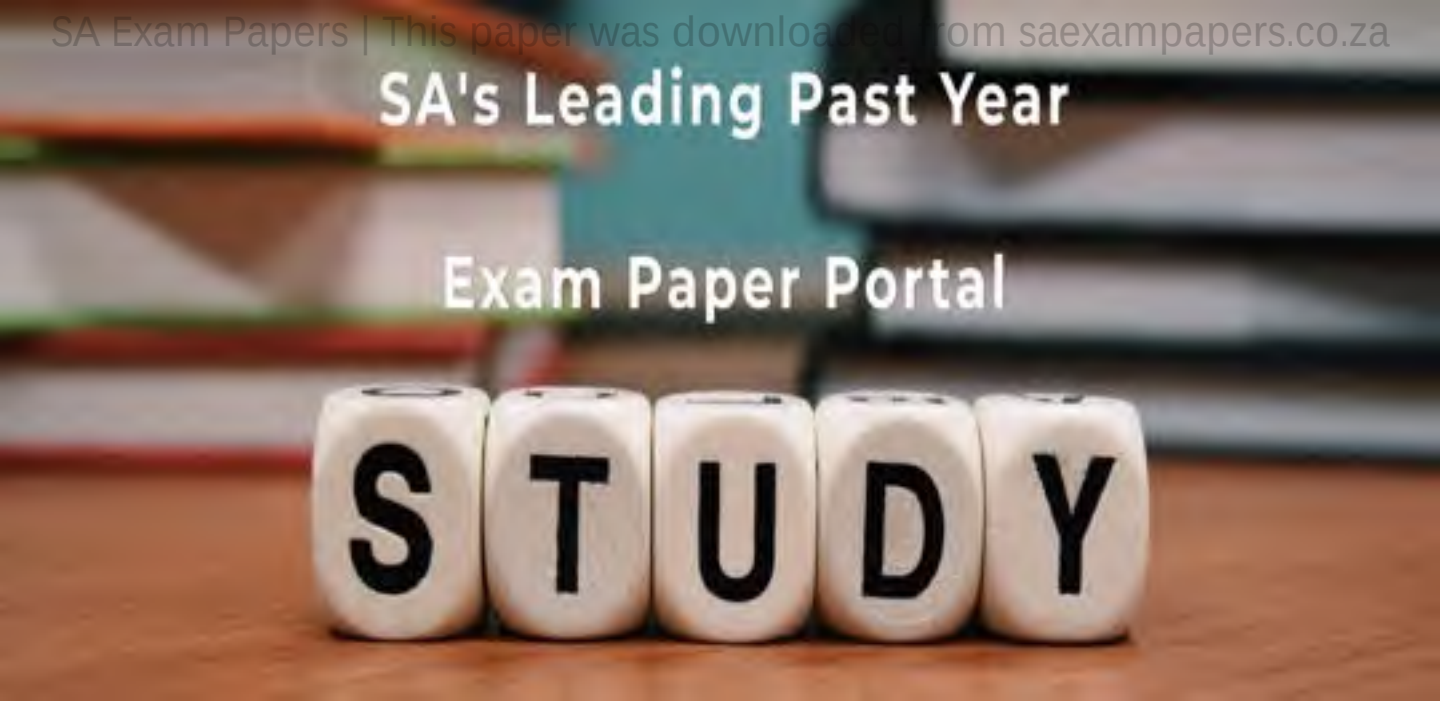

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PRELIMINARY EXAM
VOORBEREIDENDE EKSAMEN
2023
MARKING GUIDELINE
NASIENRIGLYN

PHYSICAL SCIENCES: PHYSICS (PAPER 1)
FISIESE WETENSKAPPE: FISIKA (VRAESTEL 1) (10841)

17 PAGES/BLADSYE

QUESTION / *VRAAG* 1

1.1 ✓✓ Award mark to all learners. / *Ken punte toe vir alle leerders.* (2)

1.2 B / C ✓✓ (2)

1.3 C ✓✓ (2)

1.4 B ✓✓ (2)

1.5 ✓✓ Award mark to all learners. / *Ken punte toe vir al die leerders.* (2)

1.6 A ✓✓ (2)

1.7 D ✓✓ (2)

1.8 D ✓✓ (2)

1.9 C ✓✓ (2)

1.10 ✓✓ Award mark to all learners./Ken punte toe vir al die leerders. (2)

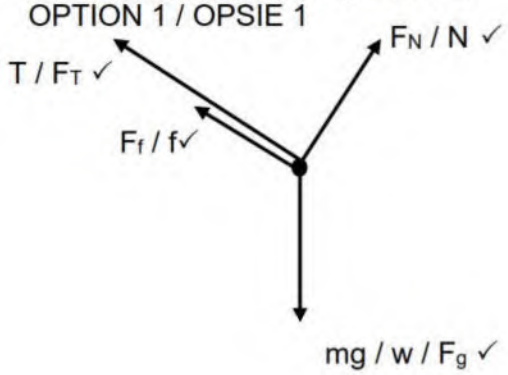
[20]

QUESTION / *VRAAG* 2

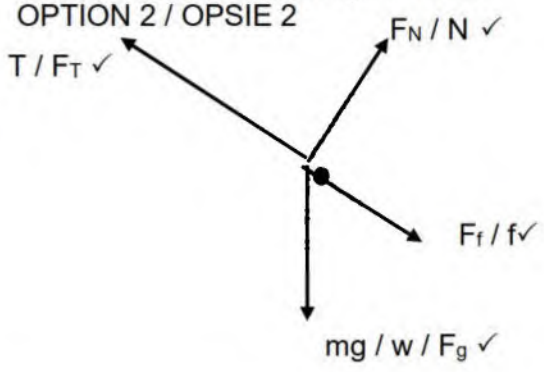
2.1 When a net force acts on an object, the object will accelerate in the direction of the force, this acceleration is directly proportional to the force and inversely proportional to the mass. **OR**
The net (or resultant) force acting on an object is equal to the rate of change of momentum of the object in the direction of the net force. (2 or zero)

*Wanneer 'n netto krag op 'n voorwerp inwerk, sal die voorwerp versnel in die rigting van die krag, hierdie versnelling is direk eweredig aan die krag en omgekeerd eweredig aan die massa. **OF***
Die netto (of resulterende) krag wat op 'n voorwerp inwerk, is gelyk aan die tempo van verandering van momentum van die voorwerp in die rigting van die netto krag. (2 of nul) (2)

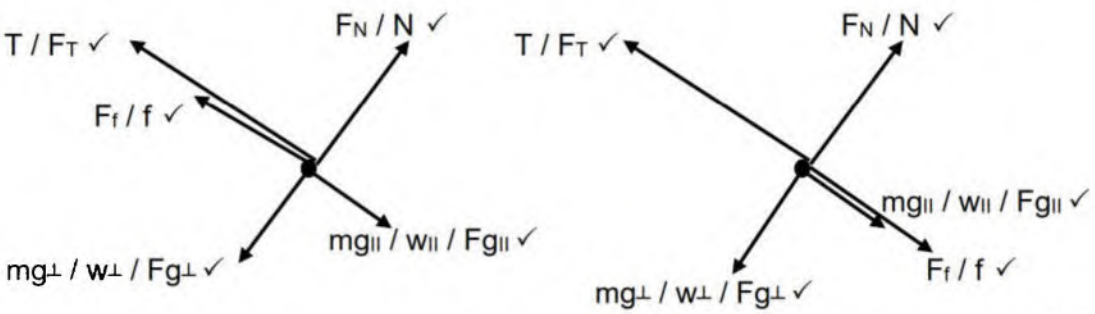
2.2.1 If box seen as moving down:
Indien beweging as afwaats gesien word:
OPTION 1 / OPSIE 1



If box seen as moving up:
Indien beweging as opwaarts gesien word:
OPTION 2 / OPSIE 2



2.2 2.2.1



(4)

IF OPTION 1 of question 2.2.1 is done: boxes move to the right

INDIEN OPSIE 1 van vraag 2.2.1 gebruik is:beweeg die bokse na regs

2.2.2

For the 12 kg box:/ *Vir die 12 kg boks*	For the 70 kg box: / *Vir die 70 kg boks*
Fnet = ma	Fnet = ma
T – FgII = ma ✓	FgII – Ff – T = ma
T – 12(9,8)sin50 ✓= 12a✓	70(9,8)sin30✓ – 0,2(70)9,8cos30✓ – T = 70a✓
T = 12a + 12(9,8)sin50 ……1	70(9,8)sin30 – 0,2(70)9,8cos30 – 70a = T ….2

✓ for equating / *vir vergelyking*

$12a + 12(9,8)\sin 50 = 70(9,8)\sin 30 - 0,2(70)9,8\cos 30 - 70a$

$a = 1,64\ m.s^{-2}$ ✓ answer / *antwoord*

(8)

IF OPTION 2 of question 2.2.1 is done: boxes move to the left

INDIEN OPSIE 2 van vraag 2.2.1 gebruik is beweeg die bokse na links

2.2.2

For the 12 kg box:/ *Vir die 12kg boks*	For the 70 kg box: / *Vir die 70 kg boks*
Fnet = ma	Fnet = ma
FgII – T = ma ✓	– FgII – Ff + T = ma
12(9,8)sin50✓ – T = 12a✓	T – 70(9,8)sin30✓ – 0,2(70)9,8cos30✓ = 70a✓
12(9,8)sin50 – 12a = T ……1	T = 70(9,8)sin30 + 0,2(70)9,8cos30 + 70a ….2

✓ for equating / *vir die gelykstelling*

$12(9,8)\sin 50 - 12a = 70(9,8)\sin 30 + 0,2(70)9,8\cos 30 + 70a$

$a = -4,53\ m.s^{-2}$ ✓ answer / *antwoord*

(8)

2.3 INCREASES. ✓

If the angle of the slope decreases the NORMAL FORCE INCREASES ✓

and since $F_f \propto F_N$, ✓ the friction force increases.

VERHOOG

Indien die hoek van die helling verlaag sal die NORMAAL KRAG VERHOOG

En aangesien, $F_f \propto F_N$, sal die weerstand verhoog.

(3)

[17]

QUESTION / *VRAAG* 3

3.1 A projectile is a (moving) object which has been given an initial velocity which then moves under the influence of the gravitational force (gravity) only.✓✓
(if the learner defines free fall then no marks) mark within context
There was a change in the guideline for 2021

'n Projektiel is 'n (bewegende) voorwerp wat 'n aanvanklike snelheid het wat dan slegs onder die invloed van die gravitasiekrag (swaartekrag) beweeg. (indien die leerder vryval definieer: geen punte nie) merk binne konteks
Daar was 'n verandering in die riglyn vir 2021

(2)

3.2 3.2.1 **OPTION 1: (UP POSITIVE) /*OPSIE 1 (OP POSITIEF)***

$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$0 = (+7{,}27)^2 + 2(-9{,}8)\Delta y$ ✓ (opposite signs / *teenoorgestelde tekens*)
$\Delta y = 2{,}7$ m (2,697 m)
Max height = 2,7 + 1,3 ✓
Maks hoogte = 4 m (3,997 m) ✓

OPTION 2: (DOWN POSITIVE) / *OPSIE 2 (AFWAARTS POSITIEF)*

$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$0 = (-7{,}27)^2 + 2(+9{,}8)\Delta y$ ✓ (opposite signs / *teenoorgestelde tekens*)
$\Delta y = -2{,}70$ m
$\Delta y = 2{,}70$ m (2,697 m) (answer must be positive / *antwoord moet positief wees*)
Max height = 2,70 + 1,3 ✓
Maks hoogte = 4 m (3,997 m) ✓

(4)

3.2.2 **OPTION 1: (UP POSITIVE) / *OPSIE 1: (OP IS POSITIEF)***

$\Delta y = v_i t + \frac{1}{2}at^2$ ✓
$(+1{,}9) = (+7{,}27)\,t + \frac{1}{2}(-9{,}8)\,t^2$ ✓
(opposite signs/*teenoorgestelde tekens*)
t = 1,14 s ✓ or ~~t = 0,339 s (too small)~~

✓ formula / *formule*
✓ substitution / *invervanging*
✓ answer / *antwoord*

OPTION 2: (UP POSITIVE) / *OPSIE 2 (OP IS NEGATIEF)*

Time to maximum height: / *Tyd tot maksimum hoogte*
$v_f = v_i + at$
$0 = 7{,}27 + (-9{,}8)\Delta t$
$\Delta t = 0{,}742$ s

(3)

Time from maximum height to balcony: / *Tyd vanaf maksimum hoogte tot by balkon)*

$v_f^2 = v_i^2 + 2a\Delta y$

$= 0^2 + 2(-9,8)\ 0,797$

$v_f = 3,952\ m.s^{-1}$

$v_f = v_i + at$ ✓

$-3,952 = 0 + (-9,8)\Delta t$ ✓

$\Delta t = 0,403\ s$

Total time: = 0,742 + 0,403

Totale tyd: = 1,145 s ✓

✓ formula that calculates the answer / *formule wat die antwoord bereken*
✓ substitution / *invervanging*
✓ answer / *antwoord*

OPTION 3: (DOWN POSITIVE) / *OPSIE 3: (AF IS POSITIEF)*

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

(–1,9) = (– 7,27) t + ½ (+9,8) t^2 ✓ (opposite signs / *teenoorgestede tekens)*

t = 1,14 s ✓

OPTION 4: (DOWN POSITIVE) / OPSIE 4: (AFWAARTS IS POSITIEF)

Time to maximum height: / T*yd tot die maks hoogte)*

$v_f = v_i + at$

$0 = -7,27 + (9,8)\Delta t$

$\Delta t = 0,742\ s$

$v_f = v_i + at$ ✓

$3,952 = 0 + (+9,8)\Delta t$ ✓

$\Delta t = 0,403\ s$

Total time: = 0,742 + 0,403

Totale tyd = 1,145 s ✓

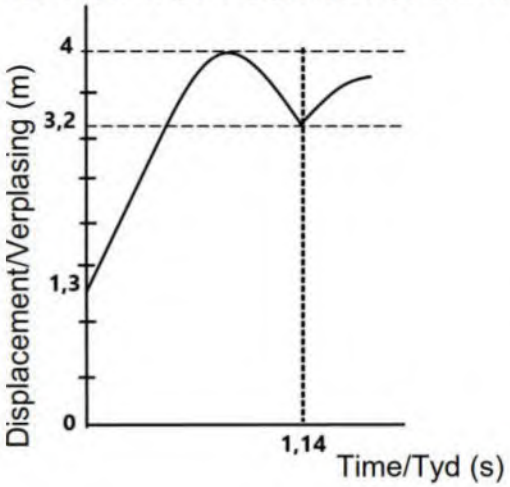
Time from top to balcony:/ *Tyd vanaf bo tot balkon*

$v_f^2 = v_i^2 + 2a\Delta y$

$= 0^2 + 2(+9,8)\ 0,797$

$v_f = 3,952\ m.s^{-1}$

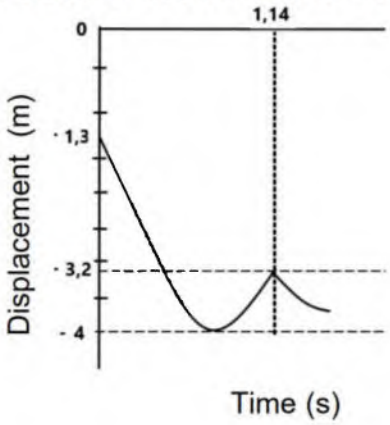
3.3 **OPTION 1: UP POSITIVE / *OPSIE 1: OP IS POSITIEF***



Marking guidelines:

- ✓ Height from which ball is thrown (1,3 m)
- ✓ Maximum height that ball reached (4 m) positive marking
- ✓ Height of the balcony (3,2 m)
- ✓ The time it takes to bounce on the balcony (1,14 s) positive marking
- ✓ Shape – no straight lines must be a parabola

OPTION 2: DOWN POSITIVE / *OPSIE 2: AFWAARTS IS POSITIEF*



- ✓ *Nasienriglyne: Hoogte waaruit bal gegooi word (1,3 m)*
- ✓ *Maksimum hoogte wat die bal bereik het (4 m) positiewe nasien*
- ✓ *Hoogte van die balkon (3,2 m)*
- ✓ *Die tyd wat dit neem om op die balkon (1,14 s) positiewe nasien te bons*
- ✓ *Vorm - geen reguit lyne mag 'n parabool wees nie*

(5)
[14]

QUESTION / *VRAAG 4*

4.1 The product of the resultant/net force acting on an object and the time the net force acts on the object. ✓✓
(DO NOT ACCEPT change in momentum.)
Die produk van die resulterende/netto krag wat op 'n voorwerp inwerk en die tyd wat die netto krag op die voorwerp inwerk.
(MOENIE verandering in momentum aanvaar nie.)

(2)

4.2 Impulse = Area under the graph /
Impuls = oppervlak onder die grafiek
$= \frac{1}{2}$ b x h
$= \frac{1}{2} \times (15 \times 10^{-3}) \times 64{,}13$ ✓
$= 0{,}481$ N.s ✓ accept kg.m.s^{-1}

(2)

4.3 Positive marking from 4.2 / *Positiewe merk vanaf 4.2*
0,481 kg.m.s^{-1} ✓ upwards/*opwaarts* ✓ (2)

4.4 Positive marking from 4.2 / *Positiewe merk vanaf 4.2*
can use up as + or down as + / *kan op of af as + gebruik word*

$F_{net}\Delta t = \Delta p$ ✓
$0{,}481 = m\,(v_f - v_i)$
$0{,}481$ ✓ $= 0{,}05\,(v_f - (-5{,}42))$ ✓
$v_f = 4{,}2$ m.s^{-1} ✓ (upwards) / (*opwaarts*) (4)

4.5 INCREASE, ✓
The change in momentum will be constant✓
The hard ball will take less time to bounce off the force sensor, ✓
The force is inversely proportional to the time, the force will increase as the time of contact will decrease.

VERHOOG
Die verandering in momentum sal konstant wees.
Die harde bal sal minder tyd neem om van die kragsensor af te bons,
Die krag is omgekeerd eweredig aan die tyd, die krag sal toeneem namate die kontaktyd sal afneem.

(3)
[13]

QUESTION / *VRAAG 5*

5.1 $P_{avg} = Fv_{avg}$ ✓

$57,6 = F \times 1,2$ ✓

$F = 48$ N ✓ (3)

5.2 The net work done on an object by a net force is equal to the change in the object's kinetic energy
OR
The work done on an object by a net force is equal to the change in the object's kinetic energy. ✓✓
Die netto werk wat deur 'n netto krag aan 'n voorwerp gedoen word, is gelyk aan die verandering in die kinetiese energie van die voorwerp
OF
Die werk wat deur 'n netto krag aan 'n voorwerp gedoen word, is gelyk aan die verandering in die voorwerp se kinetiese energie

(2)

5.3

Marking guideline:	*Nasien riglyne:*
✓ Formula	✓ *Formule*
✓ Kinetic energy substitution	✓ *Kinetiese energie invervanging*
✓ Potential energy substitution	✓ *Potensiële energie invervanging*
✓ Substitution for the work done by the frictional force	✓ *Invervanging vir arbeid verrig deur die wrywingskrag*
✓ $\frac{1,6}{\sin 32^{o}}$	✓ $\frac{1,6}{\sin 32^{o}}$
✓ answer range of 4,34 – 4,77	✓ *antwoord omvang 4,34 – 4,77 m.s^{-1}*

(6)

OPTION 1: / *OPSIE 1*

If learner takes v_i as 1,2 m.s^{-1} / *Indien die leerder kies* v_i as 1,2 m.s^{-1}

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

$$f\Delta x\cos\theta = (\frac{1}{2}mv_f^2 - mv_i^2) + (mgh_f - mgh_i) \quad \checkmark \text{ formula}$$

$$[(0,25)(41,554)]\cos 180^o \checkmark (\frac{1,6}{\sin 32^o})\checkmark = \frac{1}{2}(5)v_f^2 - \frac{1}{2}(5)(1,2^2)\checkmark + 0 - (5)(9,8)(1,6)\checkmark$$

$$v_f = 4,37 \text{ m}\cdot\text{s}^{-1} \quad \checkmark$$

OPTION 2: / *OPSIE 2*

If learner takes v_i as 1,2 m.s^{-1} / *Indien die leerder kies* v_i as 1,2 m.s^{-1}

$$W_{net} = \Delta E_k \quad \checkmark \text{ formula}$$

$$f\Delta x\cos\theta + mg\Delta x\cos\theta + N\Delta x\cos\theta = (\frac{1}{2}mv_f^2 - mv_i^2)$$

$$[(0,25)(41,554)]\cos 180^o \checkmark (\frac{1,6}{\sin 32^o})\checkmark + (5)(9,8)\cos(90-32)\checkmark + 0 = \frac{1}{2}(5)v_f^2 - \frac{1}{2}(5)(1,2^2)\checkmark$$

$$v_f = 4,37 \text{ m}\cdot\text{s}^{-1} \quad \checkmark$$

OPTION 3: / *OPSIE 3*

If learner takes v_i as 0 m.s^{-1} / / *Indien die leerder kies* v_i as 0 m.s^{-1}

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

$$f\Delta x\cos\theta = (\frac{1}{2}mv_f^2 - mv_i^2) + (mgh_f - mgh_i) \quad \checkmark \text{ formula}$$

$$[(0,25)(41,554)]\cos 180^o \checkmark (\frac{1,6}{\sin 32^o})\checkmark = \frac{1}{2}(5)v_f^2 \quad \checkmark - 0 + 0 - (5)(9,8)(1,6)\checkmark$$

$$v_f = 4,34 \text{ m}\cdot\text{s}^{-1} \quad \checkmark$$

OPTION 4: / *OPSIE 4*

If learner takes v_i as 0 m.s^{-1} / / *Indien die leerder kies* v_i as 0 m.s^{-1}

$$W_{net} = \Delta E_k \quad \checkmark \text{ formula}$$

$$f\Delta x\cos\theta + mg\Delta x\cos\theta + N\Delta x\cos\theta = (\frac{1}{2}mv_f^2 - mv_i^2)$$

$$[(0,25)(41,554)]\cos 180^o \checkmark (\frac{1,6}{\sin 32^o})\checkmark + (5)(9,8)(\frac{1,6}{\sin 32^o})\cos(90-32)\checkmark + 0 = \frac{1}{2}(5)v_f^2 - 0\checkmark$$

$$v_f = 4,34 \text{ m}\cdot\text{s}^{-1} \quad \checkmark$$

OPTION 5: / *OPSIE 5*

If learner takes v_i as 0 m.s^{-1} and F is included /*Indien die leerder kies* v_i as 0 m.s^{-1} *en F is ingesluit*

$$W_{nc} = \Delta E_k + \Delta E_p \quad \checkmark \text{ formula}$$

$$F\Delta x\cos\theta + f\Delta x\cos\theta = \left(\frac{1}{2}mv_f^2 - mv_i^2\right) + (mgh_f - mgh_i)$$

$$48\left(\frac{1,6}{\sin 32^o}\right)\cos 0 + [(0,25)(41,554)]\cos 180^o \checkmark \left(\frac{1,6}{\sin 32^o}\right)\checkmark = \frac{1}{2}(5)v_f^2 \quad \checkmark - 0 + 0 - (5)(9,8)(1,6)\checkmark$$

$$v_f = 8,76 \text{ m·s}^{-1} \quad \checkmark$$

OPTION 6: / *OPSIE 6*

If learner takes v_i as 1,2 m.s^{-1} and F is included /*Indien die leerder kies* v_i as 1,2 m.s^{-1} *en F is ingesluit*

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

$$F\Delta x\cos\theta + f\Delta x\cos\theta = \left(\frac{1}{2}mv_f^2 - mv_i^2\right) + (mgh_f - mgh_i) \quad \checkmark \text{ formula}$$

$$48\left(\frac{1,6}{\sin 32^o}\right)\cos(0) + [(0,25)(41,554)]\cos 180^o \checkmark \left(\frac{1,6}{\sin 32^o}\right)\checkmark = \frac{1}{2}(5)v_f^2 - \frac{1}{2}(5)(1,2^2)\checkmark + 0 - (5)(9,8)(1,6)\checkmark$$

$$v_f = 8.84 \text{ m·s}^{-1} \quad \checkmark$$

QUESTION / *VRAAG 6*

6.1 The (apparent) change in frequency/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 (oënskynlike) verandering in frekwensie/toonhoogte van die klank wat deur 'n luisteraar gehoor word, omdat die klankbron en die luisteraar verskillende snelhede het relatief tot die medium wat die klank veroorsaak (2)

Marking criteria: If any of the underlined words/phrases in the correct context is omitted deduct 1 mark. *Merk kriteria* *Indien enige onderstreepte woorde in die korrekte konteks uitgelaat is trek 1 ount af.*

6.2 6.2.1 A ✓ (1)

6.2.2 C ✓ (1)

6.2.3 The frequency of the waves reaching the observer decreases. ✓
OR
The wavelength increases.

Die frekwensie van die golwe wat die luisteraar bereik verlaag
OF
Die golflengte verhoog (1)

6.3 $$f_L = \frac{v \pm v_L}{v \pm v_S} \times fs$$ ✓

$$f_L = \frac{340 \checkmark}{(340+25) \checkmark} \times 900 \checkmark$$

$$= 838{,}356 \text{ Hz} \checkmark$$ (5)

6.4 The observed wavelength of the spectral lines of the hydrogen atom from the nearby star is LONGER ✓ than the wavelength of the hydrogen atom on the sun. The wavelength is RED SHIFTED ✓and therefore the nearby star is moving AWAY from the sun. ✓

Die waargenome golflengte van die spektrale lyne van die waterstofatoom vanaf die nabygeleë ster is LANGER (as die golflengte van die waterstofatoom op die son. Die golflengte is ROOI VERSKUIF (en dus die nabygeleë ster beweeg WEG van die son.

(3)
[13]

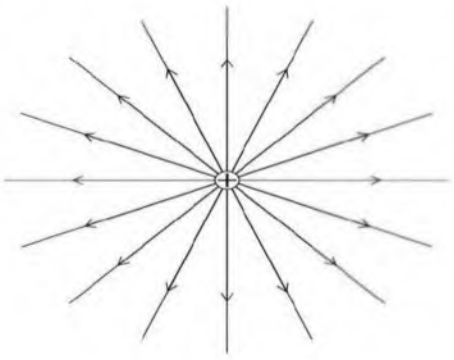
QUESTION / *VRAAG 7*

7.1 Electric field at a point is the force experienced per unit positive charge at that point. ✓✓

Elektriese veld op 'n punt is die krag wat per eenheid positiewe lading by daardie punt ervaar word

(2)

7.2

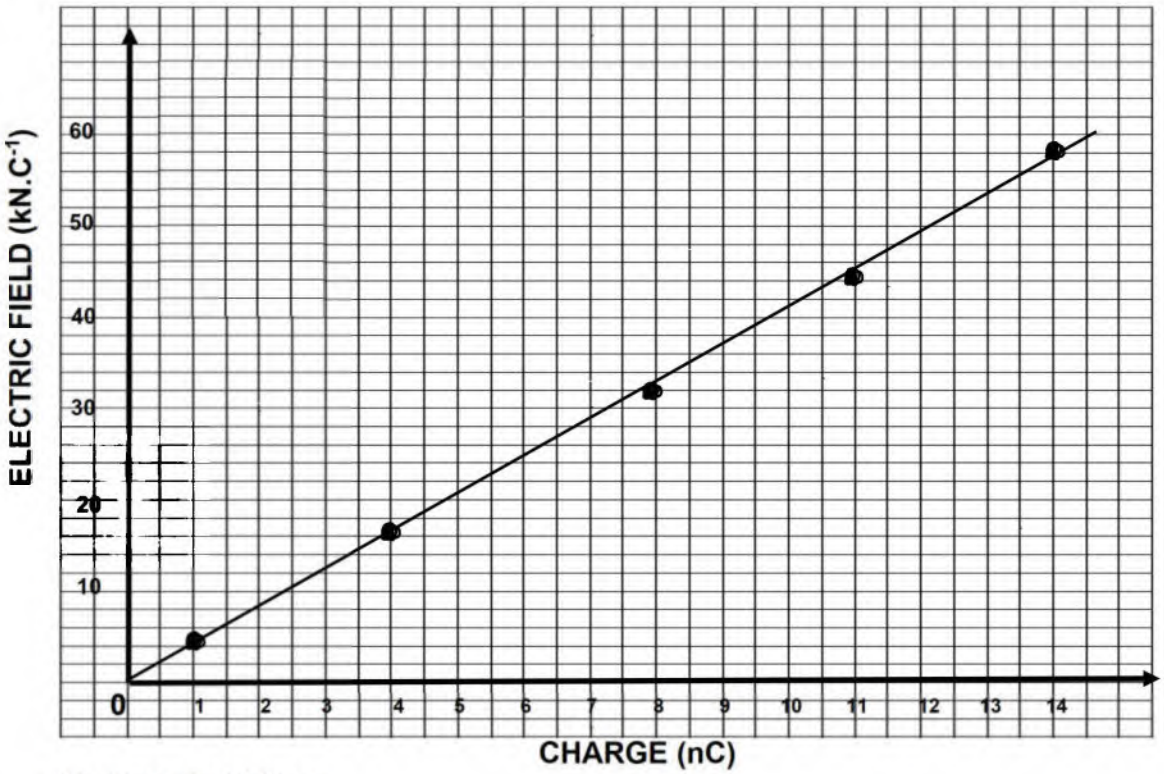


Marking guidelines:
✓ Direction
✓ Evenly spaced/not touching

Nasienriglyne
✓ *Rigting*
✓ Eweredig gespasieer

(2)

7.3 **Graph of E vs Q/*Grafiek van E vs Q***



(4)

Marking Guideline:
✓ Scale on both axes correct
✓ 3 points plotted correctly
✓ 5 points plotted correctly
✓ Line of best fit (must go through the origin)
if no Labels for both X and Y axes – penalise with one mark
if axes are swopped around -1

Nasienriglyn:
✓ *Skaal op beide asse korrek*
✓ *3 punte korrek geteken*
✓ *5 punte korrek geteken*
✓ *Lyn van die beste pas (moet deur die oorsprong gaan)*
✓ *indien geen byskrifte vir beide X- en Y-asse nie - penaliseer met een punt as die asse omgeruil is -1 geswot word*

7.4 7.4.1 The (fixed) distance ✓ */ die (vaste) afstand* (1)

7.4.2 Electric field ✓ *Elektrieseveld* (1)

7.4.3 **OPTION 1 / *OPSIE 1***

$$\text{Gradient} = \frac{\Delta y}{\Delta x}$$

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

$$r = \sqrt{\frac{k \times \Delta Q}{\Delta E}} =$$

$$\sqrt{\frac{9\times10^{9} \quad \times [12\times10^{-9} - 2\times10^{-9}]}{48\times10^{3} - 8\times10^{3}]}}$$

$$= 0{,}047\ m \checkmark$$

- ✓ Formula / gradient
- ✓ y-value (any one)
- ✓ x-value (any one)
- ✓ 9×10^9
- ✓ answer
- ✓ *Formule / gradiënt*
- ✓ *y-waarde (enige een)*
- ✓ *x-waarde (enige een)*
- ✓ *9×10^9*
- ✓ *antwoord*

OPTION 2 /*OPSIE 2*

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

$$10 \times 10^{-10} \checkmark = \frac{9x10^{9} \checkmark (40x10^{3}) \checkmark}{r^2}$$

$$r = 0{,}047\ m \checkmark$$

(5)
[15]

QUESTION / VRAAG 8

8.1 6 V ✓ (1)

8.2 When a charge of <u>0,75 Coulomb (C)</u>✓ travels in the circuit <u>in one second</u>. ✓

OR

Total of 0,75 <u>Coulombs (C) per unit time</u>

OR

The <u>rate</u> at which <u>0,75 Coulomb (C) flows</u>

Wanneer 'n lading van <u>0,75 Coulomb (C)</u> ✓ in <u>een sekonde</u> in die stroombaan beweeg.

OF

Totaal van <u>0,75 Coulombs (C) per eenheidstyd</u>

OF

Die <u>tempo waarteen 0,75 Coulomb (C) vloei</u>

(2)

8.3 8.3.1 **OPTION 1: / *OPSIE 1***

$\mathcal{E} = I(R + r)$ ✓ (3)

6 = 0,75(R + 0,4) ✓

R = 7,6 Ω ✓

OPTION 2: *OPSIE 2*

$R = \frac{V}{I}$ ✓

$= \frac{(6-0,3)}{0,75}$ ✓

= 7,6 Ω ✓

8.3.2 **OPTION 1/*OPSIE 1*:**

$R_P = R_{ex} - R_s$

= 7,6 – 4 ✓

= 3,6 Ω

$\frac{1}{R_p} = \frac{1}{R} + \frac{1}{R_3 + R_1}$

$\frac{1}{3,6} = \frac{1}{R} + \frac{1}{3+1}$ ✓

R = 36 Ω ✓

OPTION 2/*OPSIE 2:*

$R_{ext} = R_{//} + R_s$

7,6 ✓ $= \left(\frac{4R}{4+R} + 4\right)$ ✓

7,6 (4 + R) = 4R + 4(4 + R)

R = 36 Ω ✓

OPTION 3/ *OPSIE 3:*

$I_{//(1+3)} = \frac{V_{//}}{R_{(1+3)}}$

$= \frac{2,7}{4}$

= 0,675A

$I_R = 0,75 - 0,675$ ✓

= 0,075 A

$R = \frac{V_R}{I_R}$

$= \frac{2,7}{0,075}$ ✓

R = 36 Ω ✓ (3)

8.4 INCREASES ✓ / *VERHOOG*

R_{ex} decreases ✓
I increases (because $I \propto R$). ✓
According to $P = I^2R$ will increase because $P \propto I^2$ ✓

OR

R_{ex} decreases ✓
V over the resistor increases. ✓
According to $P=\frac{V^2}{R}$ will increase because $P \propto V^2$ ✓

$R_{ekstern}$ verminder
I verhoog ($I \propto R$).
Volgens $P = I^2R$ sal toeneem omdat $P \propto I^2$

OF

$R_{ekstern}$ verminder
V oor die weerstand neem toe.
Volgens $P=\frac{V^2}{R}$ *sal toeneem omdat* $P \propto V^2$

(4)

8.5 8.5.1 4,5 V ✓ (1)

8.5.2

$$\text{gradient} = -r = \frac{\Delta y}{\Delta x}$$

$$= \frac{1,5 - 4,5}{5 - 0} \quad ✓ \quad ✓$$

$$= -0,6$$

$$\therefore r = 0,6\ \Omega \quad ✓$$

(3)
[17]

QUESTION / *VRAAG 9*

9.1 AC (generator) ✓
It has two slip rings (AC). ✓✓
There is a handle to turn the coil/no power supply
OR
Sliprings for AC. ✓✓✓

WS (generator)
2 sleepringe (WS)
Daar is 'n handvatsel om die spoel te draai / geen kragbron
OF
Sleepringe vir WS (3)

9.2 B to A ✓ (1)

9.3 9.3.1 One and a half turns. ✓✓ OR 1 ½ OR 1,5 (2)

9.3.2 The rms current is the alternating current which dissipates/produces the same amount of energy as an equivalent direct current (DC). ✓✓

Die wkg stroom is die wisselstroom wat dieselfde hoeveelheid energie as 'n ekwivalente dierekte stroom (DS) (2)

9.3.3 $I_{rms} = \frac{I_{max}}{\sqrt{2}}$ ✓

$= \frac{15}{\sqrt{2}}$ ✓

$= 10{,}61\text{A}$

$P_{ave} = I_{rms}^2 \text{R}$ ✓

$= 10{,}61^2 \times 30$ ✓

$= 3377{,}16\text{ W}$ ✓ (3375 W) (5)

9.4 $P_{ave} = V_{rms}I_{rms}$

2 200 = $240I_{rms}$ ✓ if subscripts are omitted, subtract one mark

I_{rms} = 9,167 A *indien die onderskrifte weggelaat word, trek een punt af*

$I_{max} = I_{rms}\sqrt{2}$ ✓ formula mark goes for formula calculating the answer

I_{max} = (9,167) $\times (\sqrt{2})$ ✓ *formule punt word toegeken vir die formule wat die*

= 12,96 A ✓ *antwoord bereken* (4)
[17]

QUESTION / *VRAAG* 10

10.1 The process whereby electrons are ejected from a metal surface when light of a suitable frequency is incident on that surface. ✓✓

Die proses waar elektrone vrygestel word van 'n metaal oppervlak wanneer lig met 'n geskikte frekwensie op die oppervlak skyn (2)

10.2 The frequency of the red light must be lower ✓ than the threshold frequency ✓ for the phototube metal surface. (must be a comparison for both marks)

OR

The red light does not have enough energy to eject electrons from the phototube metal surface. ($E_{red\ light} < W_0$ metal surface) ✓✓ (2)
OR
The wavelength of the light is higher than the threshold wavelength.

Die frekwensie van die rooi lig moet laer wees as die drumpel frekwensie vir die fotobuis se metaal oppervlak. (moet vergelyk word vir 2 punte)

OF
Die rooi lig het nie genoeg energie om elektrone uit die fotobuis se metaaloppervlak te verwyder nie. ($E_{rooi\ lig} < W_0$ metaaloppervlak)

OF
Die golflengte van die lig is hoër as die drumpelgolflengte

10.3 10.3.1 INCREASES. ✓
VERHOOG (1)

10.3.2 INCREASES. ✓
If the intensity of the light increases, the number of photons per unit time / per second of light striking the phototube increases ✓.
This increases the number of electrons ejected per unit time / per second ✓ and therefore the reading on the ammeter increases.
VERHOOG
Indien die intensiteit van die lig verhoog, verhoog die aantal fotone per tydseenheid / per sekonde van die lig wat die fotobuis tref
Dit verhoog die aantal elektrone wat per eenheid tyd vrygestel word en dus verhoog die lesing op die ammeter. (3)

10.4
$$E = W_0 + Ek_{max} \checkmark$$
$$h\frac{c}{\lambda} = W_0 + Ek_{max}$$
$$\frac{(6{,}63\times10^{-34}\times3\times10^{8})}{(390\times10^{-9})} \checkmark = 3{,}52\times10^{-19} \checkmark + \tfrac{1}{2}(9{,}11\times10^{-31})v^2 \checkmark$$
$$5{,}108\times10^{-19} - 3{,}52\times10^{-19} = \tfrac{1}{2}(9{,}11\times10^{-31})v^2$$
$$v = \sqrt{\frac{1{,}588\times10^{-19}}{\frac{1}{2}(9{,}1\times10^{-31})}} = 5{,}89\times10^{5}\ m\cdot s^{-1} \checkmark$$
(5)

if frequency is calculated and then substituted – accept
two step question
indien die frekwenside bereken is en dan invervang word – aanvaar die twee stap vraag.

[13]

TOTAL/*TOTAAL*: 150