education

Department of Education
FREE STATE PROVINCE

PREPARATORY EXAMINATION
VOORBEREIDENDE EKSAMEN

GRADE/*GRAAD* 12

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

SEPTEMBER 2023

MARKS/*PUNTE*: 150

MARKING GUIDELINES
NASIENRIGLYNE

This marking guideline consists of 15 pages.
Hierdie nasienriglyne bestaan uit 15 bladsye.

Copyright reserved/*Kopiereg voorbehou*

Please turn over/*Blaai om asseblief*

QUESTION/*VRAAG 1*

1.1 A ✓✓ (2)

1.2 B ✓✓ (2)

1.3 B ✓✓ (2)

1.4 C ✓✓ (2)

1.5 D ✓✓ (2)

1.6 B ✓✓ (2)

1.7 B ✓✓ (2)

1.8 C ✓✓ (2)

1.9 B ✓✓ (2)

1.10 D ✓✓ (2)
[20]

QUESTION/*VRAAG* 2

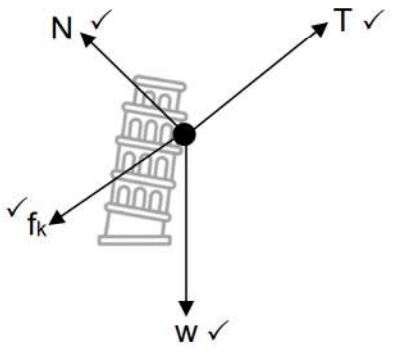
Marking criteria/*Nasienkriteria*
If any of the underlined key words/phrases in the correct context are omitted:
- 1 mark per word/phrase. Net/Resultant force mentioned at least once.

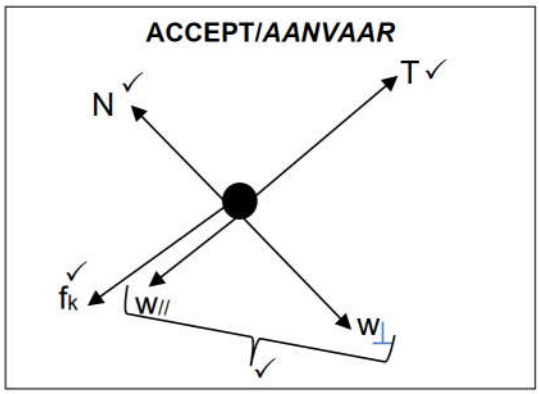
Indien enige van die onderstreepte sleutelwoorde/-frases in die korrekte konteks weggelaat word:
- 1 punt per woord/frase. Netto/resultante krag ten minste een keer genoem.

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

Wanneer 'n resulterende/netto krag op 'n voorwerp inwerk, sal die voorwerp versnel in die rigting van die netto krag by 'n versnelling wat direk eweredig is aan die netto/resultante krag en omgekeerd eweredig aan die massa van die voorwerp. (2)

2.2





Accept the following symbols/*Aanvaar die volgende simbole*		
T	F_T/Force on the rope/*Krag op die tou*	✓
w	F_g /weight/*gewig*	✓
N	F_N/Normal/Normal force/*Normaal/Normaalkrag*	✓
f_k	f/Friction/frictional force/kinetic frictional force *f/Wrywing/Wywingskrag/Kinetiese wrywingskrag*	✓

(4)

NB: Allocate ONE mark for each correct arrow and label in first option.
For the second option, give one mark for both components of weight, correctly drawn with arrows and labels.
Deduct one mark for any additional forces.

***NB**: Ken EEN punt toe vir elke korrekte pyltjie en etiket in eerste opsie.*
Vir die tweede opsie, gee een punt vir beide komponente van gewig, korrek geteken met pyle en byskrifte.
Trek een punt af vir enige bykomende kragte.



2.3

OPTION/*OPSIE* 1

Take the direction of motion of each block as positive
Neem die bewegingsrigting van elke blok as positief

For/*Vir* m_2

$F_{net} = ma$ ✓
$w_2 + (-T) = ma$
$(8)(9,8) - T$✓ $= 8a$ ..... (1)

For m_1

Any/*Enige* ✓

$F_{net} = ma$
$T + (-w_{//}) + (-f_k) = 8a$
$T-(8x9,8)\sin 30°$✓ $- \ 0,2(8)(9,8)\cos 30°$✓ $= 8a$ ....(2)

1 + 2:

$(8)(9,8) - (8x9,8)\sin 30° - \ 0,2(8)(9,8)\cos 30° = 16a$
$a = 1,6 \ m{\cdot}s^{-2}$✓

OPTION/*OPSIE* 2

Take the direction of motion of each block as negative
Neem die bewegingsrigting van elke blok as negatief

For/*Vir* m_2

$F_{net} = ma$ ✓
$-w_2 + T = -ma$
$-(8)(9,8) + T$✓ $= -8a$ ..... (1)

For m_1

Any/*Enige* ✓

$F_{net} = ma$
$T + (-w_{//}) + (-f_k) = 8a$
$-T+(8x9,8)\sin 30°$✓ $+ \ 0,2(8)(9,8)\cos 30°$✓ $= -8a$ ....(2)

1 + 2:

$-(8)(9,8) + (8x9,8)\sin 30° + 0,2(8)(9,8)\cos 30° = -16a$
$a = 1,6 \ m{\cdot}s^{-2}$ ✓

(6)

2.4 The force that block(m_2) exerts on the earth. ✓✓
Die krag wat blok (m_2) op die aarde uitoefen. (2)

2.5 Down (the incline)/*Af (die helling)* ✓ (1)
[15]

QUESTION/*VRAAG* 3

3.1 Motion of an object under the influence of the gravitational force only.✓✓
Beweging van 'n voorwerp slegs onder die invloed van gravitasiekrag. (2)

3.2 0,7 s ✓ (1)

3.3

OPTION/*OPSIE* 1
UPWARDS POSITIVE
OPWAARTS POSITIEF

$v_f = v_i + g\Delta t$✓
$0 = v_i + (-9,8)(0,7)$ ✓
$v_i = 6,86\ m\cdot s^{-1}$✓

OPTION/*OPSIE* 2
DOWNWARDS POSITIVE
AFWAARTS POSITIEF

$v_f = v_i + g\Delta t$✓
$0 = v_i + (9,8)(0,7)$ ✓
$v_i = -6,86$
$v_i = 6.86\ m\cdot s^{-1}$ ✓

OPTION/*OPSIE* 3
UPWARDS POSITIVE
OPWAARTS POSITIEF

$\Delta y = v_i\Delta t + \frac{1}{2}g\Delta t^2$✓
$2,4 = v_i + (-9,8)(0,7)^2$✓
$v_i = 6,86\ m\cdot s^{-1}$✓

OPTION/*OPSIE* 4
DOWNWARDS POSITIVE
AFWAARTS POSITIEF

$\Delta y = v_i\Delta t + \frac{1}{2}g\Delta t^2$✓
$-2,4 = v_i + (9,8)(0,7)^2$✓
$v_i = -6,86$
$v_i = 6.86\ m\cdot s^{-1}$ ✓

OPTION/*OPSIE* 5
UPWARDS POSITIVE
OPWAARTS POSITIEF

$v_f^2 = v_i^2 + 2g\Delta y$✓
$0 = v_i^2 + 2(-9,8)(2,4)$✓
$v_i = 6,86\ m\cdot s^{-1}$✓

OPTION/*OPSIE* 6
UPWARDS POSITIVE
OPWAARTS POSITIEF

$v_f^2 = v_i^2 + 2g\Delta y$✓
$0 = v_i^2 + 2(9,8)(-2,4)$✓
$v_i = -6,86$
$v_i = 6,86\ m\cdot s^{-1}$ ✓

OPTION/*OPSIE* 7
UPWARDS POSITIVE
OPWAARTS POSITIEF

$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$✓
$2,4 = \left(\frac{v_i + 0}{2}\right)0,7$✓
$v_i = 6,86\ m\cdot s^{-1}\ down/af$✓

OPTION/*OPSIE* 8
UPWARDS POSITIVE
OPWAARTS POSITIEF

$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$✓
$-2,4 = \left(\frac{v_i + 0}{2}\right)0,7$✓
$v_i = -6,86$
$v_i = 6,86\ m\cdot s^{-1}\ down/af$✓

OPTION/*OPSIE* 9

$(mgh + \frac{1}{2}mv^2)_i = \left(mgh + \frac{1}{2}mv^2\right)_f$ ✓
$(gh + \frac{1}{2}v^2)_i = (gh + \frac{1}{2}v^2)_f$
$9,8(2,4) + \frac{1}{2}(0) = 9,8(0) + \frac{1}{2}v_f^2$✓
$v_f = 6,86\ m\cdot s^{-1}$✓

OPTION/*OPSIE* 10

$W_{net} = \Delta K$✓
$mg\Delta x\cos\theta = \frac{1}{2}m(v_f^2 - v_i^2)$
$9,8(2,4)(1) = \frac{1}{2}(v_f^2 - 0)$✓
$v_f = 6,86\ m\cdot s^{-1}$✓

(3)

3.4 **POSITIVE MARKING FROM/*POSITIEWE NASIEN VANAF 3.3***

OPTION/*OPSIE* 1
UPWARDS POSITIVE
OPWAARTS POSITIEF

Whole motion/*Hele beweging*

$v_f = v_i + g\Delta t$
$= 6{,}86 + (-9{,}8)(1{,}7)$✓
$= -9{,}8\ m{\cdot}s^{-1}$
$\Delta y = v_i\Delta t + \frac{1}{2}g\Delta t^2$✓
$= (-9{,}8)(1) + \frac{1}{2}(-9{,}8)(1)^2$✓
$= -14{,}7\ m$
$Distance/Afstand = 14{,}7\ m$✓

UPWARDS POSITIVE
OPWAARTS POSITIEF

$v_f = v_i + g\Delta t$
$= 6{,}86 + (-9{,}8)(1{,}7)$✓
$= -9{,}8\ m{\cdot}s^{-1}$

Velocity striking the ground./
Snelheid as dit grond tref.

(Whole motion/*Hele beweging*)

$v_f = v_i + g\Delta t$
$= 6{,}86 + (-9{,}8)(2{,}7)$✓
$= -19{,}6\ m \cdot s^{-1}$

OR/*OF*

(Maximum height/*Maksimum hoogte*)

$v_f = v_i + g\Delta t$
$= 0 + (-9{,}8)(2)$
$= -19{,}6\ m \cdot s^{-1}$

OR/*OF*

(Point of launch/*Punt waar vrygelaat*)

$v_f = v_i + g\Delta t$
$= -6{,}86 + (-9{,}8)(1{,}3)$
$= -19{,}6\ m \cdot s^{-1}$

OR/*OF*

(Last one second/*Duur een sekonde*)

$v_f = v_i + g\Delta t$
$= -9{,}8 + (-9{,}8)(1)$
$= -19{,}6\ m \cdot s^{-1}$

OPTION/*OPSIE* 2
DOWNWARDS POSITIVE
AFWAARTS POSITIEF

Whole motion/*Hele beweging*

$v_f = v_i + g\Delta t$
$= -6{,}86 + (9{,}8)(1{,}7)$✓
$= 9{,}8\ m{\cdot}s^{-1}$
$\Delta y = v_i\Delta t + \frac{1}{2}g\Delta t^2$✓
$= (9{,}8)(1) + \frac{1}{2}(9{,}8)(1)^2$✓
$= +14{,}7\ m$
$Distance/Afstand = 14{,}7\ m$✓

OPTION/*OPSIE* 3
UPWARDS POSITIVE
OPWAARTS POSITIEF

$v_f^2 = v_i^2 + 2g\Delta y$✓
$(-19{,}6)^2 = (-9{,}8)^2 + 2(-9{,}8)(\Delta y)$✓
$\Delta y = -14{,}7\ m$
$Distance/Afstand = 14{,}7\ m$✓

OPTION/*OPSIE* 4
DOWNWARDS POSITIVE
AFWAARTS POSITIEF

$v_f^2 = v_i^2 + 2g\Delta y$✓
$(19{,}6)^2 = (9{,}8)^2 + 2(9{,}8)(\Delta y)$✓
$\Delta y = +14{,}7\ m$
$Distance/Afstand = 14{,}7\ m$✓

OPTION/*OPSIE* 5
UPWARDS POSITIVE
OPWAARTS POSITIEF

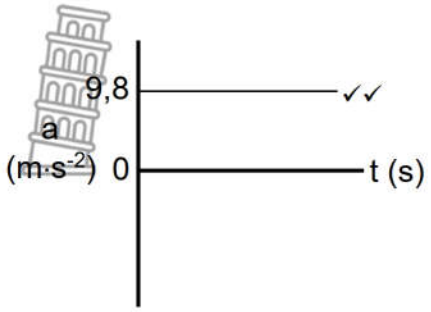
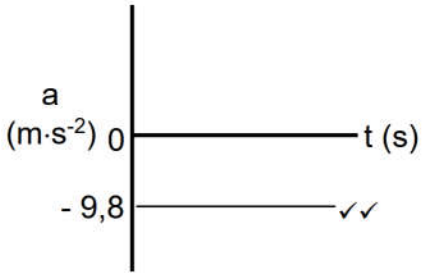
$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$✓
$= \left(\frac{-9{,}8 + (-19{,}6)}{2}\right)1$✓
$\Delta y = -14{,}7\ m$
$Distance/Afstand = 14.7\ m$ ✓

OPTION/*OPSIE* 6
DOWNWARDS POSITIVE
AFWAARTS POSITIEF

$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$✓
$= \left(\frac{9{,}8 + 19{,}6}{2}\right)1$✓
$\Delta y = 14{,}7\ m$
$Distance/Afstand = 14{,}7\ m$✓

(5)

3.5

DOWNWARDS POSITIVE ***AFWAARTS POSITIEF***	**DOWNWARDS NEGATIVE** ***AFWAARTS POSITIEF***
	

(2)
[13]

QUESTION/*VRAAG* 4

4.1.1 The product of the resultant/net force acting on an object and the time the resultant/net force acts on the object. ✓✓ **(2/0)**
Die produk van die resulterende/netto krag wat op 'n voorwerp inwerk en die tyd wat die resulterende/netto krag op die voorwerp inwerk. (2)

Accept/*Aanvaar:*
Impulse is the change in momentum of an object. **(2/0)**
Impuls is die verandering in momentum van 'n voorwerp.

4.1.2

OPTION/*OPSIE* 1 **EAST AS POSITIVE** ***OOS AS POSITIEF***	**OPTION/*OPSIE* 2** **EAST AS NEGATIVE** ***OOS AS NEGATIEF***
$F_{net}\Delta t = \Delta p$ ✓ $F_{net}\Delta t = m(v_f - v_i)$ $(400)(0,1)$ ✓$= 0,4v_f - (0,4)(-40)$ ✓ $v_f = 60\ m\cdot s^{-1}$, east/*oos* ✓	$F_{net}\Delta t = \Delta p$ ✓ $F_{net}\Delta t = m(v_f - v_i)$ $(-400)(0,1)$ ✓ $= 0,4v_f - (0,4)(40)$ ✓ $v_f = -60\ m\cdot s^{-1}$ $\therefore\ v_f = 60\ m\cdot s^{-1}$, east/*oos* ✓
OPTION/*OPSIE* 3 **EAST AS POSITIVE** ***OOS AS POSITIEF***	**OPTION/*OPSIE* 4** **EAST AS NEGATIVE** ***OOS AS NEGATIEF***
$F_{net} = ma$ $400 = 0,4a$ ✓ $a = 1000\ m\cdot s^{-2}$ $vf = vi + a\Delta t$✓ $= -40 + (1000)(0,1)$✓ $= 60\ m\cdot s^{-1}$, east/*oos* ✓	$F_{net} = ma$ $-400 = 0,4a$ ✓ $a = -1000\ m\cdot s^{-2}$ $vf = vi + a\Delta t$✓ $= 40 + (-1000)(0,1)$✓ $= -60$ m $= 60\ m\cdot s^{-1}$, east/*oos* ✓

(4)

4.2.1

OPTION/*OPSIE* 1
RIGHT AS POSITIVE/*REGS AS POSITIEF*

Σp(before/*voor*) = Σp(after/*na*) ✓
$m_A v_{Ai} + m_B v_{Bi} = m_B v_{1f} + m_B v_{2f}$
$\underline{(1750)(1,5) + (1450)(-1,1)}$✓ = $\underline{(1750)(0,25) + (1450)v_{Bf}}$✓
$v_{Bf} = 0,41\ m\cdot s^{-1}$✓ to the right/*na regs* ✓

OPTION/*OPSIE* 2
LEFT AS POSITIVE/*LINKS AS POSITIEF*

Σp(before/*voor*) = Σp(after/*na*) ✓
$m_A v_{Ai} + m_B v_{Bi} = m_A v_{Af} + m_B v_{Bf}$
$\underline{(1750)(-1,5) + (1450)(1,1)}$✓ = $\underline{(1750)(-0,25) + (1450)v_{Bf}}$✓
$v_{Bf} = -0,41\ m\cdot s^{-1}$
$v_{Bf} = 0,41\ m\cdot s^{-1}$✓ to the right/*na regs* ✓

OPTION/*OPSIE* 3
RIGHT AS POSITIVE/*REGS AS POSITIEF*

$\Delta p_A = -\Delta p_B$✓
$m(v_{Af} - v_{Ai}) = -m(v_{Bf} - v_{Bi})$
$1750(0,25 - 1,5)$✓ = $-1450(v_{Bf} - (-1,1))$✓
$v_{Bf} = 0,41\ m\cdot s^{-1}$✓ to the right/*na regs*✓

OPTION/*OPSIE* 4
LEFT AS POSITIVE/*LINKS AS POSITIEF*

$\Delta p_A = -\Delta p_B$✓
$m(v_{Af} - v_{Ai}) = -m(v_{Bf} - v_{Bi})$
$1750(0,25 - 1,5)$✓ = $-1450(v_{Bf} - 1,1)$✓
$= -0,41\ m\cdot s^{-1}$
$v_{Bf} = 0,41\ m\cdot s^{-1}$✓ to the right/*na regs* ✓

(5)

4.2.2 Flexible bumpers $\underline{\text{reduce the net force}}$✓ $\underline{\text{by increasing the time}}$✓ required to bring about $\underline{\text{the same change in momentum}}$. ✓

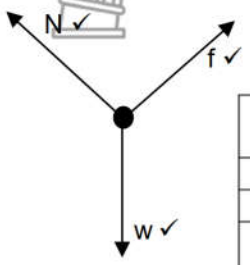
Buigsame buffers $\underline{\text{verminder die netto krag deur die tyd}}$ $\underline{\text{wat benodig word om dieselfde verandering in momentum teweeg te bring, te verhoog}}$. (3)

[14]

QUESTION/*VRAAG* 5

5.1 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



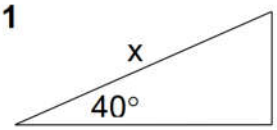
Accept the following symbols/*Aanvaar die volgende simbole*		
w	F_g /weight/*gewig*	✓
N	F_N/Normal/Normal force/*Normaal/normaalkrag*	✓
f	f_k/Friction/frictional force/kinetic frictional force *Wrywing/wrywingskrag/kinetiese wrywingskrag*	✓

(3)

5.3 Frictional force/*Wrywingskrag* ✓ (1)

5.4

OPTIO/*OPSIE* 1



$X = \frac{2,8}{sin\ 40°} = 4,356$

$W_{net} = \Delta K$
$W_{Fg//} + W_f = \frac{1}{2}m(v_f^2 - v_i^2)$
$Fg//\Delta x\cos\theta + f\Delta x\cos\theta = \frac{1}{2}m(v_f^2 - v_i^2)$
✓ Any/*Enige*

$70(9,8)\sin 4\,0°\left(\frac{2,8}{sin\ 40°}\right)\cos 0° + 0,112(70x9,8)cos\ 40°\left(\frac{2,8}{sin\ 40°}\right)cos\ 180° = \frac{1}{2}(70)[v_f^2 - 0,35^2]$

$v_f = 6,905\ m \cdot s^{-1}$ ✓

OPTION/*OPSIE* 2

$W_{net} = \Delta K$
$mg\Delta xcos\theta + f\Delta xcos\theta = \frac{1}{2}m(v_f^2 - v_i^2)$
✓ Any/*Enige*

$70(9,8)cos50°\left(\frac{2,8}{sin40}\right)cos0° + 0,112(70 \times 9,8)cos40°\left(\frac{2,8}{sin40°}\right)cos180° = \frac{1}{2}(70)[v_f^2 - 0,35^2)$

$v_f = 6,905\ m \cdot s^{-1}$ ✓

OPTION/*OPSIE* 3

$W_{nc} = \Delta K + \Delta U$
$f\Delta xcoos\theta = \frac{1}{2}m(v_f^2 - v_i^2) + mg(h_f - h_i)$
✓ Any/*Enige*

$0,112(70 \times 9,8)cos40°\left(\frac{2,8}{sin40°}\right)cos180° = \frac{1}{2}(70)[v_f^2 - (0,35)^2] + (70 \times 9,8)(0 - 2,8)$

$v_f = 6,905\ m \cdot s^{-1}$ ✓

(6)

5.5 Decreases ✓
The normal force decreases ✓ (because cosθ decreases with increase of the size of the angle to the horizontal). Friction is directly proportional to the normal / f =μN / (f ∝ N). ✓

Verlaag
Die normaalkrag neem af (omdat cosθ afneem met toename van die grootte van die hoek met die horisontaal). Wrywing is direk eweredig aan die normaal / f =μN / (f ∝ N). (3)
[15]

QUESTION/*VRAAG* 6

6.1 It is the (apparent) 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. ✓

Dit is die (skynbare) verandering in frekwensie (of toonhoogte) van die klank (bespeur deur 'n luisteraar) omdat die klankbron en die luisteraar verskillende snelhede het relatief tot die medium van klankvoortplanting.

OR/*OF*

An (apparent) change in (observed/detected) frequency (pitch), (wavelength) ✓because 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 'n bron en 'n waarnemer (luisteraar). (2)

6.2 Towards/*Na* ✓
$\frac{f_L}{f_s} > 1$ ✓ (2)

OPTION/*OPSIE* 2
$\frac{f_L}{f_s}$ *increases as* v_L *increases* ✓
$\frac{f_L}{f_s}$ *Neem toe soos wat* v_L *toeneem*

6.3 $\frac{1}{v}$ ✓ (1)

6.4 Use any set of values from the graph.
Gebruik enige stel waardes uit die grafiek.

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
$\frac{f_L}{f_s} = \frac{v_L}{v} + 1$ ✓ ✓ $1{,}06 = \frac{20}{v} + 1$ ✓ $v = 333{,}33\ m \cdot s^{-1}$ ✓	$gradient = \frac{1{,}06 ✓ - 1}{20 - 0}$ ✓ ✓ $= 0{,}003$ $\frac{1}{v} = 0{,}003$ $v = 333{,}33\ m \cdot s^{-1}$ ✓
OPTION/*OPSIE* 3	
$\frac{f_L}{f_s} = \frac{v + v_L}{v}$ ✓ $1{,}06$ ✓ $= \frac{v + 20}{v}$ ✓ $v(1{,}06 = v + 20$ $v = 333{,}33\ m \cdot s^{-1}$ ✓	

(4)

6.5 The spectral lines of the star are shifted towards the lower frequency end ✓which is the red end of the spectrum. ✓

Die spektraallyne van die ster word na die laer frekwensie-end verskuif wat die rooi-end van die spektrum is. (2)

[11]

QUESTION/*VRAAG* 7

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

Die grootte van die elektrostatiese krag wat deur een puntlading op 'n ander puntlading uitgeoefen word, is direk eweredig aan die produk van die grootte van die ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle. (2)

7.1.2
$$F_{Ae} = \frac{k\,Q_1Q_2}{r^2} \quad ✓$$
$$= \frac{9\times10^9\times(1{,}2\times10^{-9})(1{,}6\times10^{-19})}{(4\times10^{-2})^2} \quad ✓$$
$$= 1{,}08\times10^{-15}\ \text{N},\ \text{left}/links$$

$$F_{Be} = \frac{kQ_1Q_2}{r^2}$$
$$\frac{9\times10^9\times(1{,}5\times10^{-9})(1{,}6\times10^{-19})}{(1\times10^{-2})^2} \quad ✓$$
$$= 2{,}16\times10^{-14}N\,,right/regs$$
$$F_{net} = F_{Ae} - F_{Be} \quad ✓$$
$$= 1{,}08\times10^{-15} - 2{,}16\times10^{-14}$$
$$= -2{,}052\times10^{-14}$$
$$= 2{,}052\times10^{-14}\,N\,,right/regs \quad ✓$$

(5)

7.2.1
$$E = k\frac{Q}{r^2} ✓$$
$$4\times10^7 = (9\times10^9)\frac{Q}{(0{,}03)^2} ✓$$
$$Q = 4\times10^{-6}\text{C} ✓$$

(3)

7.2.2 Positive/*Positief* ✓ (1)

7.2.3

$$Q = nq_e$$
$$= 938\times1{,}6\times10^{-19} ✓$$
$$= 1{,}5\times10^{-16}$$

OPTION/*OPSIE* 1

$$E = \frac{F}{Q} ✓$$
$$4\times10^7 = \frac{F}{1{,}5\times10^{-16}} ✓$$
$$F = 6\times10^{-9}\,N ✓$$

OPTION/*OPSIE* 2

$$E = k\frac{Q}{d^2}$$
$$4\times10^7 = (9\times10)^9\frac{Q}{(0{,}03)^2}$$
$$Q = 4\times10^{-6}\,C$$
$$F = K\frac{Q_1Q_2}{d^2} ✓$$
$$= \frac{9\times10^9(1{,}5\times10^{-16})(4\times10^{-6})}{(0{,}03)^2} ✓$$
$$F = 6\times10^{-9}\,N ✓$$

(4)
[15]

QUESTION/*VRAAG* 8

8.1 12 J ✓of energy is transferred per one coulomb of charge. ✓
12 J ✓energie word per een coulomb lading oorgedra. (2)

8.2.1

OPTION/*OPSIE* 1

$V_{30\Omega} = V_{20\Omega}$
$I_{30\Omega}(30) = I_{20\Omega}(20)$
$0{,}2(30) = I_{20\Omega}(20)$✓
$= 0{,}3\ A$
$I_1 = 0{,}3 + 0{,}2$✓
$= 0{,}5\ A$ ✓

OPTION/*OPSIE* 2

$V_{30\Omega} = IR$
$= 0{,}2(25 + 5)$✓
$= 6V$
$V_{30} = V_{20} = V_p$
$6 = I_{20\Omega}R$
$6 = I_{20}(20)$
$I_{20} = 0{,}3\ A$
$I_1 = 0{,}3\ A + 0{,}2\ A$✓
$= 0{,}5$ A✓

OPTION/*OPSIE* 3

$V_p = 0{,}2(30)$
$= 6\ V$✓
$\frac{1}{R_p} = \frac{1}{20} + \frac{1}{25 + 5}$
$R_p = 12\ \Omega$
$V_p = I_pR_p$
$6 = I_p(12)$ ✓
$I_p = 0{,}5\ A$ ✓

(3)

8.2.2 **POSITIVE MARKING FROM/*POSITIEWE NASIEN VANAF* 8.2.1**

$R_X = \frac{V_2}{I}$ ✓
$= \frac{5{,}5}{0{,}5}$ ✓
$= 11\Omega$ ✓

(3)

8.2.3 **POSITIVE MARKING FROM/*POSITIEWE NASIEN VANAF* 8.2.2**

OPTION/*OPSIE* 1

$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$
$= \frac{1}{20} + \frac{1}{30}$ ✓
$R_p = 12\ \Omega$
$R_{ext} = R_p + R_s$
$= 12 + 11$✓
$= 23\ \Omega$ ✓

OPTION/*OPSIE* 2

$R_p = \frac{\text{product/}produk}{\text{sum/}som}$
$= \frac{20 \times 30}{20 + 30}$ ✓
$= 12\ \Omega$
$R_{ext} = R_{ext} + R_s$
$= 12 + 11$ ✓
$= 23\ \Omega$ ✓

(3)

8.2.4

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
$\varepsilon = I(R + r)$ ✓ $12 = 0{,}5(23 + r)$ ✓ $r = 1\ \Omega$ ✓	$V_{lost} = \varepsilon - V_{ext}$ $= 12 - 11{,}5$ ✓ $= 0{,}5$ $V_{lost} = Ir$ ✓ $0{,}5 = 0{,}5r$ $r = 1\ \Omega$ ✓

(3)

8.3 Decrease/*Afneem* ✓
Total external resistance decreases/*Totale eksterne weerstand neem af*
Total current increases/*Totale stroom neem toe* ✓
V_{lost} increases/*neem toe* ✓
V_{ext} decreases/*neem af* ✓ (ε_{mf} stays constant/*bly konstant*)

(4)
[18]

QUESTION/*VRAAG* 9

9.1.1 AC/*WS* ✓ (1)

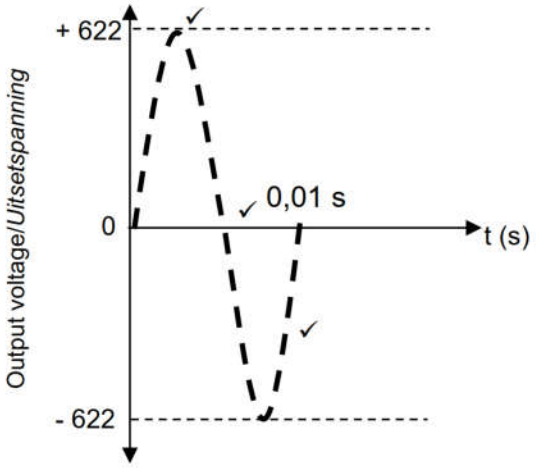
9.1.2 Slip rings/*Sleepringe* ✓ (1)

9.1.3 To ensure conductivity between the slip rings and the external circuit. ✓
Om geleiding tussen sleepringe en die eksterne stroombaan te verseker. (1)

OR/OF Allow for rotation of the slip rings while maintaining contact with the external circuit.
Laat die sleepringe roteer terwyl kontak met die eksterne stroombaan behou word.

9.1.4 P to/*tot* Q ✓ (1)

9.2.1



MARKING CRITERIA
NASIENKRITERIA

✓	Shape/*Vorm*
✓	Amplitude +/- 622 V
✓	Half the period (0,01 s) *Helfte van die tyd*

(3)

9.2.2 (a)

OPTION/*OPSIE* 1	**OPTION/OPSIE 2**
$V_{rms} = \frac{V_{max}}{\sqrt{2}}$ $= \frac{311,12}{\sqrt{2}}$ $= 220\ V$ $I_{rms} = \frac{I_{max}}{\sqrt{2}}$ $= \frac{8}{\sqrt{2}}$ $= 5,66\ A$ $V_{rms} = I_{rms}R$✓ 220 ✓$= 5,66R$✓ $R = 38,87\ \Omega$✓	$V_{max} = I_{max}R$✓ $311,12$ ✓$= 8R$✓ $R = 38,87\ \Omega$✓

(4)

9.2.2 (b) **POSITIVE MARKING FROM/*POSITIEWE NASIEN VANAF 9.2.2(a)***

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**	**OPTION/*OPSIE* 3**
$P_{ave} = V_{rms}I_{rms}$ $= 220(5,66)$ $1\ 245,2\ W$ $P = \frac{W}{\Delta t}$✓ ✓ $1\ 245,2 = \frac{W}{7200}$✓ $W = 8965440$ J✓	$P_{ave} = I_{rms}^2R$ $= (5,66)^2 38,87$ $1\ 245,22\ W$ $P = \frac{W}{\Delta t}$✓ ✓ $1\ 245,22 = \frac{W}{7200}$✓ $W = 8965611,16$ J✓	$P_{ave} = \frac{V_{rms}^2}{R}$ $= \frac{(220)^2}{38,87}$ $1\ 245,18\ W$ $P = \frac{W}{\Delta t}$✓ ✓ $1\ 245,18 = \frac{W}{7200}$✓ $W = 8965268,85$ J✓
OPTION/*OPSIE* 4	**OPTION/*OPSIE* 5**	**OPTION/*OPSIE* 6**
$W = VI\Delta t$✓ ✓ $= 220(5,66)(7200)$✓ $= 8965440\ J$✓	$W = I^2R\Delta t$✓ ✓ $= (5,66)^2(38,87)(7200)$✓ $= 8965611,16$ J✓	$W = \frac{V^2}{R}t$✓ ✓ $= \frac{(220)^2}{38,87}(7200)$✓ $= 8965268,85$ J✓

(4)
[15]

QUESTION/*VRAAG* 10

10.1 The work function of a metal is the minimum energy ✓ that an electron (in the metal) needs to be emitted/ejected from the(metal)surface. ✓

Die werkfunksie van 'n metaal is die minimum energie wat 'n elektron (in die metaal) uit die (metaal)oppervlak moet vrygestel. (2)

10.2

$$E = W_0 + K_{max/maks}$$
$$h\frac{c}{\lambda} = W_0 + \frac{1}{2}mv^2_{max/maks}$$

Any/*Enige* ✓

$$6{,}63 \times 10^{-34}\frac{(3 \times 10^8)}{\lambda} = 3{,}36 \times 10^{-19} + \frac{1}{2}(9{,}11 \times 10^{-31})(7{,}14 \times 10^5)^2$$ ✓ ✓ ✓

$$\lambda = 3{,}50 \times 10^{-7}\ m$$ ✓

(5)

10.3 **Positive marking from/*Positiewe nasien vanaf* 10.2**

$$E = W_0 + K_{max/maks}$$
$$h\frac{c}{\lambda} = W_0 + \frac{1}{2}mv^2_{max/maks}$$

Any/*Enige* ✓

$$6{,}6{,}3 \times 10^{-34}\frac{(3 \times 10^8)}{3{,}50 \times 10^{-7}} = 3{,}65 \times 10^{-19} + \frac{1}{2}(9{,}11 \times 10^{-31})v^2_{max/maks}$$ ✓ ✓

$$v_{max/maks} = 6{,}68 \times 10^5\ m \cdot s^{-1}$$ ✓

(4)

10.4 Increase ✓
More photo electrons strike the surface of the metal per unit time. ✓
More electrons are ejected per unit time. ✓
From the formula $I = \frac{Q}{\Delta t}$ $(= \frac{nq}{\Delta t}\ ;\ I \propto n)$ ammeter reading increases.

Verhoog
Meer fotoelektrone tref die oppervlak van die metaal per eenheid tyd.
Meer elektrone word per eenheid tyd vrygestel.
Vir die formule $I = \frac{Q}{\Delta t}$ $(= \frac{nq}{\Delta t}\ ;\ I \propto n)$ *ammeterlesing neem toe.* (3)

[14]

TOTAL/*TOTAAL*: 150

Copyright reserved/*Kopiereg voorbehou*