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)*

**NOVEMBER 2016**

**MEMORANDUM**

**MARKS/*PUNTE*: 150**

**This memorandum consists of 14 pages.**
***Hierdie memorandum bestaan uit 14 bladsye.***

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12/11

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## QUESTION 1/*VRAAG 1*

1.1 B ✓✓ (2)

1.2 C ✓✓ (2)

1.3 D ✓✓ (2)

1.4 D ✓✓ (2)

1.5 D ✓✓ (2)

1.6 A ✓✓ (2)

1.7 B ✓✓ (2)

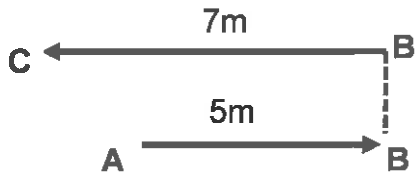
1.8 C✓✓ (2)

1.9 D ✓✓ (2)

1.10 B ✓✓ (2)
**[20]**

## QUESTION 2/*VRAAG 2*

2.1




**Mark allocation/*Puntetoekenning*:**
✓ 1 x line AB: length, arrow, label
*1 x lyn AB: lengte, rigting, benoem*
✓ 1 x line BC: length, arrow, label
*1 x lyn BC: lengte, rigting, benoem*

(2)

2.2 2 m ✓ west/to the left✓
2 m ✓ *wes/na links*✓ (2)

**OR**

If the learner has done 2.2 on the vector diagram above, allocate 1 mark for the resultant from A to C✓ and 1 mark for the label of the magnitude of 2m. ✓

*As leerder 2.2 op die bostaande vektordiagram aangedui het, ken 1 punt vir die resultant van A tot C toe, en 1 punt vir die benoeming van 2m*

2.3 Total distance/*Totale afstand*
= 5 + 7✓
= 12 m✓ (2)

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2.4 For the total distance, the whole path length travelled is considered. ✓
For change in position, only the original position and final position✓of the man are considered. (2)
*Vir die totale afstand word die totale padlengte afgelê in berekening gebring, maar slegs die begin- en eindposisie word in berekening gebring vir verandering in posisie.*

2.5 Velocity is the rate of change of displacement. ✓✓
*Snelheid is die tempo waarteen verplasing (verandering in posisie) verander.* (2)

| **ACCEPT:** |
|---|
| Change in displacement over change in time |
| **AANVAAR:** |
| Verandering in verplasing gedeel deur verandering in tyd |

2.6 **POSITIVE MARKING FROM 2.2**
***POSITIEWE NASIEN VANAF 2.2***

$v = \frac{\Delta x}{\Delta t}$ ✓

$= \frac{2}{20}$ ✓

$= 0,1\ m \cdot s^{-1}$ west/to the left✓
*wes/na links* (4)
**[14]**

## QUESTION 3/*VRAAG 3*

3.1 Acceleration is the rate of change of velocity. ✓✓
*Versnelling is die tempo van snelheidsverandering.*

**OR/*OF***

Acceleration is the change in velocity per unit time✓✓.
*Versnelling is die verandering in snelheid per tydseenheid.* (2)

3.2 No ✓
*Nee* (1)

3.3 **NEGATIVE MARKING FROM 3.2**
**NEGATIEWE MERK VANAF 3.2**

Velocity to the right, acceleration to the left ✓
*Snelheid na regs, versnelling na links.*

**OR/*OF***

Taxi slowing down so acceleration is in opposite direction✓ to movement.
*Die taxi beweeg stadiger, dus is versnelling in die teenoorgestelde rigting van beweging.* (1)

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3.4

| **OPTION 1/*OPSIE 1*** | **OPTION 2/*OPSIE 2*** |
|---|---|
| $v = \frac{D}{\Delta t}$ ✓ or $D = v \times \Delta t$ ✓<br>$25$ ✓ $= \frac{D}{1}$ ✓ $= 25 \times 1$ ✓<br>$D = 25$ m ✓ $= 25$ m ✓ | $\Delta x = \frac{(v_f + v_i)}{2} \Delta t$ ✓<br>$= \frac{25 + 25}{2}$ ✓x 1 ✓<br>$= 25$ m ✓ |
| **OPTION 3/*OPSIE 3*** | |
| $\Delta x = v_i t + \frac{1}{2} a \Delta t^2$ ✓<br>$= 25 \times 1$ ✓ $+ \frac{1}{2} \times 0 \times 1^2$ ✓<br>$= 25$ m ✓ | |

(4)

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3.5 **POSITIVE MARKING FROM 3.4**
***POSITIEWE NASIEN VANAF 3.4***

| **OPTION 1/*OPSIE 1*** | **OPTION 2/*OPSIE 2*** |
|---|---|
| $\Delta x = \left(\frac{v_f + v_i}{2}\right)\Delta t$ ✓<br><br>$= \frac{(0+25)}{2}$ x 2✓<br><br>= 25 m<br><br>∴ total distance/*totale afstand*<br>= 25 + 25✓<br>= 50 m✓<br><br>∴ taxi will not stop at the traffic light as distance > 40 m<br>*∴ die taxi sal nie ✓by verkeerslig stop nie, want die afstand is > 40* m<br><br>**OR / OF**<br>$\Delta x = \left(\frac{v_f + v_i}{2}\right)\Delta t$ ✓<br>$= \frac{(0+25)}{2}$ x 2✓<br>= 25 m ✓<br>∴ distance available for braking time is 40 – 25 = 15 m, therefore the taxi is short of 10 m to stop. ✓<br>∴ the taxi will not stop in time. ✓<br>*∴ die beskikbare afstand vir briektyd is 40 – 25 = 15m, dus sal die taxi 10 m te min hê om te stop.*<br>*∴ dus sal die taxi nie betyds stop nie* | $v_f = v_i + a\Delta t$✓<br>$a = \frac{v_f - v_i}{\Delta t}$<br><br>$a = \frac{(0 - 25)}{2}$ ✓<br><br>$= -12{,}5\ m{\cdot}s^{-2}$<br><br>Only one mark for either equation<br>*Slegs een punt vir die enige een van die vergelykings.*<br><br>$v_f^2 = v_i^2 + 2a\Delta x$<br>$0 = 25^2 + 2 \times -12{,}5 \times \Delta x$✓<br>∴ Δx = 25m<br>∴ total distance/*totale afstand*<br>= 25 + 25<br>= 50 m✓<br>∴ taxi will not stop at the traffic light as distance > 40 m✓<br>*∴ die taxi sal nie by verkeerslig stop nie, want die afstand is > 40* m |

| **OPTION 3/*OPSIE 3*** |
|---|
| $a = \frac{v_f - v_i}{\Delta t}$✓<br>$= \frac{(0 - 25)}{2}$ ✓<br>$= -12{,}5\ m{\cdot}s^{-2}$<br>$\Delta x = v_i t + \frac{1}{2}a\Delta t^2$<br>$= 25 \times 2 + \frac{1}{2} \times -12{,}5 \times 2^2$ ✓<br>= 25 m<br>∴ total distance/*totale afstand*<br>= 25 + 25<br>= 50 m✓<br>∴ taxi will not stop at the traffic light, as distance > 40 m✓<br>*∴ die taxi sal nie betyds stop nie, want die afstand is > 40* m<br><br>Only one mark for either equation<br>*Slegs een punt vir enige een van die vergelykings.* |

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**OPTION /OPSIE 4**

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

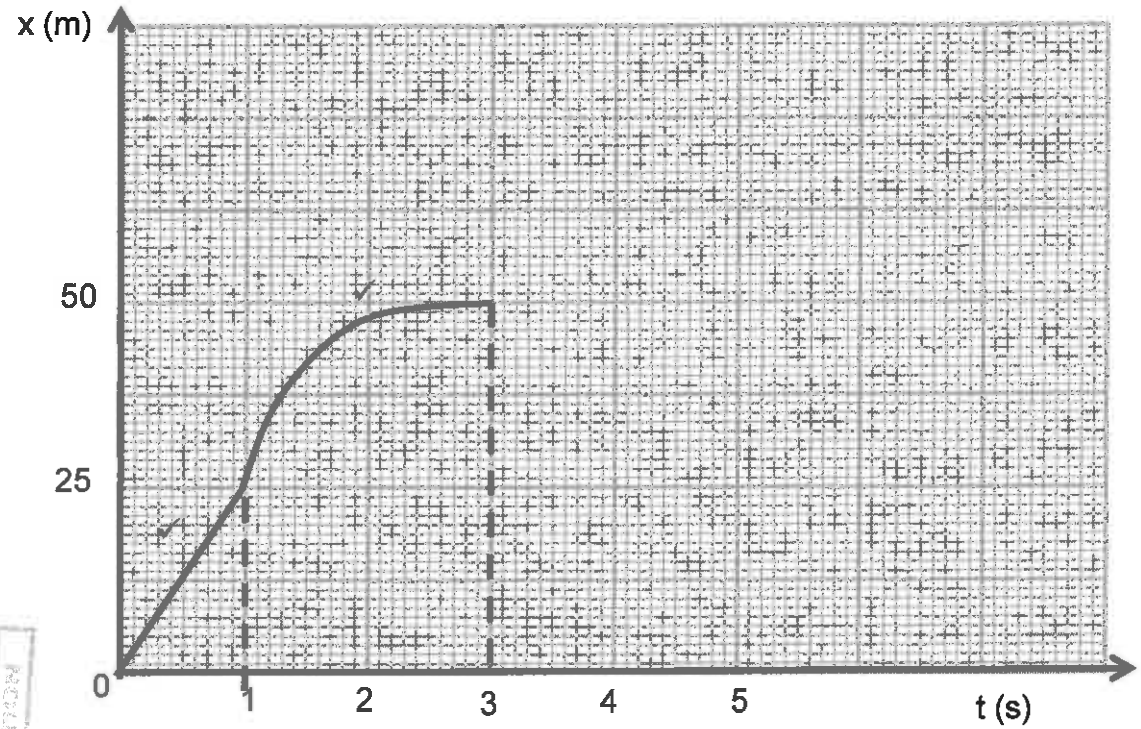
$15 = \frac{25 + 0}{2}$ ✓x $\Delta t$ ✓

$\Delta t = 1{,}2$ s✓

Actual time to reach traffic light is 1,2s which is shorter than the 2s. Therefore the taxi will not stop in time. ✓

*Eintlike tyd of verkeerslig te bereik is 1,2s wat korter is as 2s. Dus sal die taxi nie betyds stop nie.*

3.6

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**MARKING GUIDELINES/*NASIENRIGLYNE***

✓ Both axes correctly labelled with unit
*Beide asse korrek benoem met eenheid*
✓ Straight line (t =0 s and t = 1 s)
*Reguitlyn (t =0 s en t = 1 s)*
✓✓Curve shape (t = 1 s and t = 3)
*Kurwe (t =1 s en t = 3)*
✓ values for displacement and time indicated
*Waardes vir verplasing en tyd aangedui*

(4)
**[17]**

## QUESTION 4/*VRAAG 4*

4.1 5 m·s$^{-1}$ ✓north ✓ (accept range from 4,9 to 5,1)
*5 m·s$^{-1}$ noord (aanvaar vanaf 4,9 tot 5,1)* (2)

4.2 8,3 m·s$^{-1}$ ✓✓ (accept range from 8,2 to 8,4)
8,3 m·s$^{-1}$ *(aanvaar vanaf 8,2 tot 8,4)* (2)

4.3.1
- The velocity is uniformly increasing.
- Velocity increases from 5 m·s$^{-1}$ to 10 m·s$^{-1}$ in 150 s.
- Positive acceleration.
- The girl is speeding up.
- The girl is uniformly accelerating

Any **ONE** of the options ✓✓
*Enige **EEN** korrekte opsie*

- *Snelheid neem uniform toe.*
- *Snelheid neem van 5 m·s$^{-1}$ tot 10 m·s$^{-1}$ in 150 s toe.*
- *Positiewe versnelling.*
- *Die meisie se spoed neem toe.*
- *Die meisie se versnelling is uniform.* (2)

4.3.2
- Uniform/constant velocity
- Zero acceleration
- Same speed / velocity

Any **ONE** of the options ✓✓
*Enige **EEN** korrekte opsie*

- *Uniforme/konstante snelheid*
- *Nil versnelling*
- *Dieselfde spoed/ snelheid* (2)

4.4.1

| **OPTION 1/*OPSIE 1*** | **OPTION 2/*OPSIE 2*** |
|---|---|
| Distance A to C<br>*Afstand A tot C*<br>= ℓ x b + ½ x b x h✓<br>= 5 x 350 ✓+ ½ x 150 x 5✓<br>= 2 125 m ✓ | Distance A to C<br>*Afstand A tot C*<br>= ℓ x b + ℓ x b + ½ x b x h✓<br>= 200 x 5 + 150 x 5✓+½ x 150 x 5✓<br>= 2 125 m ✓ |

| **OPTION 3/*OPSIE 3*** |
|---|
| Distance A to C<br>*Afstand A tot C*<br>= ℓ x b + ½ ( sum of parallel sides )h✓<br>= ℓ x b + ½ ( som van parallele sye )h✓<br>= 5 x 200 ✓+ ½ ( 5 + 10)(150) ✓<br>= 2 125 m ✓ |

(4)

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4.4.2 Gradient of this graph is the acceleration

$$\text{gradient} = \frac{y_2 - y_1}{x_2 - x_1} \checkmark \text{ or } \frac{v_f - v_i}{t_f - t_i}$$
$$= \frac{(0 - 10)}{(65 - 0)} \checkmark$$
$$= -0{,}15 \text{ m·s}^{-2}$$
$\therefore$ a = 0,15 m·s$^{-2}$ South✓/ *Suid* (4)

4.5 D to E. ✓✓
*D tot E* (2)

4.6 The change in speed from D to E is (-)10 $m \cdot s^{-1}$ ✓ and that occurs over (65 s) a shorter period. ✓
**OR**
From B to C, the change in speed is 5 $m \cdot s^{-1}$ over a period of 150 s.✓✓
**OR**
Gradient is the steepest

*Die verandering is spoed van D tot E is (-)10* $m \cdot s^{-1}$ ✓*en die beweging gebeur oor 'n korter tydperk.(65 s)*✓
***OF***
*Vanaf B tot C is die verandering in spoed 5* $m \cdot s^{-1}$ *oor 'n tydperk van 150* s.
***OF***
*Gradient is die steilste* (2)
**[20]**

## QUESTION 5/*VRAAG 5*

5.1 $14 \times \frac{3\,600}{1\,000}$ ✓

$= 50,4 \text{ km} \cdot h^{-1}$✓

**OR/*OF***

14 x 3,6 ✓
$= 50,4 \text{ km} \cdot h^{-1}$ ✓ (2)

5.2 The energy an object possesses as a result of its motion. ✓✓
*Die energie van 'n voorwerp as gevolg van die beweging daarvan.* (2)

5.3 $E_p = mgh$✓
$= 0,01 \times 9,8 \times 5$✓
$= 0,49$ J✓ (3)

5.4

| **OPTION/*OPSIE 1*** |
|---|
| $(E_p + E_k)_{top/bo} = (E_p + E_k)_{bottom/onder}$ ✓<br>$mgh + \frac{1}{2}mv^2 = mgh + \frac{1}{2}mv^2$<br>$(0,01)(9,8)(10) + 0$✓ $= \underline{(0,01)(9,8)(5) + \frac{1}{2} \times 0,01 \times v^2}$ ✓<br>$v = 9,89 \text{ m} \cdot s^{-1}$ ✓ |
| **OPTION/OPSIE 2** |
| $(E_p + E_k)_{top/bo} = (E_p + E_k)_{bottom/onder}$ ✓<br>$mgh + \frac{1}{2}mv^2 = mgh + \frac{1}{2}mv^2$<br>$(0,01)(9,8)(10) + 0$ ✓ $= \underline{0,49 + \frac{1}{2} \times 0,01 \times v^2}$ ✓<br>$v = 9,89 \text{ m} \cdot s^{-1}$ ✓ |

| **ACCEPT/ AANVAAR:** |
|---|
| $(E_p + E_k)_i = (E_p + E_k)_f$ |

(4)

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5.5 Equal to✓. Mechanical energy is conserved✓, it is a closed system.✓
*Gelyk aan. Meganiese energie word behou, dit is 'n geslote stelsel.* (3)
**[14]**

**QUESTION 6/*VRAAG 6***

6.1 0,4 m ✓✓ (2)

6.2.1 Trough✓
*Trog/buik* (1)

6.2.2 Crest✓
*Kruin* (1)

6.3 A and C✓
*A en C* (1)

6.4 2½✓✓ (2)

6.5 $v = f \times \lambda$✓
$0,4 = 0,5 \times \lambda$✓
$\therefore \lambda = 0,8$ m✓ (3)

6.6 2½ x 0,8✓
= 2 m✓

**OR/*OF***

$v = \frac{d}{t}$

$0,4 = \frac{d}{5}$ ✓

= 2 m ✓ (2)
**[12]**

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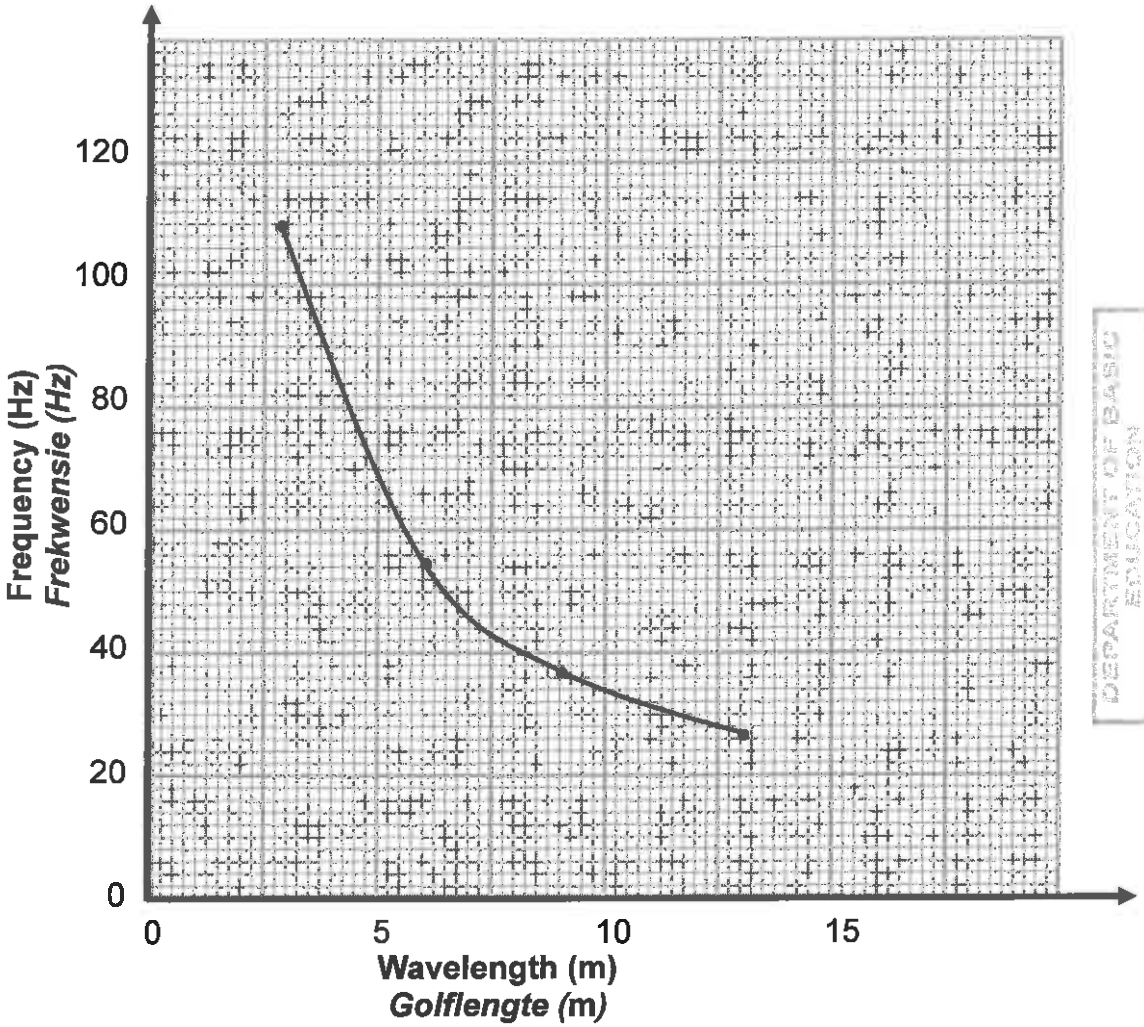
## QUESTION 7/*VRAAG 7*

7.1 The wavelength of notes (played). ✓
*Die golflengte van note (gespeel)* (1)

7.2 The frequency. ✓
*Die frekwensie* (1)

7.3

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| **MARK ALLOCATION:** | ***PUNTETOEKENNING:*** |
|---|---|
| ✓ correct $y$-axis label and unit<br>correct $x$-axis label and unit<br>✓ all points plotted correctly<br>And best fit line drawn<br>✓ shape of graph<br>✓correct scales on axes | ✓*korrekte benoeming en eenheid op $y$-as*<br>*korrekte benoeming en eenheid op $x$-as*<br>✓*alle punte korrek gestip en beste lyn geteken*<br>✓ *vorm van grafiek*<br>✓*korrekte skaal vir asse* |

(4)

7.4 Frequency and wavelength are <u>inversely proportional</u> ✓to each other.
*Frekwensie en golflengte is <u>omgekeerd eweredig</u> aan mekaar.*
**OR**
$f \propto \frac{1}{\lambda}$

(1)

7.5 $v = f \times \lambda$ ✓
$= 55 \times 6$ ✓
$= 330\ m \cdot s^{-1}$ ✓ (3)
**[10]**

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## QUESTION 8/*VRAAG 8*

8.1.1 C ✓
8.1.2 A ✓
8.1.3 B ✓ (3)

8.2.1
- Keeping food warm
- Remote controls
- Optical fibres ✓
- Animals like snakes which hunt
- Infrared scanners (for picking up heat)

Any ONE ✓/*Enige een*

- *Hou voedsel warm*
- *Afstandbeheerders*
- *Optiese vesels*
- *Sekere diere soos slange wat jag*
- *Infrarooi skandeerders (wat hitte optel)*

(1)

8.2.2
- Telephone OR satellite OR cellphone connections
- RADAR systems ✓
- RADAR speed traps
- Microwave ovens

Any ONE ✓/*Enige een*

- *Telefoon- OF satelliet- OF selfoonkonneksies*
- *RADARstelsels*
- *RADARspoedlokvalstelsels*
- *Mikrogolfoonde*

(1)

8.3.1 X-ray ✓
*X-strale* (1)

8.3.2 X-ray has a high frequency OR (high) penetration into soft tissues of humans, ✓ but not bones.
*X-strale het 'n hoë frekwensie OF sagte weefsel van mense (hoog)indring, maar nie been nie.* (1)

8.3.3 X-rays can:
- damage living tissue
- cause cancer

Any ONE ✓/*Enige een*

*X-strale kan:*
- *weefsel beskadig*
- *kanker veroorsaak*

(1)

8.4

| OPTION/OPSIE 1 | OPTION/OPSIE 2 |
|---|---|
| $E = h\frac{c}{\lambda}$ ✓<br>$= 6{,}63 \times 10^{-34}$ ✓ x $\frac{3 \times 10^8}{3}$ ✓<br>$= 6{,}63 \times 10^{-26}$ J ✓ | $f = \frac{c}{\lambda}$<br>$= \frac{3 \times 10^8}{3}$ ✓<br>$= 1 \times 10^8$ Hz<br>E = hf ✓ (one mark for both equations/ een punt vir albei vergelykings)<br>$= 6{,}63 \times 10^{-34} \times 1 \times 10^8$ ✓<br>$= 6{,}63 \times 10^{-26}$ J ✓ |

(4)
**[12]**

## QUESTION 9/*VRAAG 9*

9.1.1 A force exerted on an object without touching the object. ✓✓
**OR**
A force exerted on an object that is at a distance. ✓✓

*'n Krag wat op 'n voorwerp uitgeoefen word sonder om aan die voorwerp te raak.*
***OF***
*'n Krag wat oor 'n afstand op 'n voorwerp uitgeoefen word.* (2)

9.1.2
- Gravity/Weight/Gravitational force ✓
- Electrostatic/Coulombic force

Any ONE ✓/*Enige een*

- *Gravitasiekrag/Gewig/Gravitasie*
- *Elektrostatiese/Coulomb-kragte* (1)

9.2 Attractive ✓
*Aantrekkend* (1)

9.3
- North / N✓
- The direction of magnetic field lines is from north to south✓

- *Noord/ N*
- *Die rigting van magneetveldlyne is van noord na suid* (2)
**[6]**

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## QUESTION 10/*VRAAG 10*

10.1 B ✓ (1)

10.2 B to A✓
*B tot A* (1)

10.3 $Q_{new/nuut} = \frac{Q_1 + Q_2}{2}$ ✓

$= \frac{(+3 \times 10^{-6} + (-2 \times 10^{-6}))}{2}$ ✓

$= 5 \times 10^{-7}C$ ✓ (3)

10.4

| OPTION 1/*OPSIE 1* | OPTION 2/*OPSIE 2* |
|---|---|
| $n = \frac{Q}{e}$ ✓<br>$= \frac{5 \times 10^{-7} - (-2 \times 10^{-6})}{1,6 \times 10^{-19}}$ ✓<br>$= 1,56 \times 10^{13}$ electrons ✓<br>*elektrone* | $n = \frac{Q}{e}$ ✓<br>$= \frac{5 \times 10^{-7} - (+3 \times 10^{-6})}{-1,6 \times 10^{-19}}$ ✓<br>$= 1,56 \times 10^{13}$ electrons ✓<br>*elektrone* |

(3)
**[8]**

## QUESTION 11/*VRAAG 11*

11.1.1

| OPTION 1/*OPSIE 1* | OPTION 2/*OPSIE 2* |
|---|---|
| $\frac{1}{R_{//}} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓<br>$= \frac{1}{6} + \frac{1}{3}$ ✓<br>$\therefore R_{//} = 2\Omega$<br><br>$\therefore R_{total/totaal} = 4 + 2$ ✓<br>$= 6\ \Omega$ ✓ | $R_{//} = \frac{R_1 \times R_2}{R_1 + R_2}$ ✓<br>$= \frac{6 \times 3}{6+3}$ ✓<br>$= 2\Omega$<br><br>$\therefore R_{total/totaal} = 4 + 2$ ✓<br>$= 6\ \Omega$ ✓ |

(4)

11.1.2

| | ACCEPT/ AANVAAR: |
|---|---|
| $R_{//}$ : $R_{series}$<br>$2\Omega$ : $4\Omega$ ✓<br>∴ potential difference is also in ratio of<br>*Potensiaal verskil is ook in die verhouding*<br>2: 4 or 1:2 ✓<br>∴ 12V ÷ 3 parts/*dele* = 4V<br>∴ $V_{series} = 2 \times 4 = 8V$ ✓ | $R_{4\Omega} = \frac{V_2}{I_T}$ ✓<br>$4 = \frac{V_2}{2}$ ✓<br>$\therefore V_2 = 8\ V$ ✓ |

(3)

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11.1.3

| | |
|---|---|
| $R \alpha \frac{1}{I}$ or in words:<br>resistance is inversely proportional to current and<br>$\therefore$ ratio of resistors is 6 : 3✓<br>2 : 1<br><br>$\therefore$ ratio of current is 1 : 2 ✓<br>$A_2 : A_3$<br>$\therefore I_{A2} = \frac{2}{3} \times 1$<br>$\therefore I_{A2}$ = 0,67 A ✓<br><br>*$R \alpha \frac{1}{I}$ in woorde:*<br>*weerstand is omgekeer eweredig aan stroom*<br>*$\therefore$ verhouding van resistors is 6 : 3✓*<br>*2 : 1*<br><br>*$\therefore$ verhouding van stroom is 1 : 2 ✓*<br>*$A_2 : A_3$*<br>*$\therefore I_{A2} = \frac{2}{3} \times 1$*<br>*$\therefore I_{A2}$ = 0,67 A* ✓ | **ACCEPT/*AANVAAR:***<br>$I = \frac{V}{R}$ ✓<br>$= \frac{12 - 8}{6}$ ✓<br>= 0,67 A ✓ |

(3)

11.1.4 $A_1$ = 2 A
$\therefore Q = I \Delta t$ ✓
= 2 x 120 ✓
= 240 C ✓ (3)

11.2 Decrease ✓
*Afneem* (1)

11.3 **NEGATIVE MARKING FROM 11.2**
**NEGATIEWE MERK VANAF 11.2**

- If the 6 Ω resistor is removed, the resistance of the whole circuit increases ✓
- Since $R \alpha \frac{1}{I}$ ✓, if R increases, and V is constant ✓ and I of the circuit decreases

- *Indien die 6 Ω-resistor verwyder word, sal die totale weerstand van die stroombaan verhoog.*
- *$R \alpha \frac{1}{I}$ ✓, so indien R verhoog en V bly konstant✓, sal die stroom (I) verlaag.* (3)

**[17]**

**TOTAL/TOTAAL: 150**

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