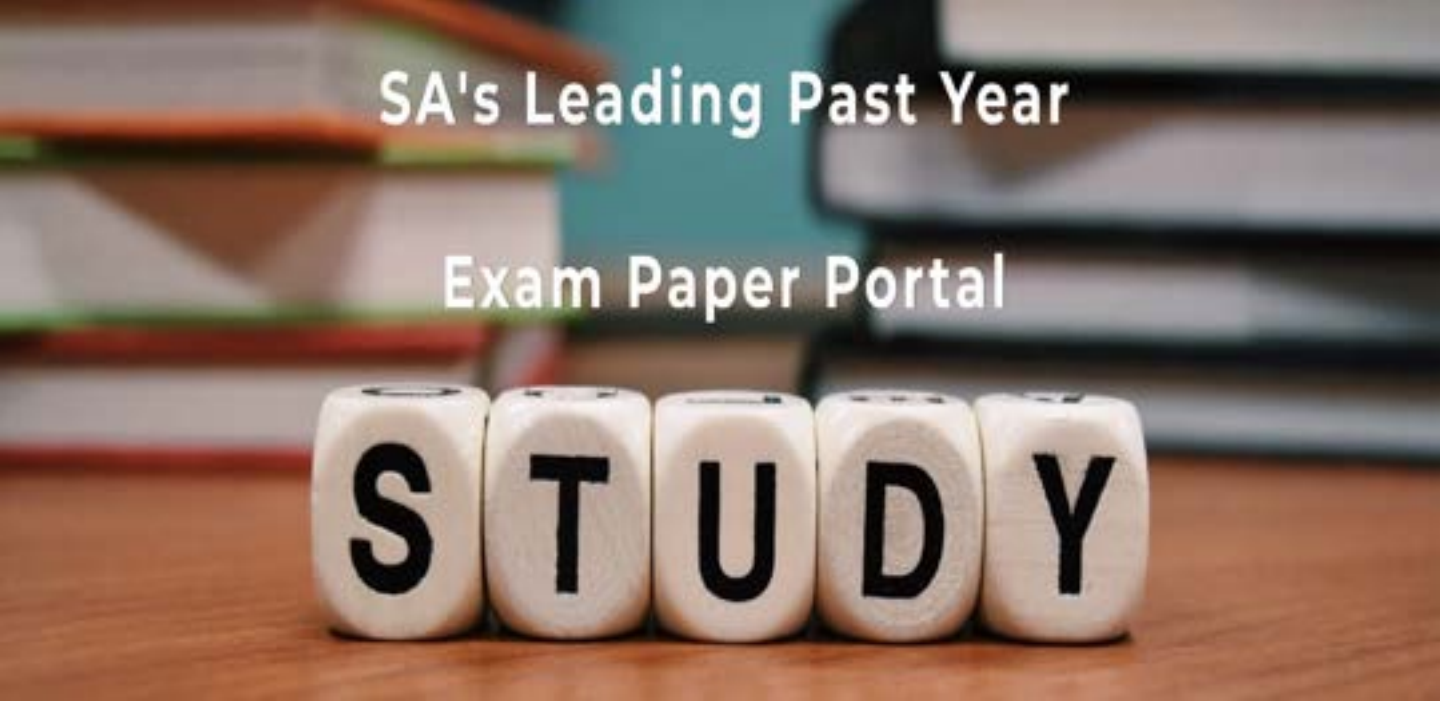

education

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GRADE/GRAAD 12

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

SEPTEMBER 2021

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/ *PUNTE*: 150

These marking guidelines consist of 17 pages including 2 pages with the cognitive grid./ *Hierdie nasienriglyne bestaan uit 17 bladsye* nwat 2 bladsye met die kognitiewe tabel insluit.

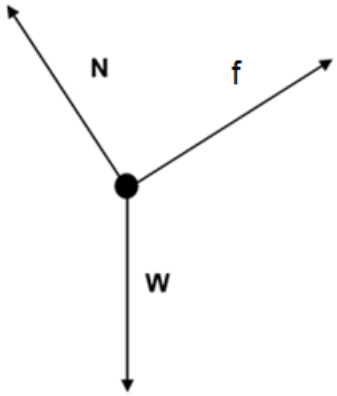
QUESTION 1/VRAAG 1

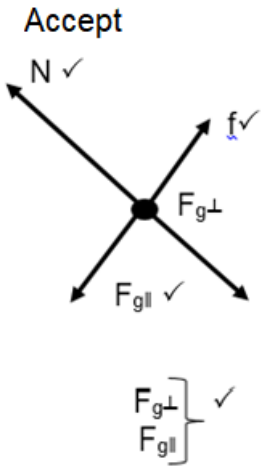
1.1	D	✓✓	(2)
1.2	C	✓✓	(2)
1.3	A	✓✓	(2)
1.4	C	✓✓	(2)
1.5	B	✓✓	(2)
1.6	C	✓✓	(2)
1.7	D	✓✓	(2)
1.8	C	✓✓	(2)
1.9	B	✓✓	(2)
1.10	D	✓✓	(2)
			[20]

QUESTION 2 /VRAAG 2

2.1.1 The force or the component of a force which a surface exerts on an object with which it is in contact, and which is perpendicular to the surface. ✓✓
/Die krag of die komponent van die krag wat `n voorwerp op `n oppervlakte uitoefen waarmee dit in kontak is, en wat loodreg op die oppervlakte is.
2 or/*of 0* (2)

2.1.2





Accept the following symbols	
N ✓	F_N/Normal/Normal force *Normaal/Normaalkrag*
f ✓	F_f/frictional force / *Wrywingskrag*
w ✓	F_g/mg/weight/$F_{earth\ on\ suitcase}$/gravitational force *Gewig/F $_{aarde\ op\ tas}$/gravitasiekrag*

(3)

2.1.3 $F_f = F_{g\parallel}$
$F_f = mg \sin\theta$ ✓Any one / *Enige een*
$F_f = 32 \times 9{,}8 \times \sin 30^\circ$ ✓
$F_f = 156{,}8$ N✓ (3)

2.1.4 $f_s^{max} = \mu_s N$ ✓
$156{,}8 = \mu_s \times 32 \times 9{,}8 \cos 30^\circ$ ✓
$\mu_s = 0{,}58$✓ (3)

2.2.1 **Marking Criteria / Nasien kriteria**

Substitution of / *Substitusie van* $\frac{mg\sin\theta}{mg\cos\theta} = \frac{5}{3}$ ✓

- Any appropriate formula for F_{net} / *Enige aanvaarbare formule vir* F_{net} ✓
- All substitutions into F_{net} for 30 kg / *Alle substitusies in F_{net} vir 30 kg*✓
- All substitutions into F_{net} for 50 kg / *Alle substitusies in F_{net} vir 50 kg* ✓
- Substitutions for 'ma' in any one of the equations / *Substitusies vir 'ma' in enige van die vergelykings*✓
- Final answer / *Finale antwoord* ✓

Note: System approach maximum 4/6 marks
Sisteem benader maksimum 4/6 punte
Accept positive final answer: Range 332,1 N -332,3 N
Aanaar positiewe finale antwoord: Interval 332,1 N -332,3 N

OPTION 1 / *OPSIE 1*

$\frac{mg\sin\theta}{mg\cos\theta} = \frac{5}{3}$ ✓ or/*of* $tan\theta = \frac{y}{x} = \frac{5}{3}$

$\theta = 59{,}04^\circ$

$F_{net} = ma$
$T - Fg_{\parallel} - F_f = ma$ } any one / *enige een* ✓

For 50 kg:
$F_A - Fg_{\parallel} - F_f - T = ma$
$500 - (50 \times 9{,}8 \times \sin 59{,}04^\circ) - F_{f(50)} - T$ ✓ $= 50 \times 2$
$-T = 20{,}19 + F_{f(50)}$ ……..(1)

For 30 kg:
$T - (30 \times 9{,}8 \times \sin 59{,}04^\circ) - F_{f(30)}$ ✓ $= 30 \times 2$
$T = 312{,}11 + F_{f(30)}$……(2)

Any one/*enige een*✓

combine equations (1) and (2) / *kombineer vergelykings (1) en (2)*
$0 = 312{,}11 + F_{f(30)} + 20{,}19 + F_{f(50)}$
$F_{f(30)} + F_{f(50)} = -332{,}3$ N
Total frictional force/ *Totale weerstandskrag* = - 332,3 N✓

OPTION 2 / OPSIE 2

$\frac{mg\sin\theta}{mg\cos\theta} = \frac{5}{3}$ ✓

$\theta = 59{,}04^\circ$

$F_{net} = ma$
$T - Fg_{\parallel} - F_{f\,(30)} = ma$ } Any one / *enige een* ✓

For the 50 kg:
$F_A - Fg_{\parallel} - F_f - T = ma$
$500 - (50 \times 9{,}8 \times \sin 59{,}04^\circ) - F_{f(50)} - T$ ✓ $= 50 \times 2$
$-T = 20{,}19 + F_{f(50)}$ ……..(1)

For the 30 kg:
$T - (30 \times 9{,}8 \times \sin 59{,}04^\circ) - 3/5\, F_{f(50)}$ ✓ $= 30 \times 2$
$T = 312{,}11 + 3/5\, F_{f(50)}$ ……(2)

Any one ✓

combine equations (1) and (2)
$0 = 312{,}11 + 3/5\, F_{f(50)} + 20{,}19 + F_{f(50)}$
$8/5\, F_{f(50)} = -332{,}3$ N
$(F_f)_{50} = -207{,}69$ N
Total frictional force = - 332,3 N / *Totale weerstandskrag* = - 332,3 N ✓ (6)

OPTION 3 / OPSIE 3
System approach / Sisteem benadering

$\frac{mg\sin\theta}{mg\cos\theta} = \frac{5}{3}$ ✓

$\theta = 59{,}04^\circ$

Fnet = ma
$T - F_{g\parallel} - F_{f\,(80)} = ma$ } Any one ✓

$500 - (80)(9{,}8)(\sin 59{,}04) - F_{f\,(80)}$ ✓ $= (80)(2)$ ✓

$500 - 672{,}3 - F_{f\,(80)} = 160$

$F_{f\,(80)} = -332{,}3$ N **Maximum marks/ Maksimum punte 4/6**

2.2.2 **POSITIVE MARKING FROM QUESTION 2.2.1 /**
POSITIEWE NASIEN VANAF 2.2.1

$F_{f(Tot)} = 332{,}3$ N

OPTION 1 / OPSIE 1

$F_{f(50)} = (\frac{5}{8}) - 332{,}3$ N
$F_{f(50)} = -207{,}69$ N
Substitute in equation (1)
Substitusie in vergelyking (1)
$-T = 20{,}19 + F_{f(50)}$
$-T = 20{,}19 + -207{,}69$ ✓
$T = 187{,}5$ N ✓

OPTION 2 / OPSIE 2

$F_{f(30)} = (\frac{3}{8}) - 332{,}3$ N
$F_{f(30} = -124{,}613$ N
Substitute in equation (2)
Substitusie in vergelyking (2)
$T = 312{,}11 + 3/5\ F_{f(30)}$
$T = 312{,}11 + -124{,}613$ ✓
$T = 187{,}5$ N ✓ (2)

[19]

QUESTION 3/ VRAAG 3

3.1 Motion during which the only force acting on an object is the force of gravity.
Beweging waar die enigste krag wat op die voorwerp inwerk gravitadsiekrag is. ✓✓ *2 or/of 0 marks* (2)

3.2 5 $m\cdot s^{-1}$ upwards / *opwaarts* ✓ (1)

3.3 **Marking Criteria / Nasien kriteria**

- Any appropriate formula / *Enige aanvaarbare formule* ✓
- All substitutions to calculate the value of Δy / *Alle substitusies om die waarde van* Δy *te bereken* ✓
- Addition of $60 + \Delta y$ / *Som van* $60 + \Delta y$ ✓
- Final answer / *Finale antwoord* ✓

UPWARDS AS POSITIVE / *OPWAARTS AS POSITIEF*

OPTION 1 / OPSIE 1

$v_f^2 = v_i^2 + 2a\Delta y$ ✓

$(0)^2 = 5^2 + 2(-9,8)\Delta y$ ✓

$\Delta y = 1,28$ m

The ball will reach a maximum height of (60 +1,28) ✓= 61,28 m ✓ above the ground

/Die bal sal `n maksimum hoogte van (60 + 1,28) = 61,28 m bo die grond bereik

DOWNWARDS AS POSITIVE / *AFWAARTS AS POSITIEF*

$v_f^2 = v_i^2 + 2a\Delta y$ ✓

$(0)^2 = -5^2 + 2(9,8)\Delta y$ ✓

$\Delta y = -1,28$ m✓

Height = 1,28 m

The ball will reach a maximum height of (60 +1,28) ✓= 61,28 m ✓ above the ground

/Die bal sal `n maksimum hoogte van (60 + 1,28) = 61,28 m bo die grond bereik

OPTION 2 / OPSIE 2

$v_f = v_i + a\Delta t$

$0 = 5 + (-9,8)\Delta t$

$\Delta t = 0,51$ s

$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$

Any one / *Enige een*✓

$(\frac{5+0}{2})\ 0,51$✓

$= 1,28$ m

The ball will reach a maximum height of (60 +1,28) ✓ = 61,28 m ✓above the ground

Die bal sal `n maksimum hoogte van (60 + 1,28) = 61,28 m bo die grond bereik

OPTION 3 / OPSIE 3

$v_f = v_i + a\Delta t$

$0 = 5 + (-9,8)\Delta t$

$\Delta t = 0,51$ s

$\Delta y = v_i\Delta t + ½\ a\Delta t^2$

Any one / *Enige een* ✓

$\Delta y = 5 \times 0,51 + ½\ (-9,8 \times 0,51^2)$ ✓

$= 1,28$ m

The ball will reach a maximum height of (60 +1,28) = 61,28 m ✓ above the ground

Die bal sal `n maksimum hoogte van (60 + 1,28) = 61,28 m bo die grond bereik (4)

3.4 **OPTION 1 / OPSIE 1**

The hot- air balloon moved upwards at a constant velocity.
/Die warmlugballon het opwaarts beweeg teen `n konstante snelheid.

$\Delta y = v_i\Delta t + ½ a\Delta t^2$ ✓

$\Delta y = (5)(3) + 0$ ✓

$\Delta y = 15$ m

After 3 s the hot- air balloon will be 15 m above the starting point.
/Na 3 s sal die warmlugballon 15 m bo die beginpunt wees.

The distance travelled by the ball after 3s / *Afstand deur bal beweeg na 3s.*

$\Delta y = v_i\Delta t + ½ a\Delta t^2$

$\Delta y = (5)(3) + ½ (-9,8) (3)^2$ ✓

$\Delta y = -29,1$ m ✓

The ball is 29,1 m below the point from where it was released.

After 3 s the hot air balloon and the ball will be (15 + 29,1) ✓= 44,1 m ✓apart
/ Die bal is 29,1 m onder die punt vanwaar dit laat val is. Na 3s sal die bal en die warmlugballon (15 + 29,1) = 44,1 m van mekaar wees.

OPTION 2 / OPSIE 2

$V_{ave} = \frac{\Delta y}{\Delta t}$ ✓

$\Delta y = (5)(3)$ ✓

15 m

$v_f = v_i + a\Delta t$

$= 5 + (-9,8)(3)$

$= -24,4\ m\cdot s^{-1}$

$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$

$= (\frac{-24,4 + 5}{2})(3)$✓

$= -29,1$ m✓

The ball is 29,1 m below the point from where it was released.

After 3 s the hot air balloon and the ball will be (15 + 29,1) ✓= 44,1 m ✓apart
/ Die bal is 29,1 m onder die punt vanwaar dit laat val is. Na 3s sal die bal en die warmlugballon (15 + 29,1) = 44,1 m van mekaar wees. (6)

3.5 ANY ONE

Some of the ball's kinetic energy is converted into heat and sound energy.
/ Sommige van die energie van die bal word omgeskakel in hitte en klank energie. ✓✓

OR/OF

The collision between the ball and the ground is inelastic. ✓✓
/ Die botsing tussen die bal en die grond is onelasties (2)

[15]

QUESTION 4 / VRAAG 4

4.1 The total linear momentum of an isolated system is conserved both in magnitude and direction✓✓ (2)
Die totale liniêre momentum van `n geslote sisteem bly behoue in grootte en rigting. **(2 or/*of* 0)**

4.2 $\Sigma P_{before} = \Sigma P_{after}$ ✓
$\underline{(15)(V_R) + 0 = (15 + 13,5)(4,4)}$✓
$V_R = 8,36\ m\cdot s^{-1}$.✓ (3)

4.3

OPTION 1 / OPSIE 1	**OPTION 2 / OPSIE 2**
$v_f = v_i + a\Delta t$ ✓ $0 = 4,4 + (a)(3)$✓ $a = -1,47\ m\cdot s^{-2}$ $F_f = F_{net} = ma$ $F_f = \underline{(15 + 13,5)(-1,47)}$✓ $F_f = 41,9\ N$ ✓ Accept – 41,9 N	$F_{net}\Delta t = \Delta P = m(v_f - v_i)$✓ $F_{net}(3)$ ✓$= 28,5(0-4,4)$ ✓ $F_{net} = F_f$ $F_{net} = -41,8\ N$ $F_f = 41,8\ N$✓ Accept – 41,8 N

(4)

[9]

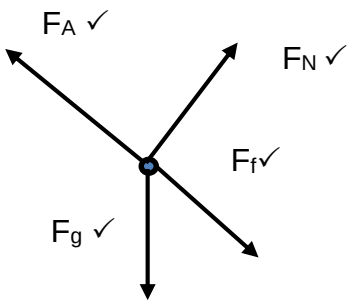
QUESTION 5 / VRAAG 5

5.1 The net/total work done on an object is equal to the change in the object's kinetic energy. ✓✓
/ Die netto werk verrig op `n voorwerp is gelyk aan sy verandering in kinetiese energie.

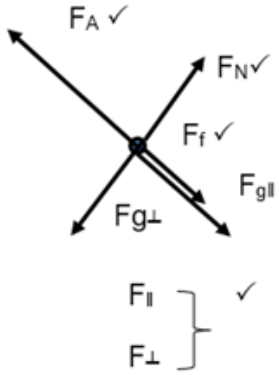
OR

The work done on an object by a resultant/net force is equal to the change in the objects kinetic energy. ✓✓
/ Die werk verrig op `n voorwerp deur `n netto/resultante krag is gelyk aan sy verandering in kinetiese energie. (2)

5.2



Accept



Accept the following symbols / Aanvaar die volgende simbole	
F_A ✓	Applied Force /Force by engine/ *Toegepaste krag/krag van engin*
N ✓	F_N/Normal/Normal force / Normaal / *Normaalkrag*
f ✓	F_f/frictional force / *Wrywingskrag*
w ✓	F_g/mg/weight/$F_{earth\ on\ car}$/gravitational force *Gewig/F $_{aarde\ op\ tas}$/gravitasiekrag*

(4)

5.3 **<u>OPTION 1 / OPSIE 1</u>**

<u>Marking Criteria for Option 1</u>

- Any appropriate formula / *Enige aanvaarbare formule* ✓
- Substitution of 0,1 in equation of W_{net} ✓ / *Substitusie van 0,1 in vergelyking van W_{net}* ✓
- All substitutions to calculate W_{net} ✓ / *Alle substitusies om W_{net} te bereken*✓
- Substituting $W_{net} = 0$ ✓ / *Vervanging van $W_{net} = 0$* ✓
- Calculation of the power required ✓/ *Berekenig van die drywing benodig*✓
- Calculation of the power of the engine ✓ / *Berekening van die drywing van die motor*✓
- Stating the car has enough power ✓ / *Staaf dat die motor genoeg drywing het*✓

$W_{net} = \Delta K$
$W_{g\parallel} + W_{Ff} + W_{FA} = \Delta K$
$mg \sin\theta\ \Delta x \cos\theta + F_f\ \Delta x \cos\theta + F_A\ \Delta x \cos\theta = \Delta K$
} Any one / *Enige een*✓

W_{net} = <u>(1200) (9,8) (0,1) ✓(100) (cos180°) + (820)(100)(cos180°) +</u>
<u>+ F_A (100)(cos0°)</u> ✓= 0 ✓

F_A = 1996 N upward /*opwaarts*

Power = F_A v

. $P_{required}$ = (1996)(6) ✓
= 11976 W
=11,976 kW

$\sin\theta = 10/100$ $\sin\theta = 0,1$ Fnet = Fg∥ + Ff + FA Fg∥ = mg sinθ

Accept range P/ *Aanvaar interval van* = 11,972 kW to 11,977 kW

Real power of the engine / *Werklike drywing van die motor* = $(62)(\frac{83}{100})$ ✓

P_{Engine} = 51,460 kW

or

P_{Engine} = 51460 W

$P_{Engine} > P_{required}$ The car has enough power✓ / *Die motor het genoegsame drywing*

<u>OPTION 2</u>

<u>Marking Criteria for Option 1</u>

- Any appropriate formula ✓
- Substitution of 0,1 in equation of ΔK ✓
- All substitutions to calculate ΔK ✓
- Substituting $\Delta K = 0$ ✓
- Calculation of the power required ✓
- Calculation of the power of the engine ✓
- Stating the car has enough power ✓
- *Enige aanvaarbare formule* ✓
- *Substitusie van 0,1 in vergelyking* ΔK ✓
- *Alle substitusies om* ΔK *te bereken*✓
- *Vervanging van* $\Delta K = 0$ ✓
- *Berekenig van die drywing benodig*✓
- *Berekening van die drywing van die motor*✓
- *Staaf dat die motor genoeg drywing het*✓

$W_{net} = \Delta K$

$W_{gll} + W_{Ff} + W_{FA} = \Delta K$ Any one / Enige een✓

$mg \sin\theta\ \Delta x \cos\theta + F_f\ \Delta x \cos\theta + W_{FA} = \Delta K$

$\underline{(1200)(9,8)(0,1)\ ✓(100)(\cos 180^\circ) + (820)(100)(\cos 180^\circ + W_{FA}}$ ✓ = 0✓

W_{FA} = 199600 J

$v = \frac{\Delta x}{\Delta t}$

$6 = \frac{100}{\Delta t}$

Δt = 16,67 s

$P = \frac{W}{\Delta t}$

$P_{required} = \frac{199600}{16,67}$ ✓

P = 11973,61 W

Accept range P = 11972 W-11977 W

Aanvaarbare interval P = 11972 W-11977 W

$P_{required}$ = 11,974 kW

Real power of the engine/*Werklike drywing van motor* = $(62000)\left(\frac{83}{100}\right)$ ✓

P_{Engine} = 51460 W

P_{Engine} = 51,460 kW

$P_{Engine} > P_{required}$
The car has enough power
/Die motor het genoeg drywing✓ (7)

[13]

QUESTION 6 / VRAAG 6

6.1 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 die frekwensie (toonhoogte) van die waargenome klank deur die luisteraar agv die klankbron en die luisteraar wat verskillende snelhede realtief tot mekaar het. (2)

6.2

OPTION 1 / OPSIE 1	**OPTION 2 / OPSIE 2**
$f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ ✓	$f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ ✓
910✓ = $\frac{(340+v_L)}{(340-0)}$ $\frac{850}{}$ ✓ ✓	790✓ = $\frac{(340-v_L)}{(340+0)}$ $\frac{850}{}$ ✓ ✓
$v_L = 24\ m{\cdot}s^{-1}$ ✓	$v_L = 24\ m{\cdot}s^{-1}$ ✓

(5)

6.3

OPTION 1/ OPSIE 1	**OPTION 2 / OPSIE 2**
$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$ ✓	$\Delta x = v\ \Delta t$ ✓
$\Delta x = (24)(6) + ½ \times 0 \times 6^2$✓	$\Delta x = 24 \times 6$ ✓
$\Delta x = 144\ m$ ✓	$\Delta x = 144\ m$ ✓

(3)

[10]

QUESTION 7 / VRAAG 7

7.1.1 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 their charges✓ and inversely proportional to the square of the distance (r) between them ✓
/ Die grootte van die elektrostatiese krag wat deur een puntlading (Q_1) op 'n ander puntlading (Q_2) uitgeoefen word, is direk eweredig aan die produk van die grootte van die ladings en omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle (2)

7.1.2	**OPTION 1** **Before contact/*Voor kontak*** $F = \frac{kQ_1Q_2}{r^2}$ ✓ $F = \frac{k(q)\ (3q)}{d^2}$ ✓ $F = 3\frac{kq^2}{d^2}$ **After contact/*Na kontak*** New Charge $q_{new} = \frac{Q_1 + Q_2}{2}$ $= \frac{-q + 3q}{2}$ $= q$ ✓ $F_{new} = \frac{kqq}{d^2}$ $= \frac{kq^2}{d^2}$ ✓ $F_{new} = \frac{F}{3}$ ✓	**OPTION 2** $F = \frac{kQ_1Q_2}{r^2}$ ✓ $F = \frac{k\ q \times 3q}{d^2}$ ✓ $= \frac{3\ k\ q^2}{d^2}$ ✓ $F\ new = \frac{kQ_1Q_2}{r^2}$ $= \frac{kq^2}{d^2}$ ✓ $F_{new} = \frac{F}{3}$ ✓	(5)

7.2.1

$E = \frac{kQ}{r^2}$ ✓

'E' at 'X' due to Q_1

$E = \frac{(9{,}0 \times 10^9)\ (6 \times 10^{-9})}{2^2}$ ✓

$= 13{,}5\ N{\cdot}C^{-1}$ to the left/*na links*

'E' at x due to Q_2

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

$E = \frac{(9{,}0 \times 10^9)\ (8 \times 10^{-9})}{1^2}$ ✓

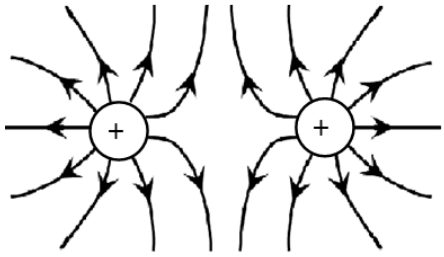
$= 72{,}0\ N{\cdot}C^{-1}$ to the right/*na regs*

Net electric field at X / *Netto elektrieseveld by X* $= 72{,}0 - 13{,}5 = 58{,}5\ N{\cdot}C^{-1}$ ✓ (4)

[11]

QUESTION 8 / VRAAG 8

8.1



Guideline for allocating marks/*Riglyne vir toekenning van punte*
Arrows point outwards *Pyle uitwaarts gerig*
Correct shape *Korrekte vorm*

(2)

8.2 $E = F/Q$ ✓
$E = (3{,}23 \times 10^{-5})/(4{,}8 \times 10^{-9})$ ✓
$E = 6729{,}17\ N.C^{-1}$ ✓ (3)

8.3 **<u>OPTION 1 OPSIE 1</u>**

$F = \frac{kQ_1Q_2}{r^2}$ ✓

$3{,}23 \times 10^{-5} = \frac{(9 \times 10^9 \times 4{,}8 \times 10^{-9} \times 4{,}8 \times 10^{-9})}{r^2}$ ✓

$r = 0{,}08\ m$ ✓

<u>OPTION 2: POSITIVE MARKING FROM QUESTION 8.2</u>
<u>OPSIE 2: POSITIEWE NASIEN VANAF VRAAG 8.2</u>

$E = \frac{kQ}{r^2}$ ✓

$6729{,}17 = \frac{9 \times 10^9 \times 4{,}8 \times 10^{-9}}{r^2}$ ✓

$r = 0{,}08\ m$ ✓ (3)

[8]

QUESTION 9 / VRAAG 9

9.1.1 $V = IR_T$ ✓
$14 = 1{,}4 \times R_T$ ✓
$R_T = 10\ \Omega$ ✓ (3)

9.1.2 **POSITIVE MARKING FROM QUESTION 9.1.1**
<u>POSITIEWE NASIEN VANAF VRAAG 9.1.1</u>
$R_T = (R_{ext} + r)$ ✓
$10 = (6+3{,}6) + (r)$ ✓
$r = 0{,}4\ \Omega$ ✓ (3)

9.1.3 $W = I^2R\Delta t$ ✓
$W = 1,4^2 \times 6 \times 3 \times 60$ ✓
$= 2116,8$ J✓ (3)

9.2

$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + ...$ $\frac{1}{R_p} = \frac{1}{8} + \frac{1}{6}$ ✓ $R_p = 3,43\ \Omega$ emf (ε) = I(R + r) ✓ /*emk* (ε) = *I(R + r)* 14 = I(3,43 + 3,6 + 0,4) ✓ I = 1,88 A	**OPTION 1** V = IR $V_p = 1,88 \times 3,43$ ✓ = 6,46 V $I_{8\Omega} = \frac{6,45}{8}$ ✓ = 0,81 A✓ **OPTION 2** $I_{8\Omega} = \frac{6 \times 1,88}{14}$ ✓ ✓ = 0,81 A ✓ (6)

9.3 Increases ✓/ energy transfer from the battery increases. ✓
Toeneem ✓/ energie oorgedra van die battery neem toe. ✓
OR / OF
External resistance decreases because the parallel combination is eliminated by the short circuit.
Die eksterne weerstand neem af omdat die paralelle kombinasie uitgesluit word duer die kortsluiting. (2)
[17]

QUESTION 10 / VRAAG 10

10.1.1 AC generator/*WS generator*✓ (1)

10.1.2 Q- Carbon brush / *Koolstofborseltjies*✓
R- Slip ring / *Sleepring*✓ (2)

10.2.1 Graph A represents direct current. ✓
Grafiek A verteenwoordig gelykstoom
Graph B represents alternating current. ✓
Grafiek B verteenwoordig wisselstroom (2)

10.2.2 $f = \frac{\text{no of ocillations}}{\text{time}} / \frac{\text{aantal ossilasies}}{\text{tyd}}$
= 1,5/0,03✓
= 50 Hz✓ (2)

10.3.1 $V_{rms} = \frac{V_{max}}{\sqrt{2}}$ ✓
$200 = \frac{V_{max}}{\sqrt{2}}$ ✓
$V_{max} = 282,84$ V ✓ (3)

10.3.2 $V_{rms} = I_{rms} \times R$✓
$200 = I_{rms} \times 10$✓
$I_{rms} = 20$ A✓ (3)

10.3.3 **OPTION 1 / OPSIE 1**

$P_{ave} = I_{rms}V_{rms}$ ✓
$= 20 \times 200$ ✓
$= 4000$ W ✓

OPTION 2 / OPSIE 2

$P_{ave} = \frac{V_{rms}^2}{R}$ ✓
$= \frac{200^2}{10}$ ✓
$= 4000$ W ✓

OPTION 3 / OPSIE 3

$P_{ave} = I_{rms}^2 R$ ✓
$=(20)^2(10)$ ✓
$= 4000$ W ✓

(3)
[16]

QUESTION 11 / VRAAG 11

11.1 The work function of a metal is the minimum energy that an electron needs to be emitted from the metal surface ✓✓ **2 or 0**/
Die werksfunksie van `n metaal is die minimum hoeveelheid energie benodig om elektrone uit die oppervlakte van die metaal vry te stel ✓✓ **2 or 0** (2)

11.2.1 $c = f\lambda$
$3 \times 10^8 = f\,(200 \times 10^{-9})$ ✓
$f = 1{,}5 \times 10^{15}$ Hz ✓ (2)

11.2.2 $W_o = hf_0$ ✓
$2{,}3 \times 10^{-19} = 6{,}63 \times 10^{-34} \times f_0$ ✓
$f_0 = 3{,}47 \times 10^{14}$ Hz ✓ (3)

11.2.3 **POSITIVE MARKING FROM QUESTION 11.2.1 /*POSITIEWE NASEIN VANAF 11.2.1***
$E = W_o + E_{k(max)}$ ✓
$\underline{(6{,}63 \times 10^{-34})\,(1{,}5 \times 10^{15})}$ ✓ $= \underline{(2{,}3 \times 10^{-19}) + E_k}$ ✓
$E_k = 7{,}65 \times 10^{-19}$ J ✓ (4)

11.3 Decrease/*Verminder* ✓ (1)
[12]

TOTAL/*TOTAAL*: 150

GRADE 12: PHYSICAL SCIENCES P1

ANALYSIS GRID SEPTEMBER: 2021

		Knowledge,Recall,Low demand			Comprehension,Basic questions			Application,Analysis,Problem solving			Synthesis,Evaluation,Higher abilities,Hard new problems			TOTAL	Mechanics ≈ 63Marks	Waves,Sound & Light ≈ 17 Marks	Electricity & Magnetism ≈ 55 Marks	Matter & Materials ≈ 15 Marks	Total Marks	Question Total
	Content	**E**	**M**	**D**	**E**	**M**	**D**	**E**	**M**	**D**	**E**	**M**	**D**							
1.1	Friction				2									2	2				2	
1.2	Energy		2											2	2				2	
1.3	Mechanical Energy	2												2	2				2	
1.4	Net force					2								2	2				2	
1.5	Net charge							2						2		2			2	
1.6	Power												2	2			2		2	
1.7	emf	2												2			2		2	
1.8	Motor				2									2			2		2	
1.9	Red shift					2								2	2				2	
1.10	Work function					2								2				2	2	20
2.1.1	Normal force	2												2	2				2	
2.1.2	Free body diagram				3									3	3				3	
2.1.3	Force of friction							3						3	3				3	
2.1.4	Static friction								3					3	3				3	
2.2.1	Frictional force												6	6	6				6	
2.2.2	Tension					2								2	2				2	19
3.1	Free fall	2												2	2				2	
3.2	Velocity					1								2	1				1	
3.3	Maximum height								4					1	4				4	
3.4	Vertical projectile									6				4	6				6	
3.5	Displacement					2								6	2				2	15
4.1	Momentum	2												2	2				2	
4.2	Velocity								3					3	3				3	
4.3	Force of friction								4					4	4				4	9
5.1	Work-energy theorem		2											2	2				2	
5.2	Free body diagram					4								4	4				4	
5.3	Power												7	7	7				7	13
6.1	Doppler effect		2											2		2			2	
6.2	Speed						5							5		5			5	
6.3	Distance								3					3		3			3	10
7.1	Coulomb,s law	2												2			2		2	

7.2	Electrostatic force									5				5			5		5	
7.3	Electric field strength									4				4			4		4	11
8.1	Electric field pattern					2								2			2		2	
8.2	Electric field strength							3						3			3		3	
8.3	Distance								3					3			3		3	8
9.1.1	Resistance							3						3			3		3	
9.1.2	Internal resistance							3						3			3		3	
9.1.3	Energy							3						3			3		3	
9.2	Current								6					6			6		6	
9.3	Resistance					2								2			2		2	17
10.1.1	Generator	1												1			1		1	
10.1.2	Generator		2											2			2		2	
10.2.1	Type of current				2									2			2		2	
10.2.2	Frequency					2								2			2		2	
10.3.1	Peak voltage						3							3			3		3	
10.3.2	rms current									3				3			3		3	
10.3.3	Power								3					3			3		3	16
11.1	Work function	2												2				2	2	
11.2.1	Frequency							2						2				2	2	
11.2.2	Threshold frequency						3							3				3	3	
11.2.3	Kinetic energy									4				4				4	4	
11.3	Intensity						1							1				1	1	12
		15	8	0	9	21	12	19	29	22	0	0	15	150	66	12	58	14	150	150
Actual marks		23			42			70			15				64	15	57	14	150	
Actual %		15,3			28,0			46,7			10,0				43	10	38	9	100	
Prescibed Marks		22,5			52,5			60			15			150	63	17	55	15	150	
Prescibed %		15			35			40			10			100	42	11	36,6	10	100	

Overall	E	M	D
Prescribed Marks	**45**	**60**	**45**
Actual Marks	43	58	49
Prescribed %	30	40	30
Actual %	29	39	33