HILLCREST HIGH SCHOOL

PHYSICAL SCIENCE

GRADE 10

PAPER 1 - Physics

NOVEMBER 2022

TIME: 2 HRS **Total: 100**

Question 1

1.1 A

1.2 A

1.3 A

1.4 B

1.5 *mistake in question paper. Correct answer is $\sqrt{2}.v$

Question 2- waves

2.1 Pulse is a single disturbance in a medium ✓✓ /
Pols is 'n enkele steuring in 'n medium. (2)

2.2 down ✓ (1)

2.3.1 $T = 1/f$ ✓
$= 1/30$ ✓
$= 0,033$

$\Delta t = 0,033 \times 3$ ✓
$\Delta t = 0,10$ s ✓ (4)

2.3.2 Wavelength/*Golflengte*(m) = 12/3 ✓
= 4 m ✓ (2)

2.3.3

Option 1/*Opsie 1* **Positive marking from 6.3.2/*Positiewe nasien vanaf 6.3.2***	**Option 2/*Opsie 2***	**Option 3/*Opsie 3*** **Positive marking from 6.3.1 and 6.3.2/ *Positiewe nasien vanaf 6.3.1 en 6.3.2***
$v = f\lambda$ ✓ $= (30)(4)$ ✓ $V = 120$ m·s^{-1} ✓	$\Delta x = v\Delta t$ ✓ $12 = v(0.10)$ ✓ $V = 120$ m·s^{-1} ✓	$V = \frac{\lambda}{T}$ ✓ $V = \frac{4}{0,033}$ ✓ $V = 121,21$ m·s^{-1} ✓

(3)
[12]

Question 3 - EMR

3.1.1 Infra-red/*infrarooi* ✓ (1)

3.1.2 Sun/*Son* ✓

OR/*OF*

Gas discharge tube/*Gasafvoerbuis* ✓ (1)

3.2 $E = h\frac{c}{\lambda}$ ✓

$E = (6.63 \times 10^{-34})\frac{3\times10^{8}\checkmark}{4\times10^{-5}}$ ✓✓

$E = 4.97 \times 10^{-21}\ J$ ✓ (5)

3.3.1 **B**, ✓ • **B** has a highest energy/frequency than ultraviolet ✓
B, • *B het die hoogste energie/frekwensie as ultraviolet* (2)

3.3.2 Type of (electromagnetic) radiation ✓
Tipe (elektromagnetiese) straling

OR/*OF*

Frequency (of electromagnetic radiation) ✓
Frekwensie (van elektromagnetiese straling (1)

3.3.3 Fair test ✓✓ **OR** fair investigation **OR** to have one independent variable/ *Billike toets **OF** billike ondersoek **OF** om een onafhanklike veranderlike te hê.* (2)

[13]

Question 4 – circuits

4.1 $1/R_p = 1/R_1 + 1/R_2$ ✓

$1/R_p = 1/2 + 1/4$ ✓

$1/R_p = 3/4\Omega$

$R_p = 4\Omega/3$

$R_p = 1.33\Omega$

I = V/R✓
= 6/(2+1,33) ✓
= 1,8 A✓

4.2

Vp = IT.Rp ✓
= 1,8 (1,33) ✓
= 2,39 V✓

Or

Vs = I.R
= 1,8 (2) ✓
= 3,6V
Vp = Vt – Vs
= 6 – 3,6 ✓
= 2,4 V✓

4.3 I = V/R✓
= 2,4/2✓
= 1,2 A✓

4.4 $I = I_T - I_{2\Omega}$✓
= 1,8 – 1,2✓
= 0,6 A✓

Or

I = V/R✓
= 2,4/4✓
= 0,6 A✓

4.5 $Q = I.\Delta t$✓
= 0,6(60) ✓
= 36 C ✓

4.6.1 Decrease✓, the Rt increases, thus It decreases since I is inversely proportional to resistance✓

4.6.2 Remain the same, since the p.d/emf of the battery remains constant

4.7 Voltmeters have extremely high resistance

Changed to 2 instead of 3 marks

Question 5 – electrostatics

5.1 The electrostatic force between two point charges is directly proportional to the product of their charges✓ and inversely proportional to the square of the distance between their centres✓.

(2)

5.2 $F = kQ_1Q_2/r^2$ ✓

$= (9 \times 10^9)(5 \times 10^{-9})(10 \times 10^{-9})$ ✓$/ (0.006)^2$✓

$= 1.25 \times 10^{-2}$ N✓ (4)

5.3 $Q_{new} = Q_1 + Q_2/2$

$= (5 \times 10^{-9}) + (-10 \times 10^{-9})/ 2$✓

$= -2.5 \times 10^{-9}$ C✓ (2)

5.4 $Q_{transferred} = Q_{final} - Q_{initial}$✓

$= (-2.5 \times 10^{-9}) - (5 \times 10^{-9})$ ✓

$= -7.5 \times 10^{-9}$ C

$n = Q/e$✓

$= -7.5 \times 10^{-9}/-1.6 \times 10^{-19}$✓

$= 4.7 \times 10^{10}$ electrons ✓ (5)

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Question 6

6.1.1 $V_f = v_i + a\Delta t$ ✓

$V_f = 0 + (2)(10)$ ✓

$V_f = 20 m \cdot s^{-1}$ ✓

(3)

6.1.2

Option 1/*Opsie 1*	Option 2/*Opsie 2* Positive marking from 4.1/*Positiewe nasien vanaf 4.1*	Option 3/*Opsie 3* Positive marking from 4.1/*Positiewe nasien vanaf 4.1*
$\Delta x = v_i\Delta t + \frac{1}{2} a\Delta t^2$ ✓	$v_f^2 = v_i^2 + 2a\Delta x$ ✓	$\Delta x = (\frac{v_f + v_i}{2})\Delta t$ ✓
$\Delta x = \underline{(0)(10) + \frac{1}{2}(2)(10)^2}$ ✓	$20^2 = 0^2 + 2(2)\Delta x$ ✓	$\Delta x = (\frac{20 + 0}{2})10$ ✓
$\Delta x = 0 + 100$	$\Delta x = 100$ m ✓	$\Delta x = 100$ m ✓
$\Delta x = 100$m ✓		

(3)

6.2 $V_f^2 = v_f^2 + 2a\Delta x$ ✓

$\underline{(2v_i)^2}$ ✓ = $\underline{v_i^2 + 2(5)(3500)}$ ✓

$4v_i^2 = v_i^2 + 35\,000$

$3v_i^2 = 35\,000$

$V_i^2 = 11\,666.67$

$V_i = 108{,}01\ m \cdot s^{-1}$

$V_f = v_i + a\Delta t$

$216{,}02$ ✓ = $\underline{108{,}01 + (5)\Delta t}$ ✓

$5\Delta t = 108{,}01$

$\Delta t = 21{,}60$ s ✓

(6)

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Question 7 – graphs of motion

7.1.1 5 m.s^{-1} ✓ EAST ✓ (2)

7.1.2 8.4 m.s^{-1} ✓✓ (Accept 8,2 to 8,6 m.s^{-1}) (2)

7.2.1 The velocity is uniformly increasing / *Die snelheid verhoog eenvormig* ✓
Positive acceleration/ *Positiewe versnelling* ✓ (2)

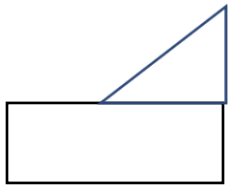
7.2.2 Constant velocity/ *Konstante snelheid* ✓✓ **OR/** ***OF*** acceleration is equal to zero / *Versnelling is gelyk aan nul*
No acceleration / *Geen versnelling* (2)

7.3.1 Distance **A** to **C** / *Afstand vanaf **A** na **C**.*

$\Delta x = (l \times b) + (1/2\ bh)$ ✓

$\Delta x = (5 \times 350)$✓ + $(1/2 \times 150 \times 5)$ ✓

$\Delta x = 2\ 125$ m ✓



Breaking it up into one big rectangle and small triangle is the easiest

7.3.2 $a = (v_f - v_i)/\Delta t$

$= (0 - 10)/50$ ✓✓

$= -0,2$ ✓

$a = 0,2$ m.s^{-2} west / *wes* ✓ (4)

4.4 Gradient/slope is the steepest / *Gradiënt/h… is die steilste.* ✓✓ (2)
[18]

When a question says "use the graph" we must use the gradient and area under the graph, and not the equations of motion.

Extension question

4.2.1 $V_1 = 22\ V$ ✓ (1)

4.2.2 $V_2 = 0\ V$ ✓ (1)

4.2.3 $A_1 = 0\ A$ ✓ (1)

4.3

Option 1/*Opsie 1:*

$R = \frac{V}{I}$ ✓

$28 = \frac{21}{I_2}$ ✓

$I_2 = 0,75\ A$

Option 2/*Opsie 2:*

$R_1 = (14 \times 2) = 28\Omega$ [V_{R1} is x2 that of/van 14 Ω] ✓

$R_{14\Omega} = \frac{V}{I}$

$14 = \frac{7}{I_{top}}$

$I_{top} = 0,5\ A$ ✓

$\therefore I_2 = \left(\frac{3}{2}\right) I_{top} = \left(\frac{3}{2}\right)(0,5)$ $\left[R_{series} = \left(\frac{2}{3}\right)(R_{bottom})\right]$

$\therefore I_2 = 0,75\ A$

Option 1/*Opsie 1:*

Step 1/*Stap 1:* Calculate I_{total}

Or/of

$R_{14\Omega} = \frac{V}{I}$

✓ $14 = \frac{7}{I_{top}}$

$I_{top} = 0,5\ A$

$I_{total} = 0,5 + 0,75$ ✓

$I_{total} = 1,25\ A$

I_{total} divides/*verdeel* 3 : 2

$I_2 = \frac{3}{5} I_{total}$

$\therefore I_{total} = \frac{5}{3}(0,75) = 1,25\ A$ ✓

Or/of

$I_{total} = 0,5 + 0,75$ ✓

$I_{total} = 1,25\ A$

Step 2/*Stap 2:* Calculate r/*Bereken r*

$V_{lost/verlore} = Ir$ ✓

$(22-21) = (1,25)\ r$ ✓

$R = 0,8\ \Omega$ ✓

Other formulae/

$emf = V_{terminal} + V_{lost}$

Option 2/*Opsie 2:*

Step 1/*Stap 1:* Calculate I_{total}/*Bereken* I_{totaal}

Or/*of*

$R_{14\Omega} = \frac{V}{I}$

$14 = \frac{7}{I_{top}}$ ✓

$I_{top} = 0,5\ A$

$I_{total} = 0.5 + 0,75$ ✓

$I_{total} = 1,25\ A$

I_{total} divides/*verdeel* 3 : 2

$I_2 = \frac{3}{5} I_{total}$

$\therefore I_{total} = \frac{5}{3}(0,75)$ ✓ $= 1,25\ A$

Or/*of*

$I_{total} = 0,5 + 0,75$ ✓

$I_{total} = 1,25\ A$

Step 2/*Stap 2:* Calculate r/*Bereken r*

$\frac{1}{R_{total}} = \frac{1}{R_{series}} + \frac{1}{R_2}$

$\frac{1}{R_{total}} = \frac{1}{(14+28))} + \frac{1}{28}$

$\frac{1}{R_{total}} = \frac{2+3}{84}$

$R_{total} = 16,8\ \Omega$

$emf = IR + Ir$ ✓

$22 = 1,25(16,8) + 1,25\ r$ ✓

$r = 0,8\ \Omega$ ✓

Notes/*Aantekeninge*:

Accept $R = \frac{R_1 R_2}{R_1 + R_2}$

Aanvaar $R = \frac{R_1 R_2}{R_1 + R_2}$

OPTION 3:

Step 1:

$\frac{1}{R_{total}} = \frac{1}{R_{series}} + \frac{1}{R_2}$

$\frac{1}{R_{total}} = \frac{1}{(14+28))} + \frac{1}{28}$

$\frac{1}{R_{total}} = \frac{2+3}{84}$

$R_{total} = 16,8\ \Omega$

Notes/*Aantekeninge*:

Accept $R = \frac{R_1 R_2}{R_1 + R_2}$

Aanvaar $R = \frac{R_1 R_2}{R_1 + R_2}$

Step 2: $I_{total} = \frac{V_{ext}}{R_{total}} = \frac{21}{16.8} = 1.25A$ ✓

emf = IR + Ir ✓
22 = 1,25(16,8) + 1,25 r ✓
r = 0,8 Ω ✓

(4)

Question 9

We first calculate the force of Q1 on Q2:

$$F_1 = \frac{kQ_1Q_2}{r^2}$$

$$= \frac{(9 \times 10^9)\,(3 \text{ X } 10\text{-}9)(7 \text{ X } 10\text{-}9)}{0{,}08^{\,2}}$$

$$= \text{ 2,95 x 10-5 N right}$$

Next we calculate the force of Q3 on Q2:

$$F_2 = \frac{kQ_1Q_2}{r^2}$$

$$= \frac{(9 \times 10^9)(7 \times 10^{-9})(5 \times 10^{-9})}{0{,}13^{\,2}}$$

$$= \text{ 7,99 x 10-6 N right}$$

Now we calculate the total force:

$$F_{\text{total}} = F_1 + F_2$$

$$= \text{ 2,95 x 10-5 } + \text{ 7,99 x 10-6}$$

$$= \text{ 3,75x 10-5 N right}$$