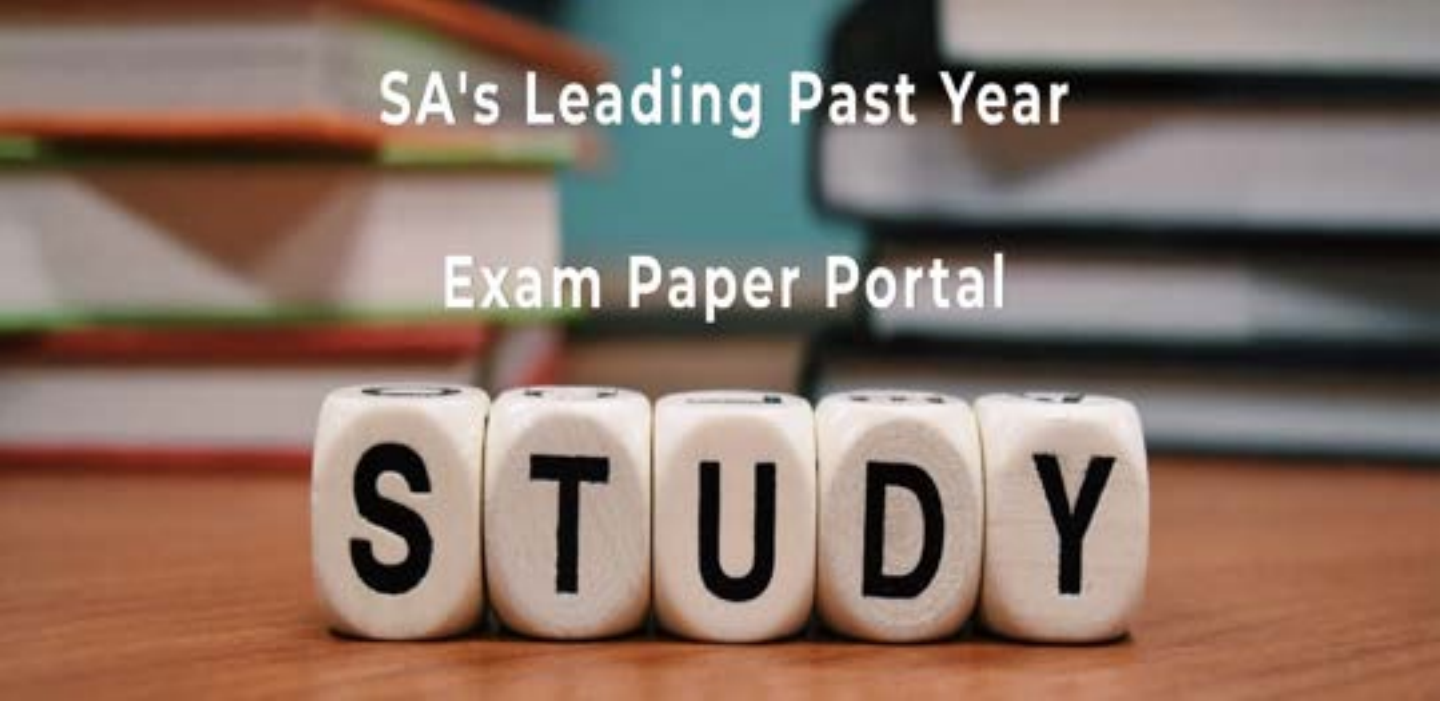


education

Department of Education
FREE STATE PROVINCE

PREPARATORY EXAMINATION
VOORBEREIDENDE EKSAMEN

GRADE/*GRAAD* 12

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

SEPTEMBER 2021

MARKS/*PUNTE*: 150

MARKING GUIDELINES
NASIENRIGLYNE

This marking guidelines consists of 17 pages.
***Hierdie nasienriglyne bestaan uit 17 bladsye*.**

QUESTION/*VRAAG 1*

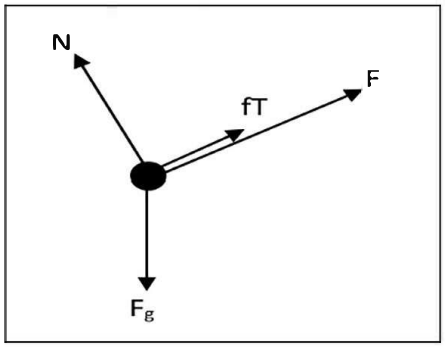
1.1	B ✓✓	(2)
1.2	D ✓✓	(2)
1.3	C ✓✓	(2)
1.4	A ✓✓	(2)
1.5	A ✓✓	(2)
1.6	A ✓✓	(2)
1.7	C ✓✓	(2)
1.8	A ✓✓	(2)
1.9	B ✓✓	(2)
1.10	A ✓✓	(2)
		[20]

QUESTION/*VRAAG 2*

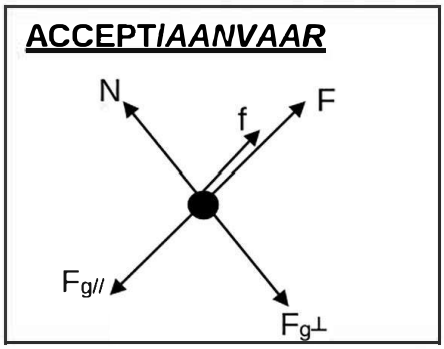
Marking criteria/*Nasienkriteria:*
If any of the underlined key words/phrases in the correct context are omitted:
- 1 mark per word/phrase
As een van die onderstreepte sleutelwoorde/frases in die regte konteks weggelaat word:
- 1 punt per woord/frase

2.1 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 'n krag wat 'n oppervlak op 'n voorwerp uitoefen waarmee dit in kontak is, en wat loodreg op die oppervlak is. (2)

2.2



ACCEPT/*AANVAAR*



Accept the following symbols/*Aanvaar die volgende simbole*		
F	$F_{applied}$ / Force applied / F_A *$F_{toegepas}$ / Krag toegepas* / F_A	✓
F_g	w / F_w / weight / *gewig*	✓
N	F_N / Normal / Normal force *F_N / Normaal / Normaalkrag*	✓
f	F_f / f_k / friction / frictional force/kinetic frictional force F_f / f_k / wrywing / *wrywingskrag / kinetiese wrywingskrag*	✓

NOTE/LET WEL:
- Mark awarded for label and arrow/*Punt toegeken vir byskrif en pyl*
- Do not penalise for length of arrow since drawing is not to scale. *Moenie penaliseer vir die lengte van die pyl nie, want die tekening is nie volgens skaal nie.*
- Any additional force(s)/*Enige bykomende krag(te)* $\frac{3}{4}$
- If force(s) do not make contact with body/*As krag(te) nie kontak met liggaam maak nie* $\frac{3}{4}$
- No labels/*Geen byskrifte* $\frac{0}{4}$

2.3

Marking criteria / Nasienkriteria:

- Showing $F_{net/netto} = 0$✓
-
- Substitution of first term°✓
- Substitution of *second term*
- Final answer of / *Finale antwoord van* 157,48 N✓
  Range (152,98N to/*tot* 157,45N)

OPTION / *OPSIE 1:*

Downwards as positive/Afwaarts positief:

$$\left.\begin{array}{l} F_{net} = ma \text{ or } F_{net} = 0 \\ -F - f_k + F_{g//} = 0 \\ -F - \mu_k mg\cos\theta + mg\sin\theta = 0 \end{array}\right\} \text{Any } ✓$$

$-F - \underline{0{,}289 \times (100 \times 9{,}8\cos 25°)}$✓ + $\underline{(100 \times 9{,}8)\sin 25°}$✓ $= 0$ ✓

$F = 157{,}48$ N✓

Downwards as negative / *Afwaarts positief*

$$\left.\begin{array}{l} F_{net} = ma \text{ or } F_{net} = 0 \\ F + f_k - F_{g//} = 0 \\ F + \mu_k mg\cos\theta - mg\sin\theta = 0 \end{array}\right\}$$

$\underline{F + 0{,}289 \times (100 \times 9{,}8\cos 25°)}$✓ - $\underline{(100 \times 9{,}8)\sin 25°}$✓ $= 0$ ✓

$F = 157{,}48$ N✓ (5)

2.4 Perpendicular force tha the water tank exerts on the surface.✓
Loodreg krag wat die watertenk op die oppervlak uitgeoefen.

ACCEPT/*AANVAAR*

$mg\cos\theta$ (1)

[12]

QUESTION/*VRAAG* 3

3.1 An object upon which the only force acting is the force of gravity (2 or 0) ✓✓
'n Voorwerp waarop die enigste krag wat daarop inwerk, swaartekrag is. (2)

3.2.1

Marking criteria / Nasinkriteria:
Appropriate formula / *Toepaslike formule* ✓
Substitution of / *Vervanging van* 3,28 & 35 ✓
Final answer of / *Finale antwoord van* 26,396 m^{-1} ✓
Range (26,397 to 26,41)

Downwards as positive/ *Afwaarts positief*	**Upwards as positive/ *Opwaarts posiitief***
OPTION 1/*OPSIE 1*	
$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $= (3,28)^2 + 2(9,8)(35)$ ✓ $v_f = 26,396\ m \cdot s^{-1}$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $= (3,28)^2 + 2(9,8)(35)$ ✓ $v_f = 26,396\ m \cdot s^{-1}$ ✓
OPTION 2/ OPSIE 2	
$v_f = v_i + a\Delta t$ ✓ $= 3,28 + (9,8)(2,359)$ ✓ $v_f = 26,398\ m \cdot s^{-1}$ ✓	$v_f = v_i + a\Delta t$ ✓ $= -3,28 + (-9,8)(2,359)$ ✓ $v_f = 26,398\ m \cdot s^{-1}$ ✓
OPTION 3/ *OPSIE 3*	
$\Delta y = \left(\frac{v_f + v_i}{2}\right)\Delta t$ ✓ $35 = \left(\frac{v_f + 3,28}{2}\right)(2,359)$ ✓ $v_f = 26,398\ m \cdot s^{-1}$ ✓	$\Delta y = \left(\frac{v_f + v_i}{2}\right)\Delta t$ ✓ $35 = \left(\frac{v_f + 3,28}{2}\right)(2,359)$ ✓ $v_f = 26,398\ m \cdot s^{-1}$ ✓

(3)

3.2.2 **POSITIVE MARKING FROM QUESTION 3.2.1 / *POSITIEWE NASIEN ANAF 3.2.1***

Downwards as positive/ *Afwaarts positief*	**Upwards as positive/ *Opwaarts posiitief***
OPTION 1/*OPSIE 1* $v_f = v_i + a\Delta t$ ✓ $26{,}396 = 3{,}28 + (9{,}8)\Delta t$ ✓ $\Delta t = 2{,}359\ s$ ✓	$v_f = v_i + a\Delta t$ ✓ $-26{,}396 = 3{,}28 + (-9{,}8)\Delta t$ ✓ $\Delta t = 2{,}359\ s$ ✓
OPTION 2/*OPSIE 2* $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $35 = 3{,}28\Delta t + \frac{1}{2}(9{,}8)\Delta t^2$ ✓ $\Delta t = 2{,}359\ s$ ✓	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $-35 = -3{,}28\Delta t + \frac{1}{2}(-9{,}8)\Delta t^2$ ✓ $\Delta t = 2{,}359\ s$ ✓
OPTION 3/*OPSIE 3* $\Delta y = \left(\frac{v_f + v_i}{2}\right)\Delta t$ ✓ $35 = \left(\frac{26{,}396 + 3{,}28}{2}\right)\Delta t$ ✓ $\Delta t = 2{,}359\ s$ ✓	**OPTION 3/*OPSIE 3*** $\Delta y = \left(\frac{v_f + v_i}{2}\right)\Delta t$ ✓ $35 = \left(\frac{-26{,}396 + (-3{,}28)}{2}\right)\Delta t$ ✓ $\Delta t = 2{,}359\ s$ ✓

(3)

3.2.3 **Calculate velocity at t_2/ *Bereken snelheid by* t_2**

$t_2 = \underline{2{,}359 + 0{,}1}$ ✓
$= 2{,}459$ s

Time to max(**x**) = $\underline{3{,}86 - 2{,}459}$ ✓
$= 1{,}40$ s

$v_f = v_i + a\Delta t$ ✓

$\underline{0 = v_i + 9{,}8(1{,}40)}$ ✓

$v_i = -13{,}73\ m \cdot s^{-1}$

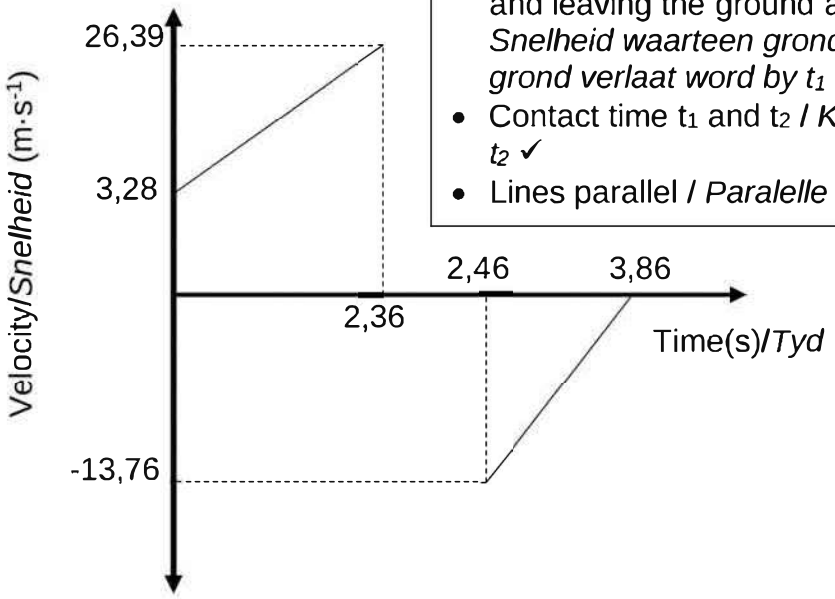
Downward as positive / *Afwaarts positief*	**Upward as positive / *Opwaarts positief***
OPTION 1/ *OPSIE 1* $v_f^2 = v_1^2 + 2a\Delta y$ ✓ $\underline{0 = (-13{,}73)^2 + 2(9{,}8)\Delta y}$ ✓ $\Delta y = -9{,}62$ m $\therefore$ Height / *Hoogte* = 9,62 m ✓	$v_f^2 = v_1^2 + 2a\Delta y$ ✓ $\underline{0 = (13{,}73)^2 + 2(-9{,}8)\Delta y}$ ✓ $\Delta y = 9{,}62$ m $\therefore$ Height / *Hoogte* = 9,62 m ✓
OPTION 2/ *OPSIE 2* $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $\underline{= (-13{,}73)(1{,}4) + \frac{1}{2}(9{,}8)(1{,}4)^2}$ ✓ $\Delta y = -9{,}62$ m $\therefore$ Height / *Hoogte* = 9,62 m ✓	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $\underline{= (13{,}73)(1{,}4) + \frac{1}{2}(-9{,}8)(1{,}4)^2}$ ✓ $\Delta y = 9{,}62$ m $\therefore$ Height / *Hoogte* = 9,62 m ✓
OPTION 3/ *OPSIE 3* $\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓ $\underline{= \left(\frac{(0 + (-13{,}73))}{2}\right)(1{,}4)}$ ✓ $\Delta y = -9{,}62$ m $\therefore$ Height / *Hoogte* = 9,62 m ✓	$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ ✓ $\underline{= \left(\frac{(0 + (-13{,}73))}{2}\right)(1{,}4)}$ ✓ $\Delta y = -9{,}62$ m $\therefore$ Height / *Hoogte* = 9,62 m ✓

(7)

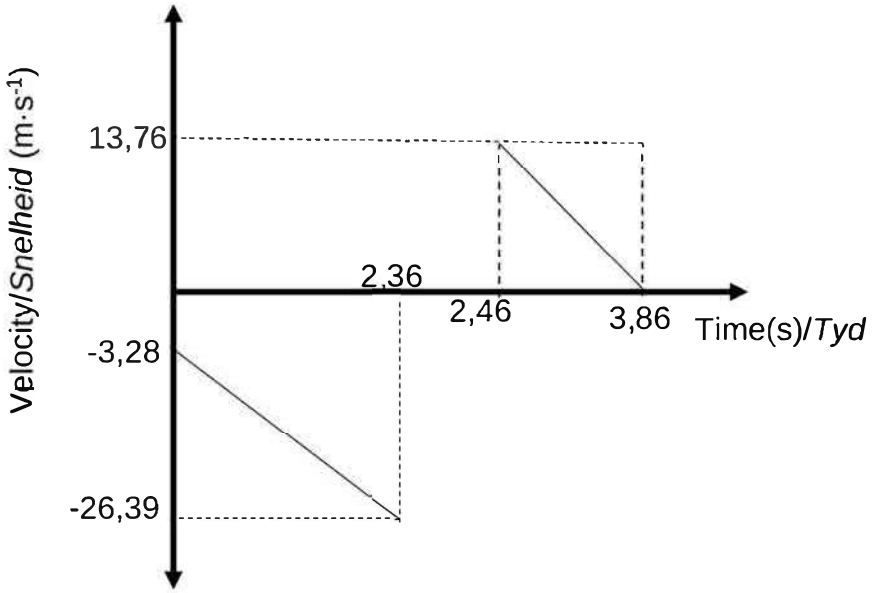
3.3 **POSITIVE MARKING OF QUESTION 3.2.1 AND 3.3.2 / *POSITIEWE NASIEN VAN 3.2.1 EN 3.2.2***

OPTION 1: Downward Positive
OPSIE 1: Afwaarts Positief

Marking criteria / *Nasienkriteria:*
- Velocity striking the ground and leaving the ground at t_1 and t_2.✓ *Snelheid waarteen grond getref en grond verlaat word by t_1 en t_2*
- Contact time t_1 and t_2 / *Kontaktyd t_1 en t_2* ✓
- Lines parallel / *Paralelle lyne* ✓



OPTION 2: Upwards positive
OPSIE 2: Opwaarts positief



(3)
[18]

QUESTION/*VRAAG* 4

4.1 The resultant/net force acting on an object is equal to the rate of change of momentum of the object in the direction of the net/resultant force. ✓✓ **(2 or 0)**
Die resulterende/netto krag wat op 'n voorwerp inwerk is gelyk aan die tempo van verandering van momentum van die voorwerp in die rigting van die netto/resulterende krag. ***(2 of 0)*** *(2)*

4.2.1

OPTION 1 / *OPSIE 1*

Motion to the east (+) / *Beweging na* ops (+)

$$\Sigma p_f = \Sigma p_i$$ Any/*Enige* ✓

$$m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$$ ✓

$$1085(+33) + 3450(-28) = 1085(-5) + 3450v_{2f}$$

$$v_{2f} = -16{,}05$$ ✓

$$= 16{,}05\ m \cdot s^{-1}$$ west / forward ✓ *wes / voorwaarts*

OPTION 2/ *OPSIE 2*

Motion to the east (-) / *Beweging na* oos (-)

$$\Sigma p_f = \Sigma p_i$$

$$m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$$ Any/*Enige* ✓

$$1085(-33) + 3450(+28) = 1085(+5) + 3450v_{2f}$$ ✓✓

$$v_{2f} = +16{,}05$$

$$= 16{,}05\ m \cdot s^{-1}$$ ✓ west / forward ✓ *wes / voorwaarts*

(5)

4.2.2 **POSITIVE MARKING FROM QUESTION 4.2.1/ *POSITIEWE NASIEN VANAF* 4,2,1**

OPTION 1: CAR B **Motion to the west (+)** ***OPSIE 1: KAR B*** ***Beweging na wes (+)*** Impulse = $\Delta p = m\Delta v$✓ $= 3450(16,05 - 28)$✓ $= -41\ 227,5$ $= 41\ 227,5$ N·s✓	**OPTION 2: CAR B** **Motion to the west (-)** ***OPSIE 2: KAR B*** ***Beweging na wes (-)*** Impulse = $\Delta p = m\Delta v$✓ $= 3450(-16,05 - (-28))$✓ $= 41\ 227,5$ N·s ✓
OPTION 3: CAR A **Motion to the west (+)** ***OPSIE 3: KAR A*** ***Beweging na wes (+)*** Impulse = $\Delta p = m\Delta v$✓ $= 1085(5 - (-33))$✓ $= 41\ 230$ N·s✓	**OPTION 4: CAR A** **Motion to the west (-)** ***OPSIE 4: KAR A*** ***Beweging na wes (-)*** Impulse = $\Delta p = m\Delta v$✓ $= 3450(-5 - (+33))$✓ $= -41\ 230$ $= 41\ 230$ N·s ✓

(3)

4.3.1 According to Newton's second law✓ / $F_{net} = \frac{\Delta p}{\Delta t}$

Air bag causes an increase in collision time ✓ which results in a lesser / smaller force✓ (for the driver/passenger) (3)

4.3.2 Car A / *Kar A*✓ (1)

[14]

QUESTION/*VRAAG* 5

5.1 A force for which the work done in moving an object between two points is dependent of the path taken.✓✓

'n Krag waarvan die werk wat verrig word om 'n voorwerp tussen twee punte te skuif, afhanklik is van die pad wat gevolg word. (2)

5.2

$W_{net} = W_f + W_{Fg//}$

$= f\Delta x\cos\theta + mg\sin\theta\Delta x\cos\theta$ ✓

$= \underline{150(135)\cos180°}$ ✓+ $\underline{70(9,8)\sin25°(135)\cos0°}$✓

$= -20\ 250 + 39\ 138,677$

$= 18\ 888,677$ J ✓ (4)

5.3 **POSITIVE MARKING FROM QUESTION 5.2/ *POSITIEWE NASIEN VANAF* 5.2**

OPTION 1/*OPSIE 1*

$$\left.\begin{aligned} W_{net} &= \Delta K \\ &= \frac{1}{2}m(v_f^2 - v_i^2) \end{aligned}\right\} \text{Any} \checkmark$$

$$18\,888{,}677 \checkmark = \frac{1}{2}(70)(v_f^2 - 0) \checkmark$$

$$v_f = 23{,}23\ m \cdot s^{-1}$$

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

$$135 = \left(\frac{23{,}23 + 0}{2}\right)\Delta t \checkmark$$

$$\Delta t = 11{,}625\ s \checkmark$$

OPTION 2/ *OPSIE 2*

$$\left.\begin{aligned} W_{nc} &= \Delta K + \Delta U \\ f\Delta y \cos\theta &= \frac{1}{2}m(v_f^2 - v_i^2) + mg(h_f - h_i) \end{aligned}\right\} \text{Any} \checkmark$$

$$150(135)\cos 180° \checkmark = \frac{1}{2}(70)(v_f^2 - 0) + (70)(9{,}8)(0 - \sin 25° \times 135) \checkmark$$

$$v_f = 23{,}23\ m \cdot s^{-1}$$

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

$$135 = \left(\frac{23{,}23 + 0}{2}\right)\Delta t \checkmark$$

$$\Delta t = 11{,}625\ s \checkmark$$

OPTION 3/ *OPSIE 3*

$W_{net} = F_{net}\Delta x\cos\theta$ ✓

$18\,888{,}68 = F_{net}(135)\cos 0°$ ✓

$F_{net} = 139{,}92\ N$

$F_{net} = ma$

$139{,}92 = 70a$ ✓

$a = 2\ m\cdot s^{-2}$

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓

$135 = 0 + \frac{1}{2}(2)\Delta t^2$ ✓

$\Delta t = 11{,}625\ s$ ✓

(6)
[12]

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 (waargeneem deur 'n luisteraar) omdat die klankbron en die luisteraar verskillende snelhede het in verhouding tot die medium van klankverspreiding.

OR/*OF*

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

6.2

$$f_L = \left(\frac{v \pm v_L}{v \pm v_s}\right) f_s \checkmark$$

$$\text{Towards}: f_L = \left(\frac{v}{v - v}\right) f_s$$

$$f \checkmark = \left(\frac{340}{340 - v_s}\right) f_s \checkmark \quad \cdots \text{equation 1}$$

$$\text{Away}: f_L = \left(\frac{v}{v + v_s}\right) f_s$$

$$0{,}55 \checkmark f = \left(\frac{340}{340 + v_s}\right) f_s \checkmark \quad \ldots \text{equation 2}$$

Equating – eqn 1 & eqn 2

$153f = 1{,}55 v_s f$

$v_s = 98{,}71\ m \cdot s^{-1}$ ✓ (6)

6.3 **ANY TWO** ✓✓

Doppler /Blood flow meter
Measuring the heart beat of a foetus
Radar
Sonar
Use to determine whether stars are receding or approaching earth (2)

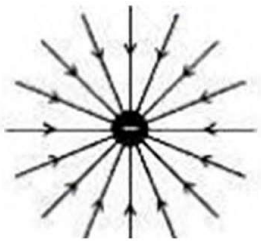
[10]

QUESTION/*VRAAG* 7

7.1 The electric field at a point is the electrostatic force ✓ experienced per unit positive charge (placed at that point). ✓
Die elektrieseveld by 'n punt is die elektrostatiese krag ervaar per eenheid positiewe lading (op daardie punt geplaas). (2)

Note: If electric field defined $\left(\frac{1}{2}\right)$ ***I Let wel*:** *As elektriese veld gedefinieer* $\left(\frac{1}{2}\right)$

7.2



Marking criteria/*Nasienkriteria:*

Correct direction towards the sphere *Korrekte rigting na die sfeer*	✓
Field lines not crossing and radial *Veldlyne wat nie die radial kruis nie*	✓

(2)

7.3

$$E_{XQ1} = \frac{kQ}{r^2} \checkmark$$

$$= \frac{9\times10^9(3\times10^{-5})}{(0{,}2)^2} \checkmark$$

$$= 6{,}75\times10^6\ \text{N}\cdot\text{C}^{-1}\ \text{west}$$

$$E_{XQ2} = \frac{kQ}{r^2}$$

$$= \frac{9\times10^9(12\times10^{-5})}{(0{,}15)^2} \checkmark$$

$$= 4{,}8\times10^7\ \text{N}\cdot\text{C}^{-1}\ \text{west}$$

$$E_{net} = E_{XQ1} \overset{\checkmark}{+} E_{XQ2}$$

$$= 6{,}75\times10^6 + 4{,}8\times10^7$$

$$= 5{,}475\times10^7\ \text{N}\cdot\text{C}^{-1} \checkmark\ \text{west} \checkmark$$

(6)

7.4 The electrostatic force(of attraction/repulsion) between two point charges is <u>directly proportional to the product of the charges and inversely proportional to the squareof the distance between them.✓✓</u> (2)

7.5

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

$$= \frac{9\times10^9(3\times10^{-5}0(12\times10^{-5})}{(0{,}35)^2} \checkmark$$

$$= 264{,}49\ \text{N} \checkmark$$

(3)

7.6 Increase / *Neem aan* ✓ (1)

[16]

QUESTION/*VRAAG* 8

8.1 The battery supplies 12J ✓of energy per coulomb of/per unit charge. ✓

Die battery voorsien 12J per coulomb van/per eenheidslading. (2)

8.2 Due to the internal resistance ✓ energy is dissipated (per coulomb of charge) in the battery. ✓
As gevolg van die interne weerstand, word energie per coulomb lading in die battery omgeskakel. (2)

8.3

Marking criteria / *Nasienkriteria:*	
Appropriate formula / *Toepaslike formule* V = IR✓ Calculating current in/ *Bereken stroom in* 15 Ω ✓ Adding two currents /✓ Final answer /*Finale antwoord van* 6Ω ✓	
$V = IR$✓ $V_{10\Omega} = V_{15\Omega}$ $I_{10\Omega}V_{10\Omega} = I_{15\Omega}V_{15\Omega}$ $0{,}9(10) = I_{15\Omega}(15)$ ✓ $I_{15\Omega} = 0{,}6$ A $I_{TOT} = I_{10\Omega} + I_{15\Omega}$ $= 0{,}9 + 0{,}6$ ✓ $= 1{,}5$ A ✓	**ACCEPT** $I_{10\Omega} : I_{15\Omega} = 15 : 10$ ✓ 0,9 0,6 ✓ $I_{TOT} = 0{,}9 + 0{,}6$✓ $= 1{,}5$ A ✓

(4)

8.4 **POSITIVE MARKING FROM QUESTION 8.3 / *POSITIEWE NASIEN VANAF 8.3***

OPTION 1 / *OPSIE* 1	**OR/*OF***	**OR/*OF***
$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ $= \frac{1}{10} + \frac{1}{15}$ ✓ $\therefore R_p = 6\Omega$	$R_p = \frac{R_1 \times R_2}{R_1 + R_2}$ $= \frac{10 \times 15}{10 + 15}$ $= 6\Omega$	$R_p = \left(\frac{1}{R_1} + \frac{1}{R_2}\right)^{-1}$ $= \left(\frac{1}{10} + \frac{1}{15}\right)^{-1}$ $= 6\Omega$

$\varepsilon = I(R + R_p + r)$ ✓ ✓ $12 = 1,5\ (R + 6 + 0,2)$ ✓ $\therefore R = 1,8\Omega$ ✓	**OPTION 2 / OPSIE 2** $R_T = \frac{V_T}{I_T}$ ✓ $= \frac{12}{1,5}$ $= 8\ \Omega$ $R_T = R + R_p + r$ ✓ $8 = R + 6 + 0,2$ ✓ $R = 1,8\ \Omega$ ✓

(5)

8.5

OPTION 1/ *OPSIE* 1	**OPTION 2 / *OPSIE 2***	**OPTION / *OPSIE* 3**
$P = VI$ ✓ $= 12(1,5)$ ✓ $= 18\ W$ ✓	$P = I^2R$ ✓ $= (1,5)^2(8)$ ✓ $= 18\ W$ ✓	$P = \frac{V^2}{R}$ ✓ ✓ $= \frac{(12)^2}{8}$ $= 18\ W$ ✓

(3)

8.6 Decreases ✓ The total resistance increases. ✓ (2)

[18]

QUESTION/*VRAAG* 9

9.1.1 AC Generators / *WS-generators/opwekkers* ✓ (1)

9.1.2 Electromagnetic induction / *Elektromagnetiese induksie* ✓ (1)

9.1.3 Anticlockwise / *Antikloksgewys* (1)

9.1.4 $T = \frac{1}{\ } ✓$

$= \frac{\ }{20} ✓$

$= 0{,}05\ s$ ✓ (3)

9.1.5 Reduce rotation speed (to less than 20Hz). ✓
Verminder rotasiespoed (na minder as 20Hz). (1)

9.2.1 The rms value of AC is the DC potential difference which dissipates the same amount of energy as AC. ✓✓
Die wgk-waarde van WS is die GS-potensiaalverskil wat dieselfde hoeveelheid energie as WS versprei. (2)

9.2.2 $P_{ave} = V_{rms}\ I_{rms}$ ✓
$1850 = (220)\ Irms$ ✓
$I_{rms} = 8{,}41\ A$ ✓ (3)

9.2.3 **POSITIVE MARKING FROM 9.2.2 / *POSITIEWE NASIEN VANAF 9.2.2***

OPTION / *OPSIE* 1	**OPTION / *OPSIE* 2**	**OPTION 3/*OPSIE 3***
$P_{ave} = I^2_{rms}\ R$ ✓ $1850 = (8{,}41)^2\ R$ ✓ $R = 26{,}16\Omega$ ✓	$R = \frac{V_{rms}}{I_{rms}}$ ✓ $= \frac{220}{8{,}41}$ ✓ $= 26{,}16\ \Omega$ ✓	$P_{ave} = \frac{(V_{rms})^2}{R}$ ✓ $1850 = \frac{(220)^2}{R}$ ✓ $\therefore R = 26{,}16\ \Omega$ ✓

(3)

[15]

QUESTION/*VRAAG* 10

10.1.1 Metal (cathode) / *Metaal (katode)/work function/threshold frequency /* W_0 /f_0✓ (1)

10.1.2 (Maximum) Kinetic energy ✓ (1)

10.2 Photoelectric effect✓ (1)

10.3 <u>The minimum energy</u> ✓ that an electron in the metal <u>needs to be emitted from the metal surface</u> ✓
<u>Die minimum energie</u> wat 'n elektron in die metaal <u>vanaf die metaal-oppervlak moet uitstraal</u> (2)

10.4.1 $W_0 = hf_0$ ✓
$= (6{,}63 \times 10^{-34})(1{,}75 \times 10^{15})$ ✓
$= 1{,}16 \times 10^{-18}$ J ✓ (3)

10.4.2 **<u>POSITIVE MARKING FROM QUESTION 10,4.1 / *POSITIEWE NASIEN VANAF 10.4.1*</u>**

$E = W_0 + E_{k(\max)}$
$hf = hf_0 + \frac{1}{2}mv_{mx}^2$ ✓
$(6{,}63 \times 10^{-34})f = 1{,}16 \times 10^{-18} + \frac{1}{2}(9{,}11 \times 10^{-31})(5{,}23 \times 10^5)^2$ ✓✓
$f = 1{,}94 \times 10^{15}\ Hz$ ✓ (4)

10.5 Increases / *Neem toe* ✓
The number of photons per unit time increases ✓ when the intensity of the light increase. Therefore, the number of photo-electrons per unit time increase. ✓ (Thus the current ($I = \frac{Q}{\Delta t}$) increases.)
Die aantal fotone per eenheidstyd neem toe wanneer die intensiteit van die lig toeneem. Daarom sal die aantal foto-elektrone per eenheidstyd toeneem. (Dus neem die stroom ($I = \frac{Q}{\Delta t}$) toe.) *(3)*

[15]

TOTAL/*TOTAAL*: 150