aan die massa van die voorwerp.

OR/OF

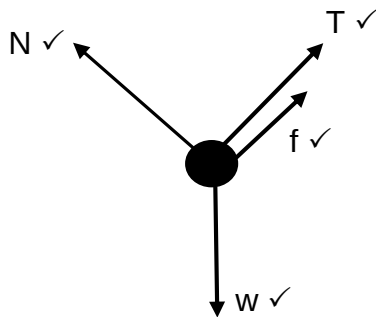
The resultant/net force acting on an object is equal to the rate of change of momentum of the object. **(2 or 0)**

Die resulterende/netto krag wat op 'n voorwerp inwerk is gelyk aan die tempo van verandering van momentum. **(2 of 0)**

(2)

2.2 DOWN THE INCLINE / AFWAARTS TEEN DIE HELLING ✓

(1)

2.3

(4)

Accepted labels / Aanvaarde benoemings

w	F_g / F_w / force of earth on block / weight / mg / gravitational force / VALUE / gravitasiekrag
T	Tension in rope / F_T / spankrag
F	F_{friction} / F_f / frictional force / wrywing
N	Normal force / F_N / Normaalkrag

Notes/Aantekeninge:

- Mark awarded for label and arrow.
- Any additional forces: deduct 1 mark: max $\frac{3}{4}$
- No labels: deduct 1 mark: max $\frac{3}{4}$
- If everything correct, but no arrows: deduct 1 mark: $\frac{3}{4}$
- Force(s) not touching object: deduct 1 mark: max $\frac{3}{4}$
- Ignore relative sizes of the vectors

2.4

Marking criteria/Nasienkriteria:

- Formula for block P or block Q ✓
- Substitution of F_{net} for block P ✓
- Substitution of F_{net} for block Q ✓
- 5a **OR** 2a ✓
- Answer ✓

For Block P:

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

$$F_{g\parallel} + (-T) + (-f) = ma$$

$$(5)(9,8)\sin 30^\circ - T - 2,5 = 5a \quad \checkmark$$

$$22 - T = 5a$$

$$T = -5a + 22$$

For Block Q:

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

$$T - F_g = ma$$

$$T - (2)(9,8) = 2a \quad \checkmark$$

$$T - 19,6 = 2a$$

$$T = 2a + 19,6$$

$$\therefore -5a + 22 = 2a + 19,6$$

$$7a = 2,4$$

$$a = 0,34 \text{ m}\cdot\text{s}^{-2} \quad \checkmark$$

(5)

2.5 GREATER THAN / GROTER AS ✓

 F_{net} increases – no more tension pulling back ✓ F_{net} neem toe – geen meer spankrag wat terug trek nie

(2)

[14]**QUESTION 3 / VRAAG 3**

3.1

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

'n Voorwerp waaraan 'n beginsnelheid gegee is en wat dan slegs onder die invloed van die gravitasiekrag beweeg. **(2 or 0)**

(2)

3.2.1

Upwards positive/**Opwaarts positief:**

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

$$-30 \checkmark = 30 + (-9,8)\Delta t \quad \checkmark$$

$$\Delta t = 6,12\text{s} \quad \checkmark$$

Downwards positive/**Afwaarts positief:**

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

$$30 \checkmark = -30 + (9,8)\Delta t \quad \checkmark$$

$$\Delta t = 6,12\text{s} \quad \checkmark$$

(4)

3.2.2 POSITIVE MARKING FROM QUESTION 3.2.1 POSITIEWE NASIEN VANAF VRAAG 3.2.1

$v_f = v_i + a\Delta t$ $0 = -30 + (9,8)\Delta t$ $\Delta t = 3,06\text{s}$	
Upwards Positive/ Opwaarts positief $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark$ $\Delta y = (30)(3,06) + \frac{1}{2}(-9,8)(3,06)^2 \checkmark$ $\Delta y = 45,92\text{ m}$ $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $\Delta y = (30)(2,06) + \frac{1}{2}(-9,8)(2,06)^2 \checkmark$ $\Delta y = 41,01\text{ m}$ displacement in the last second $= 45,92 - 41,01 = 4,91\text{ m} \checkmark$	Downwards Positive/ Afwaarts positief $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark$ $\Delta y = (-30)(3,06) + \frac{1}{2}(9,8)(3,06)^2 \checkmark$ $\Delta y = -45,92\text{ m}$ $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $\Delta y = (-30)(2,06) + \frac{1}{2}(9,8)(2,06)^2 \checkmark$ $\Delta y = -41,01\text{ m}$ displacement in the last second $= 45,92 - 41,01 = 4,91\text{ m} \checkmark$

(4)

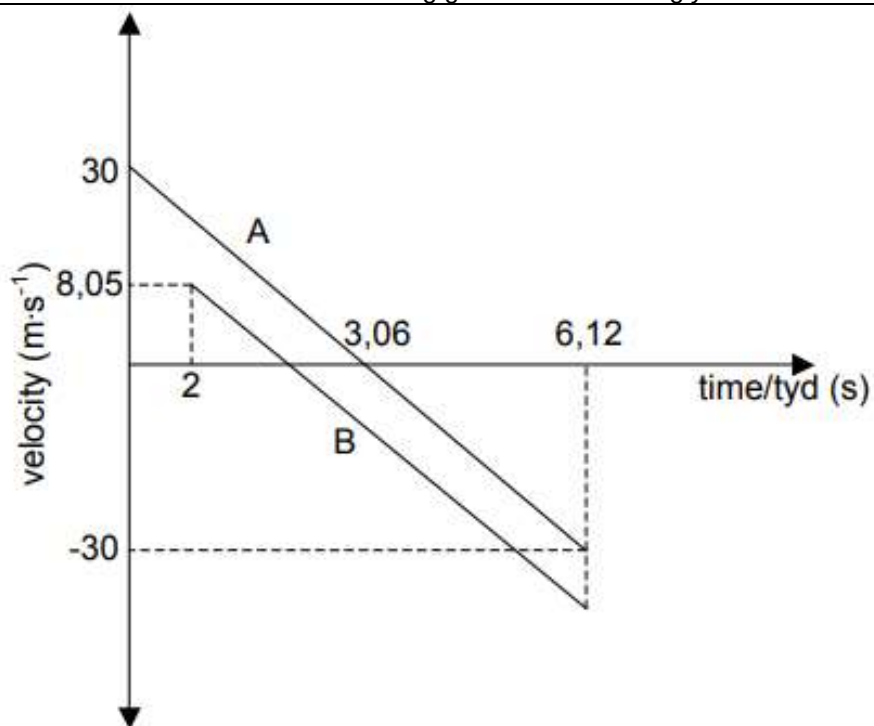
Upwards positive / Opwaarts positief $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark$ $-50 \checkmark = v_i(4,12) + \frac{1}{2}(-9,8)(4,12)^2 \checkmark$ $v_i = 8,05\text{ m}\cdot\text{s}^{-1} \checkmark$	Downwards positive/ Afwaarts positief $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark$ $50 \checkmark = v_i(4,12) + \frac{1}{2}(9,8)(4,12)^2 \checkmark$ $v_i = -8,05\text{ m}\cdot\text{s}^{-1}$ $v_i = 8,05\text{ m}\cdot\text{s}^{-1} \checkmark$
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(4)

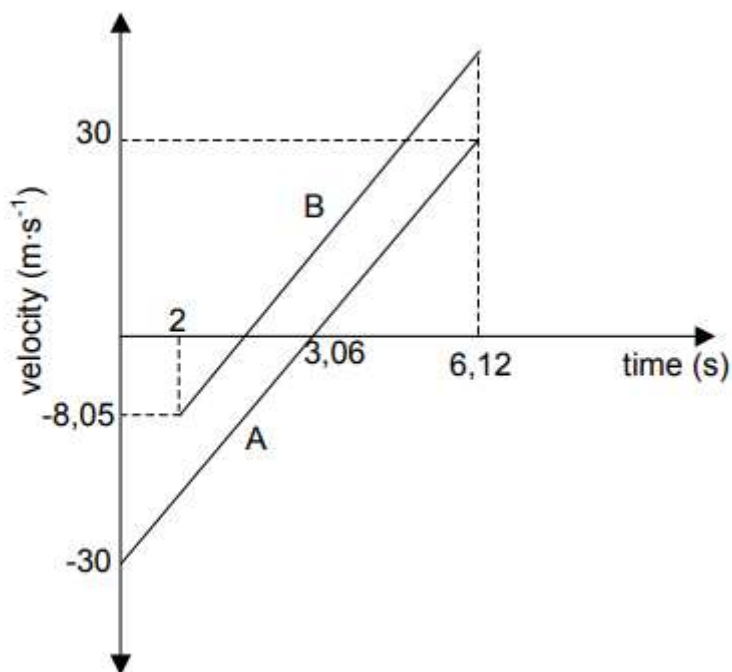
3.4 POSITIVE MARKING FROM/POSITIEWE MERK VANAF 3.2.1 & 3.2.2 & 3.3 UPWARDS POSITIVE/OPWAARTS POSITIEF

Criteria/Kriteria	Marks/Punte
Correct shape of A Korrekte vorm van A	✓
Correct shape of Graph B parallel to A above A Korrekte vorm van Grafiek parallel met A bo A	✓
Time at which both A and B reach the ground (6,12 s) Tyd wat beide A en B die grond bereik (6,12 s)	✓
Time for A to reach the maximum height (3,06 s) shown Tyd vir A om maksimum hoogte te bereik (3,06 s) aangedui	✓

(4)



DOWNWARDS POSITIVE/AFWAARTS POSITIEF



[18]

QUESTION 4 / VRAAG 4

4.1 $v_f^2 = v_i^2 + 2a\Delta y$ ✓
 $v_f^2 = 0 + 2(9,8)(15)$ ✓
 $v_f = 17,15 \text{ m}\cdot\text{s}^{-1}$ ✓

(3)

4.2. Impulse is the product of the resultant/net force ✓ acting on an object and the time the net force acts on the object. ✓

Impuls is die produk van die resulterende/netto krag ✓ wat op 'n voorwerp inwerk en die tyd wat die netto krag op die voorwerp inwerk. ✓

(2)

4.3.1 **POSITIVE MARKING FROM QUESTION 4.1**

$F_{\text{net}} \cdot \Delta t = mv_f - mv_i$ ✓
 $F_{\text{net}} (0,5) = (1,5)(0 - 17,15)$ ✓
 $F_{\text{net}} = -51,45 \text{ N}$
 $F_{\text{net}} = 51,45 \text{ N}$ ✓ upwards/opwaarts

(3)

4.3.2 **POSITIVE MARKING FROM QUESTION 4.3.1**

$F_{\text{net}} = F_{\text{mud}} + F_g$ ✓
 $-51,45 = F_{\text{mud}} + (1,5)(9,8)$ ✓
 $F_{\text{mud}} = 66,15 \text{ N}$ ✓

(3)

4.4 **DECREASE/VERMINDER** ✓
 $\Delta p = \text{constant value}$ ✓
 F_{net} is inversely proportional to Δt , therefore the longer the time of contact, the smaller the net force if the change in momentum stays the same. ✓

(3)

[14]**QUESTION 5 / VRAAG 5**

5.1 **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.

A force for which the work done in moving an object between two points depends on the path taken ✓✓

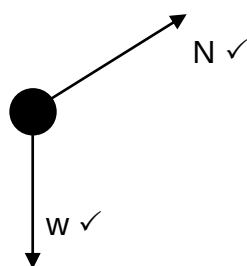
'n Krag waarvoor die arbeid verrig om 'n voorwerp tussen twee punte te beweeg, afhanklik is van die roete wat gevolg word.

(2)

5.2 $E_{\text{KT}} + E_{\text{PT}} = E_{\text{KP}} + E_{\text{PP}}$ ✓
 $\frac{1}{2}(5)(0)^2 + (5)(9,8)(5) = \frac{1}{2}(5)v^2 + (5)(9,8)(0)$ ✓
 $245 = 2,5 v^2$
 $v = 9,90 \text{ m}\cdot\text{s}^{-1}$ ✓

(4)

5.3



(2)

Accepted labels / Aanvaarde benoemings

w	F_g / F_w / force of earth on block / weight / mg / gravitational force /
N	Normal force / F_N

5.4 Velocity stays the same there is no friction working in on the object.

(1)

5.5 **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 net work done on an object is equal to the change in kinetic energy of the object. ✓✓

Die netto arbeid verrig op 'n voorwerp is gelyk aan die verandering in kinetiese energie van die voorwerp **OF** die arbeid verrig op die voorwerp deur 'n netto krag is gelyk aan die verandering in kinetiese energie van die voorwerp.

(2)

5.6 **POSITIVE MARKING FROM QUESTION 5.2****OPSIE 1/OPTION 1**

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

$$F_{\text{net}} \Delta x \cos \theta = \left[\frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2 \right]$$

$$(18 + (5)(9,8) \sin \theta) \Delta x \cos 180^\circ = \left[\frac{1}{2} (5) 0^2 - \frac{1}{2} (5) (9,90)^2 \right]$$

$$-18x - 49\left(\frac{3}{x}\right)x = \left[\frac{1}{2} (5) 0^2 - \frac{1}{2} (5) (9,90)^2 \right]$$

$$-18x - 49(3) = -245,025$$

$$\Delta x = 5,445 \text{ m}$$

$$\sin \theta = \frac{t}{s}$$

$$\sin \theta = \frac{3}{5,445} \checkmark$$

$$\theta = 33,43^\circ \checkmark$$

(6)

OPSIE 2/OPTION 2

$$W_{nc} = \Delta E_k + \Delta E_p$$

$$f\Delta x \cos\theta = [\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2] + [mgh_f - mgh_i]$$

$$\frac{18\Delta x \cos 180^\circ}{-18\Delta x} = \frac{[\frac{1}{2}(5)0^2 - \frac{1}{2}(5)(9,90)^2]}{-245 + 147} + \frac{[(5)(9,8(3) - (5)(9,8)(0)]}{-18\Delta x}$$

$$-18\Delta x = -245 + 147$$

$$\Delta x = 5,44 \text{ m}$$

$$\sin \theta = \frac{t}{s}$$

$$\sin \theta = \frac{3}{5,44}$$

$$\theta = 33,47^\circ$$

Any one ✓

[17]

QUESTION 6 / 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/pitch/wavelength 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 van frekwensie/toonhoogte/golflengte van die klank waargeneem deur 'n luisteraar omdat die klankbron en die luisteraar verskillende snelhede relatief tot die medium van klankvoorplanting het.

OR/OF

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

'n (Skynbare) verandering in waargenome frekwensie/toonhoogte/golflengte as gevolg van die relatiewe beweging tussen die bron en 'n waarnemer/luisteraar. (2)

6.2

$$f = \frac{2}{4 \times 10^{-5}} \quad \text{or} \quad \frac{1}{1 \times 10^{-4}}$$

$$= 40\,000 \text{ Hz} \quad \checkmark \checkmark$$

(2)

6.3

Waves in front of source are more compact/ wavelength decreases ✓
Dolphin is moving towards the recorder. ✓

(2)

6.4 **POSITIVE MARKING FROM QUESTION 6.2**

$$f_L = \frac{v \pm v_L}{v \pm v_S} f_S \checkmark \quad \text{OR} \quad f_L = \frac{v}{v - v_S} f_S$$

$$40\,000 \checkmark = \left(\frac{1500 + 0}{1500 - v_S} \right) \checkmark 39\,000 \checkmark$$

$$v_S = 37,5 \text{ m.s}^{-1} \checkmark$$

(5)
[11]

QUESTION 7 / VRAAG 7

7.1

Marking criteria/Nasienriglyne:

-1 mark for each of the 3 key words omitted in the correct context.

-1 punt vir elk van die 3 sleutelwoorde weggelaat in die korrekte konteks.

The electric field is an **area in space** where an electric **charge** experiences a **force**. ✓✓Die elektriese veld is 'n **gebied in die ruimte** waarin 'n elektriese **lading** 'n **krag** ondervind

(2)

7.2

$$E_{\text{nett}} = E_1 + E_2$$

$$E_{\text{net}} = \frac{kQ}{r^2} - \frac{kQ}{r^2} \quad \text{(Mark for/Punt vir } E = \frac{kQ}{r^2} \text{)}$$

$$= \frac{(9 \times 10^9)(4 \times 10^{-6})}{(0,3)^2} \checkmark - \checkmark \frac{(9 \times 10^9)(3 \times 10^{-6})}{(0,1)^2} \checkmark$$

$$= 2,3 \times 10^6 \text{ N} \cdot \text{C}^{-1} \checkmark \quad \text{right/ regs/east/oos} \checkmark$$

(6)

7.3

$$-0,5 \times 10^{-6} \text{ C} \checkmark \checkmark$$

(2)

7.4

POSITIVE MARKING FROM QUESTION 7.3

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

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

$$F (Q_1 \text{ on } 3) = \frac{(9 \times 10^9)(0,5 \times 10^{-6})Q_3}{(0,25)^2} \checkmark$$

$$F (Q_1 \text{ on } 2) = \frac{(9 \times 10^9)(0,5 \times 10^{-6})(0,5 \times 10^{-6})}{(0,2)^2} \checkmark$$

$$= 72000 \times Q_3 \text{ N}$$

$$= 0,05625 \text{ N}$$

$$F_{\text{net}} = \sqrt{(F_{1,3})^2 + (F_{1,2})^2} \checkmark$$

$$5,4 \times 10^{-1} \checkmark = \sqrt{(72000 Q_3)^2 + (0,05625)^2}$$

$$Q_3 = 7,459 \times 10^{-6} \text{ C} \checkmark$$

(6)

[16]

QUESTION 8 / VRAAG 8

8.1.1 6V ✓

(1)

8.1.2 0,2 A ✓

(1)

8.2.1 **POSITIVE MARKING FROM Q 8.1.1 AND 8.1.2**

$$R = \frac{V}{I} \quad \checkmark$$

$$= \frac{3}{0,2} \quad \checkmark$$

$$= 15 \, \Omega \quad \checkmark$$

(3)

8.2.2 **POSITIVE MARKING FROM Q8.1.2 (I=0,1A + Answer Q8.1.2)****OPTION 1**

$$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{Any one } \checkmark$$

$$= \frac{1}{45} + \frac{1}{90}$$

$$R = 30 \, \Omega$$

$$R_e = 30 + 60 \quad \checkmark = 90 \, \Omega$$

$$\varepsilon = I(R+r) \quad \checkmark$$

$$= (0,3)(90 + 2) \quad \checkmark$$

$$= 27,6 \, \text{V} \quad \checkmark$$

OPTION 2

$$V_p = IR$$

$$= (0,3)(30) \quad \checkmark$$

$$= 9 \, \text{V}$$

$$V_{\text{bulb}} = IR \quad \checkmark$$

$$= (0,3)(60)$$

$$= 18 \, \text{V} \quad \checkmark$$

$$V_i = Ir$$

$$= (0,3)(2)$$

$$= 0,6 \, \text{V}$$

$$\varepsilon = V_p + V_{\text{bulb}} + V_i$$

$$= 9 + 18 + 0,6 \quad \checkmark$$

$$= 27,6 \, \text{V} \quad \checkmark$$

(5)

8.2.3 **POSITIVE MARKING FROM Q8.1.2 + Q8.2.2****OPTION 1**

$$P = I^2 R \quad \checkmark$$

$$= (0,3)^2 (60) \quad \checkmark$$

$$= 5,4 \, \text{W} \quad \checkmark$$

OPTION 2

$$P = VI \quad \checkmark$$

$$= (18)(0,3) \quad \checkmark$$

$$= 5,4 \, \text{W} \quad \checkmark$$

OPTION 3

$$P = \frac{V^2}{R} \quad \checkmark$$

$$= \frac{18^2}{60} \quad \checkmark$$

$$= 5,4 \, \text{W} \quad \checkmark$$

(3)

8.3 0 V ✓ (1)

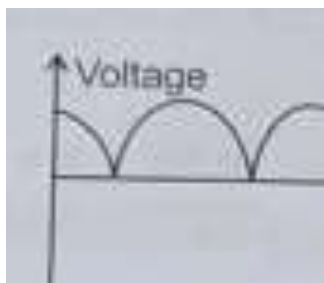
8.4 Total resistance increases ✓
 ∴ Total current decreases ✓
 ∴ 'lost volts' (V_i) DECREASE ✓ because $V_i \propto I$ ($r = \text{constant}$) (3)
[17]

QUESTION 9 /VRAAG 9

9.1.1 Anti-clockwise ✓ (1)

9.1.2 Electrical energy to kinetic(mechanical) energy ✓
 Elektriese energie na kinetiese(meganiese) energie (1)

9.1.3



Marking criteria for graph:

Correct shape *Korrekte vorm* ✓
 Two complete cycle/*Twee volledige siklus* ✓

(2)

9.2.1 The AC potential difference/voltage which dissipates the same amount of energy ✓ as DC potential difference. ✓
Die WS potensiaalverskil/spanning wat dieselfde hoeveelheid energie verbruik as GS potensiaalverskil/spanning.
 OR/OF
 (The rms value of AC is) the DC potential difference/voltage which dissipates the same amount of energy ✓ as AC potential difference/voltage. ✓
Dit is die GS potensiaalverskil/spanning wat dieselfde hoeveelheid energie verbruik as WS potensiaalverskil/spanning. (2)

9.2.2

OPTION 1

$$P_{\text{ave}} = V_{\text{rms}} \cdot I_{\text{rms}} \quad \checkmark$$

$$= 230 \cdot \frac{I_{\text{max}}}{\sqrt{2}} \quad \checkmark$$

$$2100 \quad \checkmark = 230 \frac{I_{\text{max}}}{\sqrt{2}} \quad \checkmark$$

$$I_{\text{max}} = 12,9 \text{ A} \quad \checkmark$$

OPTION 2

$$P_{\text{ave}} = V_{\text{rms}} \cdot I_{\text{rms}} \quad \checkmark$$

$$2100 = 230 I_{\text{rms}} \quad \checkmark$$

$$I_{\text{rms}} = 9,13 \text{ A}$$

$$I_{\text{rms}} = \frac{I_{\text{max}}}{\sqrt{2}}$$

$$9,13 = \frac{I_{\text{max}}}{\sqrt{2}} \quad \checkmark$$

$$I_{\text{max}} = 12,91 \text{ A} \quad \checkmark$$

(4)

[10]

QUESTION 10 / VRAAG 10

10.1 $3,6 \times 10^{-19} \text{ J}$ ✓

10.2 The maximum kinetic energy is inversely proportional✓✓ to the wavelength. (1)
(2)

10.3 **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)

10.4
$$W_0 = \frac{hc}{\lambda_0} \checkmark$$
$$= \frac{(6,63 \times 10^{-34})(3 \times 10^8)}{4,9 \times 10^{-7}} \checkmark$$
$$= 4,06 \times 10^{-19} \text{ J} \checkmark$$
 (3)

10.5 **POSITIVE MARKING FROM 10.4**
 $E = W_0 + E_{k(\max)} \checkmark$
 $\frac{hc}{\lambda} = W_0 + \frac{1}{2}mv^2$
 $\frac{(6,63 \times 10^{-34})(3 \times 10^8)}{\lambda} \checkmark = (4,06 \times 10^{-19}) \checkmark + \frac{1}{2}(9,11 \times 10^{-31})(2,6 \times 10^6)^2 \checkmark$
 $\lambda = 5,7 \times 10^{-8} \text{ m} \checkmark$ (5)
[13]

TOTAL/TOTAAL: 150