education

DEPARTMENT: EDUCATION
MPUMALANGA PROVINCE

NATIONAL SENIOR CERTIFICATE
NASIONALE SENIOR SERTIFIKAAT

GRADE/*GRAAD* 12

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

SEPTEMBER 2019

MARKING GUIDELINES / *NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consists of 18 pages

Hierdie nasienriglyne bestaan uit 18 bladsye

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QUESTION 1 / VRAAG 1

1.1 C✓✓ (2)

1.2 B ✓✓ (2)

1.3 C ✓✓ (2)

1.4 A ✓✓ (2)

1.5 A ✓✓ (2)

1.6 C ✓✓ (2)

1.7 C ✓✓ (2)

1.8 A✓✓ (2)

1.9 B ✓✓ (2)

1.10 B✓✓ (2)

[20]

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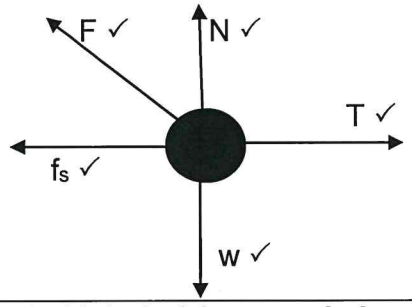
QUESTION 2 / VRAAG 2

2.1 When a resultant/net force acts on an object, the object will accelerate in the direction of the force ✓ at an acceleration 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.

Note: If any one of the underlined key words in the **correct context** is omitted, deduct 1 mark

(2)

2.2



(5)

Accepted labels / Aanvaarde benoemings	
w	Fg / Fw / force of earth on block / weight / mg / gravitational force
F	$F_{applied}$ /
T	Tension in rope / T / F_T
N	Normal force
f_s	friction / static friction / F_f

Notes/Aantekeninge:

- Any additional forces: deduct 1 mark: max $^4/_5$
- No arrows: $^0/_5$
- Force(s) not touching object: deduct 1 mark: max $^4/_5$

2.3

$F_{net} = ma$
$T - F_x - f_s = 0$ } Any one ✓
$F_x + f_s = T$

$F_x + 15 = (8 \times 9{,}8)$ ✓
$F_x = 63{,}4$ N ✓

$$\frac{63{,}4}{F} = \text{Sin}30° \checkmark$$

$$F = \frac{63{,}4}{\text{Sin}30°}$$

$= 126{,}8$ N ✓

(5)

2.4

For either 3a OR 8a ✓

FOR P:	FOR R:
$F_{net} = ma$	$F_{net} = ma$
$T - f_k = 3a$	$F_g - T = 8a$
$T - (0,4 \times 3 \times 9,8)$ ✓ $= 3a$	$(8 \times 9,8) - T$ ✓ $= 8a$
$T - 11,76 = 3a$	$78,4 - T = 8a$

$\therefore 11,76 + 3a = 78,4 - 8a$

$a = 6,06\ m \cdot s^{-2}$ ✓

(4)

[16]

QUESTION 3 / VRAAG 3

3.1

Yes ✓

Gravitational force is the only force acting on the ball. ✓

Ja ✓

Gravitasiekrag is die enigste krag wat op die bal inwerk. ✓

(2)

3.2

OPTION 1	
Upwards positive:	**Downwards positive:**
$v_f^2 = v_i^2 + 2a\Delta y$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$= \underline{(5)^2 + 2(-9,8)(-80)}$ ✓	$= \underline{(-5)^2 + 2(9,8)(80)}$ ✓
$v_f = 39,91\ m \cdot s^{-1}$ ✓	$v_f = 39,91\ m \cdot s^{-1}$ ✓

(3)

3.3

Increase ✓

Toeneem ✓

(1)

3.4 **POSITIVE MARKING FROM QUESTION 3.2**

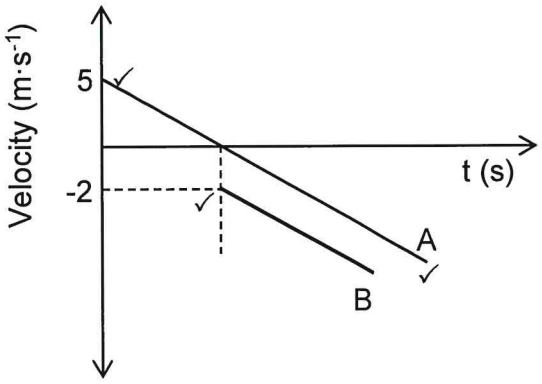
Upwards positive:	**Downwards positive:**
FOR BALL A:	*FOR BALL A:*
$v_f = v_i + a\Delta t$	$v_f = v_i + a\Delta t$
$\underline{-39,91 = 0 + (-9,8)\ \Delta t}$ ✓ Any one ✓	$\underline{39,91 = 0 + (9,8)\ \Delta t}$ ✓ Any one ✓
$\Delta t = 4,07$ s	$\Delta t = 4,07$ s
FOR BALL B:	*FOR BALL B:*
$\Delta y = v_i\ \Delta t + \frac{1}{2} a\ \Delta t^2$	$\Delta y = v_i\ \Delta t + \frac{1}{2} a\ \Delta t^2$
$\underline{-80 = (-2)\ \Delta t + \frac{1}{2} (-9,8)\ \Delta t^2}$ ✓	$80 = (2)\ \Delta t + \frac{1}{2} (9,8)\ \Delta t^2$ ✓
$\Delta t = 3,84$ s	$\Delta t = 3,84$ s
$\therefore \Delta t_{A-B} = 4,07 - 3,84 = 0,23$ s ✓	$\therefore \Delta t_{A-B} = 4,07 - 3,84 = 0,23$ s ✓

(4)

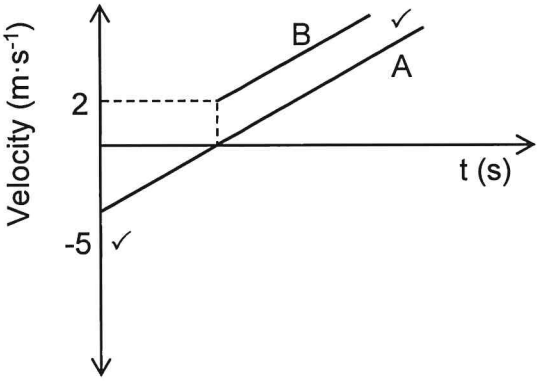
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3. 4 **POSITIVE MARKING FROM QUESTION 2.1**

Upwards positive:



Downwards positive:



CRITERIA	
Graph A is a straight line through the t-axis, starting from ± 5 m·s^{-1}.	✓
Graph B starts in line where graph A intercepts t-axis with a value of ± 2 m·s^{-1}	✓
Two sloping parallel straight lines	✓

(3)
[13]

QUESTION 4 / VRAAG 4

4.1 The product of the resultant/net force acting on an object and the time the resultant/net force acts on the object.
Die produk van die resulterende/netto krag wat op 'n voorwerp inwerk en die tyd wat die resulterende/netto krag op die voorwerp inwerk.

Note: If any one of the underlined key words in the **correct context** is omitted, deduct 1 mark

(2)

4.2.1
$p = mv$ ✓
$= (0,05)(200)$ ✓
$= 10\ kg \cdot m \cdot s^{-1}$ ✓

(3)

4.2.2 **POSITIVE MARKING FROM QUESTION 4.2.1**

TO THE RIGHT AS POSITIVE	**TO THE LEFT AS POSITIVE**
$F_{net} \cdot \Delta t = mv_f - mv_i$ ✓	$F_{net} \cdot \Delta t = mv_f - mv_i$ ✓
$F_{net}(0,1)$ ✓ $= \underline{(0,05)(-10) - (0,05)(200)}$ ✓	$F_{net}(0,1)$✓ $= \underline{(0,05)(10) - (0,05)(-200)}$ ✓
$F_{net} = -105$	
$F_{net} =$ 105 N to the left / *links* ✓	$F_{net} =$ 105 N to the left / *links* ✓

(4)

4.2.3 **POSITIVE MARKING FROM QUESTION 4.2.2**
40 marbles/*albasters* per 60 s
$\therefore$4 marbles/*albasters* per 6 s

$(F_{net})_{block} = 4(105)$✓ $= 420$ N ✓

(2)
[11]

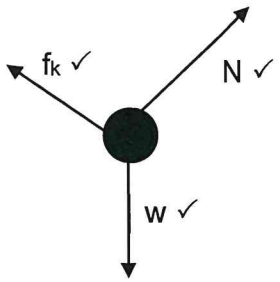
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QUESTION 5 / VRAAG 5

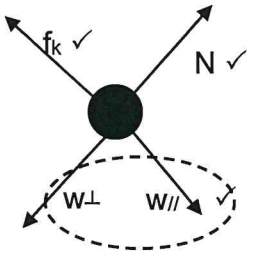
5.1

$E_k = ½ mv^2$ ✓
$= ½ (10)(15)^2$ ✓
$= 1125$ J ✓ (3)

5.2



ACCEPT



Accepted labels / Aanvaarde benoemings	
w	F_g / F_w / force of earth on block / weight / 98 N / mg / gravitational force
N	Normal force / F_N / Force of incline on block
f_k	Kinetic friction / friction / f / F_f

(3)

5.3

The net/total work done on an object is equal to the change in the object's kinetic energy.
Die netto/totale arbeid verrig op 'n voorwerp is gelyk aan die verandering in kinetiese energie van die voorwerp.

ACCEPT:
The work done on an object by a resultant/net force is equal to the change in the object's kinetic energy.
Die arbeid verrig op die voorwerp deur 'n resulterende/netto krag is gelyk aan die verandering in kinetiese energie van die voorwerp.

Note: If any one of the underlined key words in the **correct context** is omitted, deduct 1 mark

(2)

5.4

OPTION 1

$W_{net} = \Delta E_k$ ✓

$W_f + W_{Fg//} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$\underline{(50)(3)\text{Cos}180°}$ ✓ + $\underline{(10\times9,8\times\sin10°)(3)\cos0°}$ ✓ = $\underline{\frac{1}{2}(10)v^2 - \frac{1}{2}(10)(15)^2}$ ✓

$v = 14,33\ m\cdot s^{-1}$ ✓ (5)

OPTION 2

$W_{net} = \Delta E_k$ ✓

$W_f + W_{Fg} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$\underline{(50)(3)\cos180°}$ ✓ + $\underline{(10\times9,8)(3)\cos80°}$ ✓ = $\underline{\frac{1}{2}(10)v^2 - \frac{1}{2}(10)(15)^2}$ ✓

$v = 14,33\ m\cdot s^{-1}$ ✓ (5)

OPTION 3

$W_{nc} = \Delta E_k + \Delta E_p$ ✓

$\underline{(50)(3)\cos180°}$ ✓ = $[\underline{\frac{1}{2}(10)v^2 - \frac{1}{2}(10)(15)^2}]$ ✓ + [0 - $\underline{(10)(9,8)(3\sin10°)}$ ✓]

$v = 14,33\ m\cdot s^{-1}$ ✓ (5)

5.5

Because there is $\underline{\text{no friction, } F_{net} = 0\ N}$ ✓

$\underline{\text{No change in speed/velocity}}$ ✓ (or $a = 0\ m\cdot s^{-2}$)

$W_{net} = 0 = \Delta E_k$ (2)

5.6

POSITIVE MARKING FROM QUESTION 5.4

OPTION 1

$(mgh + \frac{1}{2}mv^2)_C = (mgh + \frac{1}{2}mv^2)_D$ ✓

$0 + \underline{\frac{1}{2}(10)(14,33)^2}$ ✓ = $\underline{(10)(9,8)(0,8) + \frac{1}{2}(10)v^2}$ ✓

$v = 13,77\ m\cdot s^{-1}$ ✓

OPTION 2

$W_{nc} = \Delta E_k + \Delta E_p$ ✓

$0 = [\underline{\frac{1}{2}(10)v^2 - \frac{1}{2}(10)(14,33)^2}]$ ✓ + [$\underline{(10)(9,8)(0,8)}$ ✓ - 0]

$v = 13,77\ m\cdot s^{-1}$ ✓ (4)

[19]

QUESTION 6 / VRAAG 6

6.1 The distance between two consecutive points in phase on a wave. ✓✓
Die afstand tussen twee opeenvolgende punte in fase op 'n golf.

Note: If any one of the underlined key words in the **correct context** is omitted, deduct 1 mark

(2)

6.2
$v = f\lambda$ ✓
$340 = 1\,520\,\lambda$ ✓
$\lambda = 0{,}22$ m ✓

(3)

6.3.1
$f_L = \frac{v \pm v_L}{v \pm v_S} f_S$ ✓
$= \frac{340}{340+20}$ ✓ $(1\,520)$ ✓
$f_L = 1\,435{,}56$ Hz ✓

(4)

6.3.2 **POSITIVE MARKING FROM QUESTION 6.2.2**

$f_L = \frac{v \pm v_L}{v \pm v_S} f_S$
$= \frac{340}{340-25}\,(1\,520)$ ✓
$f_L = 1\,640{,}63$ Hz ✓

$\Delta f = 1\,640{,}63 - 1\,435{,}56$ ✓ $= 205{,}07$ Hz ✓

(4)
[13]

QUESTION 7 / VRAAG 7

7.1 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 ✓

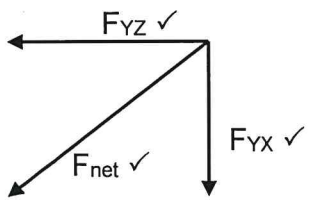
Die grootte van die elektrostatiese krag wat een puntlading (Q_1) op 'n ander puntlading (Q_2) uitoefen, is direk eweredig aan die produk van die groottes van die ladings ✓ en omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle. ✓

Note: If any one of the underlined key words in the **correct context** is omitted, deduct 1 mark

- If masses used ($^0/_2$)

(2)

7.2



NOTE:
- Award mark for correct vector with label
- No labels, but vectors correct (max $^2/_3$)

(3)

7.3

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

$$= \frac{(9\times10^9)(6\times10^{-6})(2\times10^{-6})}{(0,3)^2} \checkmark$$

$$= 1,2 \text{ N (left)}$$

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

$$= \frac{(9\times10^9)(6\times10^{-6})(2,5\times10^{-6})}{(0,4)^2} \checkmark$$

$$= 0,844 \text{ N (down)}$$

$$F_{net} = \sqrt{(F_X)^2 + (F_Z)^2}$$

$$= \sqrt{(0,844)^2 + (1,2)^2}$$

Any one ✓

$$= 1,47 \text{ N} \checkmark \text{ (ACCEPT 1,46 N)}$$

(5)

OPTION 2

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

$= \frac{(9\times10^9)(2\times10^{-6})}{(0,3)^2}$ ✓

$= 200\ 000\ N\cdot C^{-1}$ (right)

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

$= \frac{(9\times10^9)(2,5\times10^{-6})}{(0,4)^2}$ ✓

$= 140\ 625\ N\cdot C^{-1}$ (up)

$E_{net} = \sqrt{(E_X)^2 + (E_Z)^2}$

$= \sqrt{(200\ 000)^2 + (140\ 625)^2}$

$= 2,44\times10^5\ N\cdot C^{-1}$

$F = EQ$ ✓

$= (2,44\times10^5)(6\times10^{-6})$ ✓

$= 1,47\ N$ ✓

(5)

[10]

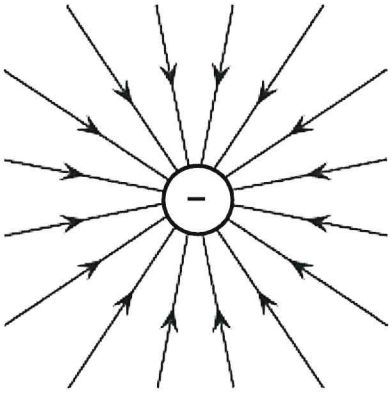
QUESTION 8 / VRAAG 8

8.1 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.

Note: If any one of the underlined key words in the **correct context** is omitted, deduct 1 mark

(2)

8.2



Criteria:

Correct shape as shown	✓
Correct direction	✓

(minimum 4 field lines)

(2)

8.3.1

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

$$= \frac{-4\times10^{-9}}{-1,6\times10^{-19}} \checkmark$$

$$= 2,5\times10^{10} \text{ é} \checkmark$$

(3)

8.3.2 **OPTION 1**

$E_f = \frac{kQ}{r^2}$ ✓	$E_f = \frac{kQ}{r^2}$ ✓
$3E$ ✓$= \frac{k(Q - 4\times10^{-9})}{0,05^2}$ ✓	$3E$ ✓$= \frac{k(Q + 4\times10^{-9})}{0,05^2}$ ✓
$3\left(\frac{kQ}{0,05^2}\right) = \frac{k(Q - 4\times10^{-9})}{0,05^2}$	$3\left(\frac{kQ}{0,05^2}\right) = \frac{k(Q + 4\times10^{-9})}{0,05^2}$
$3Q = Q - 4\times10^{-9}$	$3Q = Q + 4\times10^{-9}$
$Q = -2\times10^{-9}$ C ✓	$Q = 2\times10^{-9}$ C ✓

OPTION 2

$\Delta E = \frac{k\Delta Q}{r^2}$

$2E = \frac{(9\times10^{9})(4\times10^{-9})}{(0,05)^2}$ ✓

$E = 7\,200$ N·C^{-1}

$E_Q = \frac{kQ}{r^2}$ ✓

$7\,200 = \frac{(9\times10^{9})Q}{(0,05)^2}$ ✓

$Q = 2\times10^{-9}$ C ✓

(4)
[11]

QUESTION 9 / VRAAG 9

9.1.1 6 V ✓ (1)

9.1.2 0,2 A ✓ (1)

9.2.1 **POSITIVE MARKING FROM QUESTION 9.1.2**

$R = \frac{V}{I}$ ✓

$= \frac{3}{0,2}$ ✓

R = 15 Ω ✓ (3)

9.2.2 **POSITIVE MARKING FROM QUESTION 9.1.2**
(I = 0,1 + Answer of QUESTION 9.1.2)
OPTION 1

$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2}$
$= \frac{1}{45} + \frac{1}{90}$
} Any one ✓

R = 30 Ω ✓

R_e = 30 + 80 ✓= 110 Ω

ε = I(R+r) ✓
= (0,3)(110 + 1) ✓
= 33,3 V ✓ (6)

OPTION 2

V_p = IR
= (0,1)(6×15) ✓
= 9 V ✓

V_{bulb} = IR ✓
= (0,3)(80)
= 24 V ✓

V_i = Ir
= (0,3)(1)
= 0,3 V

ε = V_p + V_{bulb} + V_i
= 9 + 24 + 0,3 ✓
= 33,3 V ✓ (6)

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9.2.3 **POSITIVE MARKING FROM QUESTIONS 9.1.2 + 9.2.2**

OPTION 1	**OPTION 3**
$P = I^2R$ ✓ $= \underline{(0,3)^2(80)}$ ✓ $= 7,2\ W$ ✓ **OPTION 2** $P = VI$ ✓ $= (24)(0,3)$ ✓ $= 7,2\ W$ ✓	$P = \frac{V^2}{R}$ ✓ $= \frac{24^2}{80}$ ✓ $= 7,2\ W$ ✓

(3)

9.3 0 V ✓ (1)

9.4

Total resistance increases ✓ ∴Total current decreases ✓ ∴'lost volts' (V_i) decreases because $V_i \propto I$ ✓ (r = constant)

(3)

[18]

QUESTION 10 / VRAAG 10

10.1 Mechanical (energy)/kinetic (energy) ✓ TO electrical (energy) ✓
Meganiese (energie)/kinetiese (energie) NA elektriese (energie) (2)

10.2 AC ✓ (1)

10.3

OPTION 1

$V_{rms} = \frac{V_{max}}{\sqrt{2}}$
$= \frac{7,78}{\sqrt{2}}$ ✓
$= 5,5$ V

$P_{ave} = \frac{V_{rms}^2}{R}$ ✓
$= \frac{(5,5)^2}{5}$ ✓
$= 6,05$ W ✓

$V_{rms} = I_{rms}R$
$5,5 = I_{rms}(5)$
$I_{rms} = 1,1$ A

$P_{ave} = I_{rms}^2 R$ ✓
$= (1,1)^2(5)$ ✓
$= 6,05$ W ✓

$V_{rms} = I_{rms}R$
$5,5 = I_{rms}(5)$
$I_{rms} = 1,1$ A

$P_{ave} = I_{rms}^2 R$ ✓
$= \frac{5,5^2}{5}$ ✓
$= 6,05$ W ✓

(4)

OPTION 2

$V_{max} = I_{max}R$
$7,78 = I_{max}(5)$ ✓
$I_{max} = 1,56$ A

$P_{ave} = \frac{V_{max}I_{max}}{2}$ ✓
$= \frac{(7,78)(1,56)}{2}$ ✓
$= 6,07$ W ✓

(4)

OPTION 3

$V_{max} = I_{max}R$
$7,78 = I_{max}(5)$ ✓
$I_{max} = 1,56$ A

$I_{rms} = \frac{I_{max}}{\sqrt{2}}$
$= \frac{1,56}{\sqrt{2}}$
$= 1,10$ V

$V_{rms} = \frac{V_{max}}{\sqrt{2}}$
$= \frac{7,78}{\sqrt{2}}$
$= 5,5$ V

$P_{ave} = V_{rms} I_{rms}$ ✓
$= 5,5\ (1,10)$ ✓
$= 6,05$ W ✓

(4)
[7]

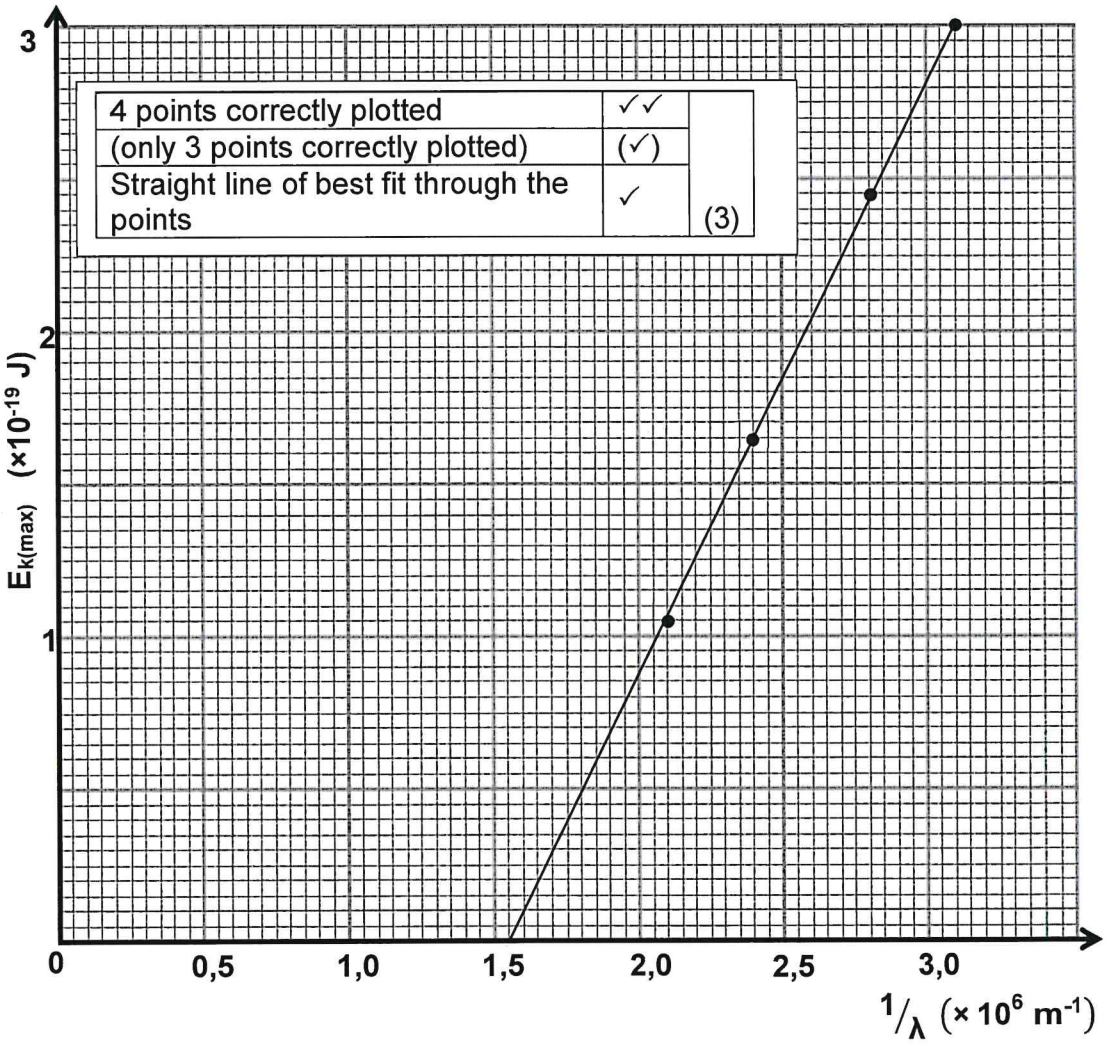
QUESTION 11 / VRAAG 11

11.1 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.

Note: If any one of the underlined key words in the **correct context** is omitted, deduct 1 mark

(2)

11.2 **GRAPH OF $E_{k(max)}$ VERSUS $^1/_\lambda$ / *GRAFIEK VAN $E_{k(maks)}$ VERSUS $^1/_\lambda$***



4 points correctly plotted	✓✓	
(only 3 points correctly plotted)	(✓)	
Straight line of best fit through the points	✓	(3)

(3)

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11.3.1 **POSITIVE MARKING FROM QUESTION 11.2** (the x-intercept on graph)

$c = f\lambda$ ✓

$f = \frac{c}{\lambda} = c \times \left(\frac{1}{\lambda}\right)$

$f = (3\times10^{8})(1,55\times10^{6})$ ✓

$f = 4,65\times10^{14}$ Hz ✓ (3)

11.3.2 **POSITIVE MARKING FROM QUESTION 11.3.1**

OPTION 1	**OPTION 2**
$W_0 = hf_0$ ✓	$W_0 = \frac{hc}{\lambda}$ ✓
$= 6,63\times10^{-34}\ (4,65\times10^{14})$ ✓	$= (6,63\times10^{-34})(3\times10^{8})(1,55\times10^{6})$ ✓
$= 3,08\times10^{-19}$ J ✓	$= 3,08\times10^{-19}$ J ✓

(3)

11.4 Remains the same ✓
Bly dieselfde (1)

[12]

TOTAL/*TOTAAL*: 150

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