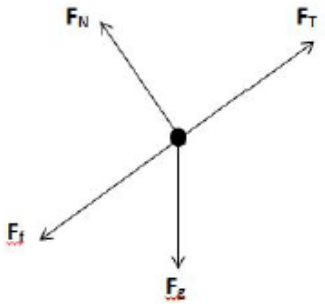
HILLCREST HIGH SCHOOL
PHYSICAL SCIENCE
GRADE 11
PAPER 1 - Physics memo

NOVEMBER 2022
TIME: 2 HRS

Total: 100

1.1 C
1.2 A
1.3 B
1.4 C
1.5 B
1.6 D
1.7 B
1.8 B
1.9 B
1.10 A

Question 2 – newton

QUESTION 2		
2.1	When a resultant force is exerted on an object, the object accelerates in the direction of the resultant force. The acceleration is directly proportional to the resultant force and inversely proportional to the mass of the object. ✓✓	(2)
2.2		(4)

2.3		$f_k = \mu_k F_N$ ✓ =(0,3)(3)(9,8)cos(60) ✓✓ =4,41 N ✓	(4)
2.4	2.4.1	**Up the plane as positive/Op teen skuinsvlak as positief** $F_{net} = ma$ ✓ 3 kg: $T - (3)(9,8)\sin 60 - 4,41 = 3a$ ✓ $T - 29,87 = 3a$ 2 kg: $70 - T - 1,96 - (2)(9,8)\sin 60 = 2a$ ✓ $51,07 - T = 2a \quad 21,2 = 5a$ $a = 4,24\ m.s^{-2}$ ✓	(4)
	2.4.2	$T = 3(4,24) + 29,87$ $= 42,59\ N$ ✓✓ OR/OF Positive marking from 2.4.1	$T = 51,07 - 2(4,24)$ $= 42,59\ N$ ✓✓ (2)
			[16]

Question 3

3.1 Each particle/body in the universe attracts every other particle/body with a gravitational force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centres.

3.2 2×10^3 N

Option 1:

$F = Gm_1m_2 / r^2$ ✓

(2×10^3) ✓ $= \frac{(6{,}67 \times 10^{-11})(5{,}98 \times 10^{24})(400)}{r^2}$ ✓

$r = 8{,}93 \times 10^6$ m ✓

Distance above Earth's surface/ Afstand bo Aardoppervlak =

$= (8{,}93 \times 10^6) - (6{,}38 \times 10^6)$

$= 2{,}55 \times 10^6$ m $= 2{,}55 \times 10^3$ km ✓

Option 2:

$F = \frac{Gm_1m_1}{r^2}$ ✓

2×10^3 ✓ $= \frac{(6{,}67 \times 10^{-11})(5{,}98 \times 10^{24})(400)}{(h+(6{,}38 \times 10^6))^2}$ ✓ ✓

$(h + 6{,}38 \times 10^6)^2 = 7{,}99732 \times 10^{13}$

$h + 6{,}38 \times 10^6 = 8{,}93 \times 10^6$

$h = 2{,}55 \times 10^6$ m

$= 2{,}55 \times 10^3$ km ✓ (2551,58 km)

Question 4 – vectors

4.1 The vector sum of two or more vectors. ✓✓
Die som van twee of meer vektore.

OR/*OF*

A single vector having the same effect as two or more vectors acting together. ✓✓
'n Enkele vektor wat dieselfde effek het as twee of meer vektore wat saam inwerk. (2)

4.2.1

OPTION 1/ *OPSIE 1*	**OPTION 2/ *OPSIE 2***
$T_{2X} = T\cos\theta$	$T_{2X} = T\sin\theta$
$T_{2X} = 245 \cos 30^o$ ✓	$T_{2X} = 245 \sin 60^o$ ✓
$T_{2X} = 212,18$ N ✓ right	$T_{2X} = 212,18$ N ✓
$T_{2Y} = T\sin\theta$	$T_{2Y} = T\cos\theta$
$T_{2Y} = 245 \sin 30^o$ ✓	$T_{2Y} = 245 \cos 60^o$ ✓
$T_{2Y} = 122,5$ N ✓ right	$T_{2Y} = 122,5$ N ✓

(4)

4.2.2 $T_1 = T_{2X}$ ✓
$T_1 = 212,18$ N ✓ left (2)

4.2.3 $W = T_{2Y}$
$W = 122,5$ N
$W = mg$
Any one/*Enige een* ✓
$122,5 = m \times 9,8$ ✓
$m = 12,5$ kg ✓ (3)

[11]

Question 5 – electrostatics

5.1.1 Positive ✓ (1)

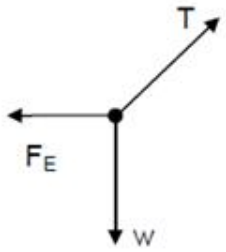
5.1.2

Marking criteria/*Nasienriglyne:*
- Appropriate formula /*Toepaslike formule*✓
- Whole substitution *Hele vervanging*✓/
- Final answer/*finale antwoord*: 2,26 x 10^{-6} C ✓

OPTION 1/*OPSIE* 1	**OPTION 2/*OPSIE* 2**
$F = \frac{kQ_1Q_2}{r^2}$ ✓ $3,05 = \frac{(9 \times 10^9)(6 \times 10^{-6})Q}{0,2^2}$ ✓ $Q = 2,26 \times 10^{-6}$ C ✓	$E = \frac{kQ}{r^2}$ $= \frac{(9 \times 10^9)(6 \times 10^{-6})}{0,2^2}$ $= 1,35 \times 10^6$ N·C^{-1} F = Eq✓ $3,05 = (1,35 \times 10^6)q$✓ $q = 2,26 \times 10^{-6}$C ✓

(3)

5.1.3



Accepted labels/*Aanvaarde benoemings*	
W✓	F_g / F_w / weight / mg / gravitational force *F_g / F_w / gewig / mg / gravitasiekrag*
T✓	F_T / tension / *spanning*
F_E/F✓	Electrostatic force/ Coulomb force/ $F_{E\ Field}$/$F_{x\ on\ Y}$ / 3,05 N *Elektrostatiese krag/ Coulombkrag*

5.1.4

$F_{net} = 0$
$F_E = T\sin10°$
$F_E = T\cos80°$
[3,05 = Tsin10°✓]✓ [**IF /*INDIEN*** $T\cos10° = 3,05\ (\frac{1}{3})$]

OR/OF

[3,05 = Tcos80°✓]✓ [**IF/*INDIEN*** $T\sin80° = 3,05\ (\frac{1}{3})$]

T = 17,56 N ✓ (17,564 N)

(3)

*sine rule could also be used

5.2.1 The electric field at a point is the (electrostatic) force experienced per unit positive charge placed at that point. ✓✓

OR/*OF*

The electric field at a point is the (electrostatic) force experienced by a UNIT positive charge placed at that point. ✓✓ (2)

5.2.2

OPTION 1/*OPSIE 1*

Electric field at **M** due to **A** ($+2 \times 10^{-5}$ C):

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

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

$$= 4,5 \times 10^6 \text{ N·C}^{-1}$$

Electric field at **M** due to **B** (-4×10^{-5} C):

$$E_B = \frac{kQ}{r^2}$$

$$= 9 \times 10^9 \frac{(4 \times 10^{-5})}{(0,2)^2} \checkmark$$

$$= 9 \times 10^6 \text{ N·C}^{-1}$$

OR/*OF*

$q_B = 2q_A$

$E_B = 2E_A$ ✓

$= 9 \times 10^6 \text{ N·C}^{-1}$

E_{net} at **M** $= E_A + E_B$

$= (4,5 \times 10^6 + 9 \times 10^6)$ ✓

$= 1,35 \times 10^7 \text{ N·C}^{-1}$ ✓ to the right/*na regs*/towards B/*na B* /*away from A / weg vanaf A*✓

OPTION 2/OPSIE 2

Net electrostatic force at M / *Netto elektrostatiese krag by M*

$$F_{net} = \frac{kQ_1Q_2}{r^2} + \frac{kQ_1Q_2}{r^2}$$

$$= \frac{(9 \times 10^9)(2 \times 10^{-5})q}{(0,2)^2} + \frac{(9 \times 10^9)(4 \times 10^{-5})q}{(0,2)^2} \checkmark \text{ (any one/ } enige\ een)$$

$= 4,5 \times 10^6 q +\checkmark 9 \times 10^6 q$

$= 1,35 \times 10^7 q$ N

If/*Indien* $F = \frac{kQ}{r^2}$ Max/*Maks* 2/6

$F_{net} = E_{net} q$ ✓

$1,35 \times 10^7 q$ ✓$= E_{net} q$

$E_{net} = 1,35 \times 10^7 \text{ N·C}^{-1}$ ✓to the right/*na regs* ✓/towards B / *na B*

(6)

[18]

Question 6 – circuits

6.1 24 J of work ✓done per unit positive charge ✓(+1C) moving from one point in the circuit to another

OR

It is the amount of work done (24 J) per unit positive charge (+1C) moving it from one point in the circuit to another (2)

6.2

V=IR ✓

(24-22,26)=I(0,5) ✓

I=3,48 A

$V_{5\Omega}$=IR

=(3,48)(5) ✓

=17,4 V

V// = 22,26-17,4 ✓ = 4,86 V

$$P = \frac{V^2}{R} \checkmark$$

$$P = \frac{(4,86)^2}{16} \checkmark$$

= 1,48 W✓ (7)

6.3

Current through/*Stroom deur* 2 Ω: $I = \frac{V}{R} \checkmark = \frac{4,86}{2} \checkmark = 2,43$ A

Current through/*Stroom deur* 16 Ω: $I = \frac{V}{R} = \frac{4,86}{16} = 0,3$ A

I_R = 3,48 – 2,43 – 0,3 ✓ = 0,75 A ✓ (4)

6.4

Increases /*Neem toe* ✓

Total resistance (R_T) increases /*Totale weerstand neem toe*
Total current (I_T) decreases /*Totale stoom neem af* } ✓

∴lost volts (Vi) AND $V_{5\Omega}$ decreases,

Thus since EMF remains constant, when Vint decreases,Vext must increase ✓ (4)

You must say increase or decrease first – otherwise the rest won't be marked

6.5

$W = P\Delta t$ ✓
$W = 1,5 \times 3,5$ ✓
$W = 5,25$ kWh
Cost = 5,25 x 1,15
Cost = R6.04 ✓ (3)

Using a general gradient formula is not accepted

Question 7 – circuits graph

QUESTION 7		
7.1	Current ✓	(1)
7.2	Temperature/*Temperatuur* ✓	(1)
7.3	9 V ✓ (Except/aanvaar 8,8 - 9.0)	(1)
7.4	Gradient/*Helling* = $\frac{\Delta V}{\Delta I}$ ✓ = $\frac{1-8.5}{15-0,4}$ (any two points on graph/*enige 2 punte op grafiek*) ✓ = -0.528 ✓ r = 0,51 Ω ✓ (If formula used/Indien formule gebruik - max 2/4)	(4)
		[7]