basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIOR SERTIFIKAAT*

GRADE/*GRAAD* 10

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

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MEMORANDUM

MARKS/*PUNTE*: 150

This memorandum consists of 10 pages.
Hierdie memorandum bestaan uit 10 bladsye.

QUESTION 1/*VRAAG 1*

1.1 B ✓✓ (2)

1.2 A ✓✓ (2)

1.3 C ✓✓ (2)

1.4 D ✓✓ (2)

1.5 C ✓✓ (2)

1.6 A ✓✓ (2)

1.7 B ✓✓ (2)

1.8 D✓✓ (2)

1.9 D ✓✓ (2)

1.10 C ✓✓ (2)

[20]

QUESTION 2/*VRAAG 2*

2.1 A vector is a physical quantity which as both magnitude✓ and direction✓
'n Vektor is 'n fisiese hoeveelheid wat beide grootte en rigting het. (2)

2.2

TAKE EAST AS POSITIVE
NEEM OOS AS POSITIEF
$\mathbf{F_{res} = F_{mbike/fiets} + F_f}$✓
$= (- 500 \text{ N} + 150 \text{ N})$✓
$= - 350 \text{ N}$
= 350 N westward/*weswaarts*✓

OR/*OF*
TAKE WEST AS POSITIVE
NEEM WES AS POSITIEF
$\mathbf{F_{res} = F_{mbike/fiets} + F_f}$✓
$= (500 \text{ N} - 150 \text{ N})$✓
$= 350 \text{ N}$
= 350 N westward/*weswaarts*✓

(3)

2.3 0 km✓ [must include unit/*moet eenheid bevat*] (1)

2.4

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
Average speed = $\frac{\text{total distance}}{\text{total time}}$ ✓ *Gemiddelde spoed* = $\frac{\text{totale afstand}}{\text{totaletyd}}$ = $\frac{(160+160)}{(2+1,67)}$ ✓ = 87 ,19 km·hr^{-1}✓	speed/afstand = $\frac{\text{distance/afstand}}{\text{time/tyd}}$ ✓ speed west = $\frac{160}{2}$ = 80 km·hr^{-1}. *spoed wes* speed east = $\frac{160}{1,67}$ = 95,81 km·hr^{-1} ✓ *spoed oos* ∴ Average speed = $\frac{(80+95,81)}{2}$ ✓ ∴ *Gemid spoed* = 87,91 km·hr^{-1}✓

(4)

2.5 **POSITIVE MARKING FROM 2.4**
POSITIEWE NASIEN VANAF 2.4
For the westward trip/*Vir die rit weswaarts*:
80✓ = ($v_{bike/motorfiets}$ – 8) ✓
$v_{bike/motorfiets}$ = 88 km·hr^{-1}✓

OR/*OF*
For eastward trip/*Vir die ooswaartse rit*
95,8✓= (v_{bike} + 8) ✓
$V_{bike/motorfiets}$ = 87,8 km·hr^{-1}✓ (3)
[13]

QUESTION 3/*VRAAG 3*

3.1 The rate of change of velocity. ✓✓
Die tempo van verandering van snelheid (2)

3.2 54 km·hr^{-1} = $\frac{(54\times1000)}{(3600)}$✓✓
= 15 m·s^{-1}✓

OR/*OF*

54 km·hr^{-1} = $\frac{54}{3,6}$ ✓✓
= 15 m·s^{-1}✓ (3)

3.3 **POSITIVE MARKING FROM 3.2**
POSITIEWE NASIEN VANAF 3.2
$v_f = v_i + a\Delta t$✓
20✓ = 0 + (2)Δt✓
Δt = 10 s✓ (4)

3.4 **POSITIVE MARKING FROM 3.2 AND 3.3**
POSITIEWE NASIEN VANAF 3.2 EN 3.2

For the police car/*Vir die polisiemotor*
$\Delta x = v_i \Delta t + ½ a\Delta t^2$✓
$= [0 + ½ (2)(10^2)]$ ✓
$= 100$ m

For the van/*Vir die paneelwa*
$\Delta x = v_i \Delta t$ ✓
$= (15 \times 10)$✓
$= 150$ m
The van✓ is ahead./*Die paneelwa is voor.* (5)

3.5 Both the van and the police car are at the same position when they catch up..
Beide die paneelwa en die polisiemotor is by dieselfde posisie wanneer hulle mekaar inhaal.

$\therefore x_{\text{police car/}polisiemotor} = x_{\text{van/}paneelwa}$ ✓
For the police car/*Vir polisiemotor*:
$(x_p - 100) = v_f \Delta t$……(1)
$(x_p - 100) = 20 \Delta t$ ✓

For the van/*Vir paneelwa*
$(x_r - 150) = 15 \Delta t$✓……..(2)
$\Delta t = 10$ s

$\therefore x_p = \underline{100 + (20)(10)}$✓
$= 300$ m

OR/*OF*
$x_r = [150 + 15(10)]$✓
$= 300$ m

The police car catches up with the van after 300 m✓ after 20 s✓
Die polisiemotor haal die paneelwa na 300 m en na 20 s in (5)

3.6 Total time/*Totale tyd* = (10 + 10)s = 20 s✓ (1)
[20]

QUESTION 4/*VRAAG 4*

4.1 30 m·s^{-1}✓✓ (2)

4.2 40 m·s^{-1}✓✓ (2)

4.3 The speed decreases ✓uniformly (from 40 m·s^{-1} to 0 m·s^{-1}) ✓
Die spoed neem uniform af (vanaf 40 m·s^{-1} tot 0 m·s^{-1})

OR/*OF*
The car slows down✓ and finally stops✓
Die motor beweeg stadiger en stop uiteindelik. (2)

4.4 $a = \frac{\Delta y}{\Delta x}$ ✓
$= \frac{(0) - 40}{25 - 20}$ ✓ ✓
= -8 m·s^{-2}✓ (4)

4.5 Equal to/*Gelyk aan*✓
Same gradient /*Dieselfde gradiënt*✓ (2)

4.6 **OPTION 1/*OPSIE 1***
Displacement = Area under the v-t graph✓
Verplasing = Oppervlakte onder v-t grafiek
=($A_{trapezium}$ + $A_{rectangle/reghoek}$ + $A_{triangle\ 1/driehoek\ 1}$) – $A_{triangle\ 2/driehoek\ 2}$
= ½ (40+30)(5)✓ +(15x40) ✓+ ½ (5 x40)✓ – [½ (2,5 x 20)]✓
= 850 m✓ east/*oos*✓ (7)

OR/*OF*
Displacement= Area under the v-t graph✓
Verplasing = Oppervlakte onder v–t grafiek
= ($A_{trapezium/trapesium}$ + $A_{rectangle/reghoek}$ + $A_{triangle/driehoek}$)- $A_{triangle/driehoek}$
= ½ (20+15)(10)✓ + (30 x 20)✓ + ½ (5 x40) ✓– ½ (2,5 x 20)✓
= 850 m✓ east/*oos*✓ (7)
[19]

QUESTION 5/*VRAAG 5*

5.1 The total mechanical energy in an isolated system is constant.✓✓
Die totale meganiese energie in 'n geïsoleerde sisteem is konstant. (2)

5.2.1 250 J✓✓ (2)

5.2.2 $(E_M)_A = (E_M)_C$
$(E_{K1} + E_{P1})_A = (E_{K2} + E_{P2})_C$
$(E_M)_A = (E_K + E_P)_C$
$(\frac{1}{2}mv^2 + mgh)_A = (\frac{1}{2}mv^2 + mgh)_C$

Any one/*Enige een*✓

250✓ = ½ (5)v^2 ✓ + (5)(9,8)(5) ✓
v = 1,41 m·s^{-1}✓ (5)

5.3 Mechanical energy at point D = ½ mv^2 + mgh
Meganiese energie by punt D = 0 + (5)(9,8)(7) ✓
= 343 J

OR/OF
Just before it goes over point D, it is momentarily stationary.
Net voordat dit oor punt D gaan, staan dit vir 'n oomblik stil
Mechanical energy/*Meganiese energie* = E_p = mgh = (5)(9,8)(7)✓ = 343 J

The minimum energy needed for the steel ball to reach the point D 343 J✓
The mechanical energy of the steel ball is 250 J which is less than that at D✓
So the ball cannot reach the point D. ✓
Die minimum energie benodig vir die staalbal om punt D te bereik is 343 J
Die meganiese energie van die staalbal is 250 J wat minder is as dit by punt D. So die bal kan nie punt D bereik nie (4)
[13]

QUESTION 6/*VRAAG 6*

6.1 Transverse/*Transversale* ✓ (1)

6.2 1,5 m✓ (1)

6.3 The distance between two consecutive points in phase✓✓
Die afstand tussen twee opeenvolgende punte in fase

OR/*OF*
The distance between two consecutive crests or two consecutive troughs.
Die afstand tussen twee opeenvolgende kruine of twee opeenvolgende trôe. (2)

6.4 λ = 4 m ✓✓ (6 m =1,5 waves/*golwe*) (2)

6.5 Any one of: A and E; B and J; D and F ✓
Enige een van A en E; B en J; D en F (1)

6.6 4 crests implies 3 waves
4 kruine impliseer 3 golwe
3 ✓x 0,5 ✓ = 1,5 s ✓ (3 waves x 0,5 seconds per wave)
(*3 golwe x 0,5 sekondes per golf)* (3)

6.7

$$\text{speed} = \frac{\text{distance}}{\text{time}} \checkmark$$

$$\textit{spoed} = \frac{\text{afstand}}{\text{tyd}}$$

$$= \frac{6}{0,75} \checkmark \checkmark$$

$$= 8 \text{ m·s}^{-1} \checkmark$$

Positive marking from 6.4
Positiewe nasien vanaf 6.4

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

$$= \frac{4}{0,5} \checkmark$$

$$= 8 \text{ m·s}^{-1} \checkmark$$

$$v = f\lambda \checkmark$$

$$= \frac{1}{T} \times \lambda$$

$$= \frac{1}{0,5} \checkmark \times 4 \checkmark$$

OR/*OF*

$$= (2 \checkmark \text{x } 4 \checkmark)$$

$$= 8 \text{ m·s}^{-1} \checkmark$$

(4)
[14]

QUESTION 7/*VRAAG 7*

7.1 A wave in which the particles of the medium vibrate parallel to the direction of motion of the wave.✓✓
'n Golf waarin die deeltjies van die medium parallel aan die rigting van beweging van die golf vibreer (2)

7.2

OPTION 1/*OPSIE 1*

$$\text{speed of sound} = \frac{\text{distance travelled}}{\text{time taken}} = \frac{2 \times \text{distance to wall}}{\text{echo time}} \checkmark$$

$$\text{spoed van klank} = \frac{\text{afstand afgele}}{\text{tyd geneem}} = \frac{2 \times \text{afstand na muur}}{\text{eggo tyd}}$$

$$\therefore 340 = \checkmark \frac{2 \times 225}{\Delta t} \checkmark$$

Time taken/*tyd geneem* = 1,32 s✓ (4)

OPTION 2/*OPSIE 2*

$$\Delta x = \frac{(v_f + v_i)\Delta t}{2} \checkmark$$

$$225 = \frac{(340 + 340)\,\Delta t}{2} \checkmark$$

$$\Delta t = 0,6617 \text{ s} \checkmark$$

Echo travels to the wall and back again / *Eggo beweeg na muur en weer terug*
∴ time/*tyd* = 1,32 s ✓ (4)

7.3 Less than/*Minder as*✓
Sound travels quicker ✓in water than in air ✓(because water is denser).
Klank beweeg vinniger in water as in lug (omdat water digter is) (3)
NOTE: There must be a comparison.
LET WEL: *Daar moet 'n vergelyking wees*

7.4 Reflection/*Weerkaatsing*✓✓ (2)
[11]

QUESTION 8/*VRAAG 8*

8.1 It can/*Dit kan*:
- travel through vacuum/*deur vakuum beweeg*
- travel at the speed of 3×10^8 m·s^{-1}/*beweeg teen 'n spoed van* 3×10^8 *m·s*$^{-1}$

It originates from accelerating (oscillating) charges
Dit onstaan van versnelde (ossillerende) ladings
It propagates as electric and magnetic fields perpendicular to each other.
Dit beweeg voort as elektriese en magnetiese velde reghoekig tot mekaar
They can be/*Hulle kan*
- Reflected/*Weerkaats word*
- Refracted/*Breking ondergaan*

They undergo/*Hulle ondergaan*
- Inteference/Interferensie
- Diffraction/*Diffraksie*

Any two/*Enige twee* (2)

8.2 Gamma rays/*Gammastrale*✓ (1)

8.3 $E = hf$ ✓
$\underline{1,99 \times 10^{-20}} = \underline{(6,63 \times 10^{-34})(f)}$ ✓
$f = 3,0 \times 10^{13}$ Hz ✓
Infra red radiation /*Infrarooistraling*✓ (4)

8.4.1 Radio waves/*Radiogolwe*✓ (1)

8.4.2 Infra red/*Infrarooi*✓ (1)

8.4.3 X-rays/*X-strale* ✓ (1)
[10]

QUESTION 9/*VRAAG 9*

9.1 A region in space where a magnetic material experiences a force.✓✓
'n Gebied in die ruimte waar 'n magnetiese stof 'n krag ondervind. (2)

9.2 Ferromagnetic materials/Ferromagnets✓
Ferromagnetiese stowwe/Ferromagnete (1)

9.3.1 Same/identical polarities✓
Dieselfde/Identiese polariteite (1)

9.3.2 No/*Nee* ✓ (1)

9.3.3 **C** to/*na* **D**✓
D is the south pole of the magnet/*is die suidpool van die magneet*✓ (2)

9.4 It shields us from (harmful radiation) from solar winds.
Dit beskerm ons van (skadelike straling) van sonwinde. (1)
[8]

QUESTION 10/*VRAAG 10*

10.1 In an isolated system the total/net charge remains constant✓✓
In 'n geïsoleerde sisteem bly die totale/netto lading konstant

ACCEPT/*AAVAAR*
In an isolated system charge is neither created nor destroyed
Lading word nie geskep of vernietig in 'n geïsoleerde sisteem nie. (2)

10.2 The water molecule has a positive charge ✓and is attracted toward the rod. ✓
Die water molekuul het 'n positiewe lading en word na die staaf aangetrek

OR/*OF*
The positive end✓ of the water molecules are attracted✓to the negatively charged rod.
Die positiewe ent van die watermolekule word aangetrek na die negatiewe staaf.

OR/*OF*
Unlike charges attract. ✓ The positive end of the water molecules are attracted ✓to the negatively charged comb.
Ongelyksoortige ladings trek mekaar aan. Die positiewe ent van die watermolekule word aangetrek na die negatief gelaaide staaf. (2)

10.3 $n = \frac{Q}{e}$ ✓**OR/*OF*** $Q = nq_e$
$Q = 10^{14}$ ✓x $(1,6 \times 10^{-19})$ ✓
$= 1,6 \times 10^{-5}$C (0,000016 C) ✓ (4)
[8]

QUESTION 11/*VRAAG 11*

11.1.1 Current/*Stroom*.✓ (1)

11.1.2 The bulbs are identical and in series✓/the same current flows through each of the bulbs
Die gloeilampe is identies en in series/dieselfde stroom vloei deur elk van die gloeilampe

OR/*OF*

The same amount of charge passes through each of them in any given time.
Dieselfde aantal lading beweeg deur elk van hulle in enige gegewe tyd.

OR/*OF*
The potential difference across each of them is the same hence current is the same.
Die potensiaalverskil oor elk van hulle is dieselfde en gevolglik is die stroom dieselfde. (1)

11.1.3 Decrease/*Afneem* ✓ (1)

11.2.1 Potential difference across a conductor is the energy per unit charge flowing through it. ✓✓
Die potensiaalverskil oor 'n geleier is die energie per eenheidslading wat deur dit vloei.

OR/*OF*
Work done per unit charge across the conductor. ✓✓
Arbeid verrig per eenheidslading oor die geleier. (2)

11.2.2

$\frac{1}{R_{//}} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓
$= \frac{1}{2} + \frac{1}{6}$ ✓
$\therefore R_{//} = 1,5\ \Omega$ ✓
	OR/*OF*
	$R_{//} = \frac{R_1 R_2}{R_1 + R_2}$ ✓
	$\frac{2 \times 6}{2 + 6}$ ✓
	$\therefore R_{//} = 1,5\ \Omega$ ✓

(3)

11.2.3

POSITIVE MARKING FROM QUESTION 11.2.2 ***POSITIEWE NASIEN VANAF VRAAG 11.2.2***	
<u>OPTION 1</u>/*OPSIE 2*	**OPTION 2/*OPSIE 2***
A series circuit acts as a potential divider./ *'n Serieskakeling dien as 'n potensiaalverdeler* $V_p = \frac{R_p}{R_{tot}}(V_{tot})$ ✓ $4 = \frac{1,5✓}{(1,5+4)✓} \times V_{tot}$ $\therefore V_1 = V_{tot} = 14,67$ V✓	V = IR✓ 4 = I(1,5) I = 2,667A V_2 = IR = 2,667(4)✓ = 10,67 V $V_1 = V_{tot}$ =(4 + 10,67)✓ = 14,67 V✓

(4)

11.2.4

POSITIVE MARKING FROM QUESTION 11.2.3 ***POSITIEWE NASIEN VANAF VRAAG 11.2.3***	**OR/*OF***
$V_2 = V_{tot} - V_{//}$ =(14,67 -4) ✓ =10,67 V✓	$V_2 = \frac{R_2}{R_{tot}}(V_{tot})$ $= \frac{4}{(1,5+4)} \times 14,67$ ✓ = 10,67 V✓

(2)
[14]

TOTAL/*TOTAAL*: 150