Province of the EASTERN CAPE EDUCATION

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NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIORSERTIFIKAAT*

GRADE/*GRAAD* 11

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PHYSICAL SCIENCES P1/ *FISIESE WETENSKAPPE V1* MARKING GUIDELINE/*NASIENRIGLYN*

MARKS/*PUNTE*: 150

This marking guideline consists of 12 pages./
Hierdie nasienriglyn bestaan uit 12 bladsye.

QUESTION/*VRAAG* 1: MULTIPLE-CHOICE QUESTIONS/ *MEERVOUDIGEKEUSE-VRAE*

1.1　　D ✓✓ (2)

1.2　　C ✓✓ (2)

1.3　　B ✓✓ (2)

1.4　　C ✓✓ (2)

1.5　　C ✓✓ (2)

1.6　　A ✓✓ (2)

1.7　　B ✓✓ (2)

1.8　　A ✓✓ (2)

1.9　　A ✓✓ (2)

1.10　　C ✓✓ (2)

[20]

QUESTION/*VRAAG 2*

2.1 Forces are in equilibrium when the net force acting at the point is equal to zero. ✓✓

Kragte is in ewewig wanneer die netto kragte wat op 'n punt inwerk gelyk is aan nul.
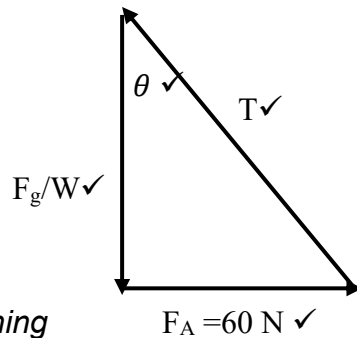
OR/*OF*

It means the forces are balanced and the object will remain stationary/ moving at a constant velocity. ✓✓

Dit beteken dat die kragte gebalanseerd is en die voorwerp bly in rus / beweeg teen 'n konstante snelheid. (2)

2.2

T : Tension /*Spanning*

F_A : Applied Force / *Toegepaste krag*

F_g/W : Weight / *Gewig* **OR/***OF* Gravitational Force / *Gravitasiekrag* (4)

2.3 2.3.1 $T^2 = F_A^2 + F_g^2$ (Pythagoras Theorem/*Stelling*)

$= [60^2 + \underline{(8 \times 9,8)^2}$ ✓] ✓

$= 9746,56$

$T = 98,72$ N ✓ (3)

2.3.2 **OPTION 1 /** *OPSIE 1*   **OPTION 2 /** *OPSIE 2*

$\sin\theta = \dfrac{F_A}{T}$ ✓	$\tan\theta = \dfrac{F_A}{W}$ ✓
$= \dfrac{60}{98,72}$ ✓	$= \dfrac{60}{78,4}$ ✓
$\theta = 37,43°$ ✓	$\theta = 37,43°$ ✓

(3)

2.4 $F_R = 0$ ✓✓ (2)

[14]

QUESTION/*VRAAG 3*

3.1   It is a single force having the same effect as the sum of the forces acting together. ✓✓

Dit is 'n enkele krag wat dieselfde effek het as die som van kragte wat saamwerk.

OR/*OF*

The vector sum of two or more vectors. ✓✓

The vektor som van twee of meer kragte.   (2)

3.2   3.2.1 $f_k = \mu_k \cdot N$ ✓
                  $f_k = [0,33\underline{[2 \times 9,8 - (\mathbf{8,26}\sin20°)} ✓] $ ✓
                  $f_k = 5,54$ N ✓   (4)

        3.2.2   **POSITIVE MARKING FROM QUESTION 3.2.1 /** *POSITIEWE NASIEN VANAF VRAAG 3.2.1*

                  $F_{net} = ma$
                  $F\cos\theta - T - f = ma$
                  $T - f = ma$
                  $[\mathbf{8,26}\underline{\cos 20°}$ ✓$- T - 5,54 = 0]$ ✓
                  $T = 2,22$ N
                  $T = f$ (for block A/ *vir blok A*)
                  $f_k = \mu_k \cdot N$
                  $2,22$ ✓ $= \underline{\mu_k(1,5 \times 9,8)}$ ✓
                  $\mu_k = 0,25$ ✓   (6)
                                                                          [12]

QUESTION/*VRAAG 4*

4.1   A body will remain in its state of rest or motion at constant/uniform velocity ✓
unless a non-zero resultant/net force acts on it. ✓

*'n Liggaam sal in sy toestand van rus of beweging teen konstante snelheid bly
tensy 'n nie-nul resulterende/netto krag daarop inwerk.*   (2)

4.2   There is air friction on the container downwards. ✓✓

Daar is lugweerstand op die houer afwaarts.

There is an extra downward force ✓✓/ *Daar is 'n ekstra afwaartse krag*   (2)

4.3   W = mg ✓

1960 = m 9,8 ✓

m = 200 kg ✓   (3)

4.4   **POSITIVE MARKING FROM QUESTION 4.3 /** *POSITIEWE NASIEN VANAF*
VRAAG 4.3

F_{net} = ma
$T - F_g - F_{Fair}$ = ma   } ✓

T – 1960 – 140 ✓ = (200)(0,13) ✓ = 26

T = 2126 N ✓   (4)

4.5   2 100 N ✓   (1)

[12]

QUESTION/*VRAAG 5*

5.1   When a net force is applied to an object, the object accelerates in the direction of the net force. The <u>acceleration</u> is <u>directly proportional to the (net) force</u> ✓ and <u>inversely proportional to the mass</u> ✓ of the object.

Wanneer 'n resulterende/netto krag op 'n voorwerp inwerk, sal die voorwerp in die rigting van die krag versnel teen 'n <u>versnelling</u> <u>direk eweredig aan die krag</u> en <u>omgekeerd eweredig</u> aan die <u>massa</u> van die voorwerp.

OR/*OF*

The acceleration is <u>directly proportional to the net force</u> ✓ and <u>inversely proportional to the mass</u> ✓ of the object.
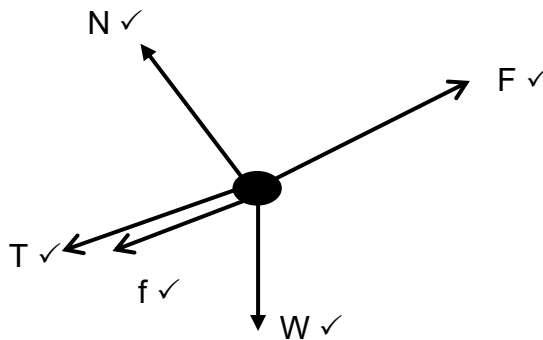
Die versnelling is direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp.

OR/*OF*

The net force is equal to the rate of change of momentum, the net force and change in momentum are in the same direction. ✓✓ **(2 or 0)**

Die netto krag is gelyk aan die tempo van verandering van momentum, die netto krag en verandering in momentum is in dieselfde rigting. (2 of 0)   (2)

5.2

(5)

5.3 $F_{net} = ma$ ✓

$F - F_{g//} - T - f = ma$ ⎤
                               ⎬ Any one / *Enige een* ✓
$T - F_{g//} - f = ma$ ⎦

$T - (1 \times 9,8\sin30°) - 1 = a$ .... 1 ✓

$\underline{20 - (2 \times 9,8\sin30° - T - 2}$ ✓ $= 2a$ .....2 ✓

$a = 2,15$ m.s^{-2} ✓

Formula
Calculating F_g for both blocks *Bereken F_g vir beide blokke*
Substituting for 1 kg block *Vervang vir 1 kg-blok*
Substituting for 2 kg block *Vervang vir 2 kg-blok*
Substituting for both 2a and a *Vervang vir beide 2a en a*
Answer/ *Antwoord*

(6)
[13]

QUESTION/*VRAAG* 6

6.1 Every particle in the universe attracts every other particle with a <u>force</u> that is <u>directly proportional to the product of their masses</u>, ✓ and <u>inversely proportional to the square of the distance between their centres</u>. ✓

Elke deeltjie in die heelal trek elke ander deeltjie aan met 'n <u>gravitasiekrag</u> wat <u>direk eweredig is aan die produk van hul massas</u> en <u>omgekeerd eweredig is aan die kwadraat van die afstand tussen hulle middelpunte</u>. (2)

6.2 $F = \dfrac{Gm_1m_2}{r^2}$ ✓

$F = \dfrac{(6{,}67 \times 10^{-11})(5{,}98 \times 10^{24})(4600)}{(6{,}38 \times 10^6 + 28 \times 10^6)^2}$ ✓ ✓

F = 1552,29 N ✓ (4)

6.3 Weightlessness is the sensation experienced when all contact forces are removed. ✓✓ /
Gewigloosheid is 'n sensasie ervaar wanneer al die kontakkragte verwyder is. (2)

6.4 **OPTION 1 / *OPSIE 1***
Greater than. ✓ The mass is greater ✓ and for the same force ✓ the distance must also be greater. ✓
Groter as. Die massa is groter en vir dieselfde krag moet die afstand groter wees.

OPTION 2
Greater than / *Groter as* ✓
$F = \dfrac{Gm_1m_2}{r^2}$

$1552{,}29 = \dfrac{(6{,}67 \times 10^{-11})(5{,}98 \times 10^{24})(5300)}{R^2}$ ✓

R = 3,69 × 10⁷ m
Distance above the surface of the earth / *Die afstand bokant die oppervlakte van die aarde*
D = 3,69 × 10⁷ – 6,38 × 10⁶ ✓
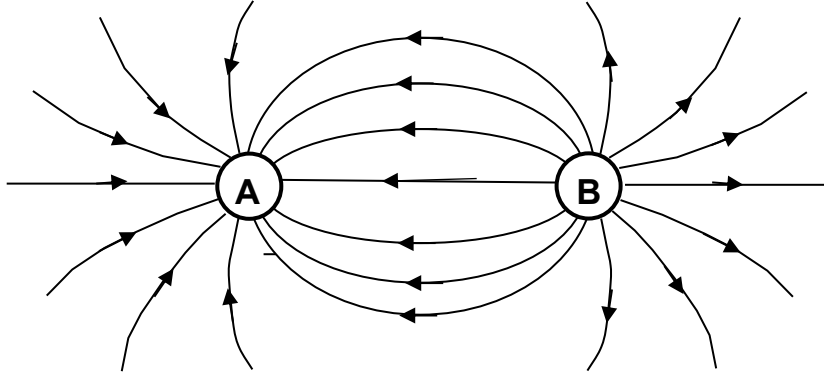   = 3,05 × 10⁷ m ✓ (or/*of* 30520000 m) (4)

[12]

QUESTION/*VRAAG 7*

7.1 Electric field at a point is the <u>electrostatic force</u> experienced <u>per unit positive charge</u> placed at that point. ✓✓

Die elektriese veld by 'n punt is die <u>elektrostatiese krag</u> ondervind <u>per eenheid positiewe lading</u> wat by daardie punt geplaas is. (2)

7.2

CRITERIA FOR MARKING / *NASIENKRITERIA*	
Correct shape / *Korrekte vorm*	✓
Correct field direction / *Korrekte veldrigting*	✓
Lines starting from sphere and not crossing each other *Lyne begin vanaf die sfeer en kruis nie mekaar nie*	✓

(3)

7.3

$$E_1 = \frac{kQ}{r^2} \quad \checkmark$$

$E_1 = \dfrac{9 \times 10^9 (15 \times 10^{-9})}{(2 \times 10^{-2})^2}$ ✓ ✓

$E_1 = 337\,500$ N.C^{-1} to the left / *na links*

$E_2 = \dfrac{9 \times 10^9\,Q}{(8 \times 10^{-2})^2}$ ✓ ✓✓

$E_2 = 1{,}40625 \times 10^{12} \times Q_x$ to the left / *na links*

$E_{net} = E_1 + E_2$

$3{,}943 \times 10^5$ ✓ $= 337\,500 + 1{,}40625 \times 10^{12}\,Q_{xn}$ ✓

$Q_x = (+)4{,}04 \times 10^{-8}$ C ✓ (8)

7.4 Decrease / *Afneem* ✓ (1)

7.5.1 The electrostatic <u>force</u> of attraction or repulsion between two charges is <u>directly proportional to the product of the charges</u> ✓ and <u>inversely proportional to the square of the distance between them</u>. ✓

Die elektrostatiese <u>krag</u> van afstoting of aantrekking wat deur twee puntladings op mekaar uitoefen word, <u>is direk</u> <u>eweredig aan die produk van die grootte van die ladings</u> en <u>omgekeerd eweredig aan die kwadraat van die afstand tussen hulle.</u> (2)

7.5.2 $F = \dfrac{kQ_1Q_2}{r^2}$ ✓

$F_A = \dfrac{(9 \times 10^9)(100 \times 10^{-6})^2}{(0{,}06)^2}$ ✓ ✓

$F_A = 25\,000$ N to the right / *na regs*

$F_B = \dfrac{(9 \times 10^9)(100 \times 10^{-6})^2}{(0{,}03)^2}$ ✓ ✓

$F_B = 100\,000$ N to the right / *na regs*

$F_{net} = F_A + F_B$
$= 25\,000 + 100\,000$ ✓
$= 125\,000$ N to the right / *na regs* ✓ (7)

[23]

QUESTION/*VRAAG 8*

8.1 $\Phi = BA \cos\theta$ ✓

   $= \underline{3,2 \, (\pi 0,04^2)}$ ✓ $\cos 0°$✓

   $= 0,016$ Wb ✓ (or 0,02 Wb)   (4)

8.2 $\varepsilon = \underline{\dfrac{-N\Delta\Phi}{\Delta t}}$ ✓

   28 ✓ $= - \dfrac{250 \, (0,016 \cos 25° - 0,016 \cos 0°)}{\Delta t}$ ✓

   $\Delta t = 0,13$ s ✓   (0,17 s if 0,02 Wb is used / 0,17 s as 0,02 Wb gebruik is)   (4)

8.3   Faraday's Law. ✓ The magnitude of the <u>induced emf</u> across the <u>end of a conductor</u> is <u>directly proportional to the rate of change in the magnetic flux</u> linkage with the conductor. ✓✓

   Faraday se wet. Die grootte van die <u>geïnduseerde emk</u> oor die <u>ente van 'n geleier</u> is <u>direk eweredig aan die tempo van verandering van die magnetiese vloedkoppeling</u> met die geleier.   (3)

8.4   8.4.1   Smaller than / *Kleiner as* ✓   (1)

   8.4.2   The area of a square is smaller than the area of a circle with the radius equal to the side length of the square. ✓✓

   Die oppervlak van 'n vierkant is kleiner as die oppervlak van 'n sirkel met die radius gelyk aan die lengte van die sye van 'n vierkant.

   OR/*OF*

   $0,04^2 < \pi \times 0,04^2$ area of square is smaller than area of circle ✓✓ / *oppervlakte van 'n vierkant is kleiner as die oppervlak van 'n sirkel.*

   OR/*OF*

   $\mathcal{E}$ directly proportional to / *direk eweredig aan* A ✓✓   (2)

   [14]

QUESTION/*VRAAG 9*

9.1   The <u>maximum energy per coulomb of charge</u> supplied by the battery. ✓✓

Die <u>maksimum energie per coulomb lading</u> wat deur 'n battery verskaf word.   (2)

9.2 $\dfrac{1}{R_p} = \dfrac{1}{R_1} + \dfrac{1}{R_2}$ ✓

$\dfrac{1}{R_p} = \dfrac{1}{8} + \dfrac{1}{\boxed{9+15}}$ ✓ ✓

$R_p = 6\ \Omega$

$R_{ext} = 6 + 3$ ✓

$R_{ext} = 9\ \Omega$

emf = I(R + r) ✓

12 = I(9 + 0,6) ✓

I = 1,25 A ✓   (7)

9.3   V = IR ✓

V = (1,25)(9) ✓

V = 11,25 V ✓   (3)

9.4   Increase / *Toeneem* ✓   (1)

9.5   Total external resistance increases / *Totale eksterne weerstand neem toe* ✓

Total current decreases / *Totale stroom neem af* ✓

Lost volts decreases/ *Verlore volts neem af* ✓   (3)

9.6 $W = \dfrac{V^2 \Delta t}{R}$ ✓

$= \left[\dfrac{240^2 \times [30 \times 60]}{48}\right.$ ✓ $\left.\right]$ ✓

= 2160 000 J

Cost /koste = $\dfrac{2160\ 000}{(3600 \times 1000)} \times 2,56$ ✓

= R 0,882 ✓   (5)

[21]

QUESTION/*VRAAG 10*

10.1   The potential difference across a conductor is directly proportional to the current in the conductor at constant temperature. ✓✓

Die potensiaalverskil oor 'n geleier is direk eweredig aan die stroom deur die geleier by konstante temperatuur.

<div align="center">**OR/***OF*</div>

The ratio of potential difference to the current is a constant provided the temperature remains constant. ✓✓

Die verhouding van potensiaalverskil tot die stroom is konstant mits die temperatuur konstant bly.   (2)

10.2   Inverse of resistance / *Omgekeerde van weerstand* ✓   **OR/***OF* 1/R ✓   (1)

10.3   Y ✓   The inverse of the gradient of graph Y is greater / *Die omgekeerde van die helling van grafiek Y is groter* ✓

OR/*OF*

Gradient of graph Y smaller /
Helling van grafiek Y is kleiner. ✓

Thus /*daarom* 1/R smaller / *kleiner* ✓

OR /*OF*

Hence/ *daarom*, R is greater/ *is groter.* ✓   (2)

10.4   **OPTION 1 /** *OPSIE 1*   **OPTION 1 /** *OPSIE 2*
R_X = inverse of gradient / $R = \dfrac{V}{I}$ ✓
omgekeerde helling

gradient $= \dfrac{\Delta I}{\Delta V}$ $R = \dfrac{6}{0,3}$ ✓ ✓

$m = \dfrac{0,4 - 0,2}{8 - 4}$ ✓ ✓ $R = 20\ \Omega$ ✓

$m = 0,05$

$R_X = \dfrac{1}{0,05}$ ✓

$R_X = 20\ \Omega$ ✓   (4)

(Any other correct values from graph / *Enige ander korrekte waardes vanaf die grafiek*)   **[9]**

<div align="right">**TOTAL/***TOTAAL***:   150**</div>