Province of the
EASTERN CAPE
EDUCATION

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NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIOR SERTIFIKAAT*

GRADE/*GRAAD* 12

SEPTEMBER 2025

TECHNICAL SCIENCES P1/ *TEGNIESE WETENSKAPPE V1* MARKING GUIDELINE/*NASIENRIGLYN*

MARKS/*PUNTE*: 150

This marking guideline consists of 13 pages./
Hierdie nasienriglyn bestaan uit 13 bladsye.

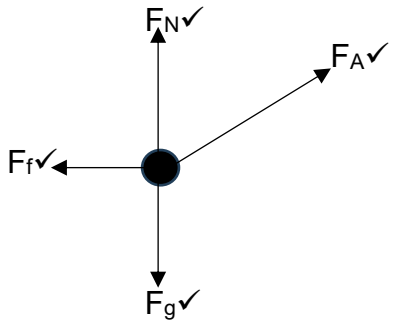
QUESTION/*VRAAG* 1

1.1	C ✓✓	(2)
1.2	C ✓✓	(2)
1.3	C ✓✓	(2)
1.4	A ✓✓	(2)
1.5	A ✓✓	(2)
1.6	B ✓✓	(2)
1.7	D ✓✓	(2)
1.8	B ✓✓	(2)
1.9	D ✓✓	(2)
1.10	A ✓✓	(2)

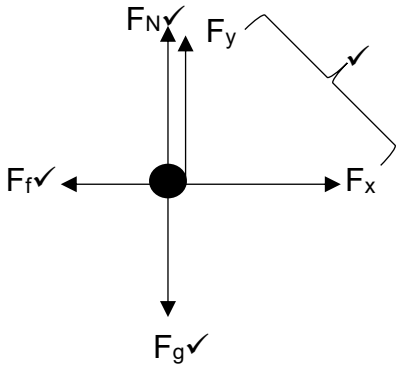
[20]

QUESTION/*VRAAG* 2

2.1 **OPTION1/ *OPSIE 1***



OPTION 2/ *OPSIE 2*



(4)

NOTES/*NOTAS*:
Allocate mark for arrow and label. /
Gee punt vir pyltjie en byskrif.

Penalise once if/*Penaliseer slegs:*
No arrows/ *Geen pyltjies*
Gaps between the line and the arrow./ *Spasies tussen die lyn en die pyltjie*
Dotted lines are used./ *Stippellyne is gebruik*
Additional force is included./ *Additionele kragte is ingesluit*

Acceptable labels/ *Aanvaabare byskrifte*:
Normal force/*Normale Krag*: N/F_N/ F_{normal}
Applied force/ *Toegepasde krag*: F/F_A/ F_{Ntombi}/150N
Gravitational force(weight)/*Gravitasie Krag(gewig)*: Fg/w/$F_{gravity}$
Vertical component of F_{Ntombi}/ *Vertikale komponent van* F_{Ntombi} *:* F_V/F_y
Horizontal component of FNtombi/ *Vertikale component van* F_{Ntombi} :F_H/F_x
Frictional force/ *Wrywings krag*: *f*/F_f

2.2 **APPLY NEGATIVE MARKING / *NEGATIEWE NASIEN WORD TOEGEPAS***
Newton's First law. ✓
An object continues in a state of rest or uniform (moving with constant) velocity ✓ unless it is acted upon by a net (resultant) force.✓

Newton se Eerste Wet
'n Liggaam sal in sy toestand van beweging of in rus of beweging teen uniforme (konstante) snelheid volhard, totdat 'n netto (ongebalanseerde of resulterende krag) daarop inwerk. (3)

2.3 It will remain at rest because the net force acting on it is zero. ✓✓

OR

It will remain at rest as long as the horizontal component (F_X) of the pulling force is equal to the static friction.

Dit sal in rus bly omdat die nettokrag wat daarop inwerk nul is.

OF

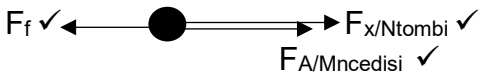
Dit sal in rus bly solank die horisontale komponent (F_x) van die trekkrag gelyk is aan die statiese wrywing. (2)

2.4 2.4.1 Tension is a (pulling) force acting in a string or rope. ✓✓
Force applied by Ntombi (F_{Ntombi})/F_{150}/150 N ✓

Spanning is 'n (trek) krag wat in 'n string of tou inwerk.
Krag toegepas deur Ntombi (F_{Ntombi})/ F_{150} / 150 N (3)

2.4.2 Decreases/*Verminder* ✓✓ (2)

2.4.3



(3)

NOTES/ *NOTAS*:
Allocate mark for arrow and label. /
Een punt vir pyltjie en byskrif
Penalise once if/ *Penaliseer slegs vir:*
No arrows / *Geen pyltjies*
Gaps between the line and the arrow. /
Spasies tussen die lyn en pyltjie.
Dotted lines are used. /
Stippellyne word gebruik.
Additional force is included. /
Additionele krag ingesluit.
Vertical force included./
Vertikale krag ingesluit.

Acceptable labels/
***Aanvaarbare byskrifte*:**
Applied force /*Toegepasde krag*:F_x /F_A/F_{Ntombi}/$F_{A/Mncedisi}$
Horizontal component of F_{Ntombi}/
Horisontale component van F_{Ntombi}: F_H/F_x
Frictional force /
Wrywingskrag: *f*/F_f

2.4.4 East to be positive/ *Oos as positief*
$F_{net} = F_x + F_{Mncedisi} + f_k$
$F_{net} = F_{x/Ntombi} \text{ Cos } 60° + F_{Mncedisi} + f_k$ ✓
$105 = 150$ ✓ Cos 60° ✓ + f_k
$f_k = -50$ N

$f_k = \mu_k N$
$f_k = \mu_k (F_g - F_{Ntombi} \text{ Sin } 60°)$ ✓
$f_k = \mu_k (mg - F_{Ntombi} \text{ Sin } 60°)$
$50 = \mu_k (200 \times 9,8 - 150 \text{ sin } 60°)$ ✓
$50 = \mu_k (1960 - 129,904)$
$\mu_k = 0,027/0,03$ ✓ (6)
[23]

QUESTION/*VRAAG* 3

3.1 Momentum is the product of an object's mass and its velocity. /✓✓
Momentum is die produk van 'n voorwerp se massa en sy snelheid. (2)

3.2 $v_{i\ minibus} = 120 \times \frac{1000}{3600}$ ✓
= 33,33 m.s^{-1}, east/*oos* ✓ (2)

3.3 $p = m_{car}\, v_{i\ car}$ ✓
= 1 100 x 16,67 ✓
= 18 337 kg.m.s^{-1}, west/*wes* ✓ (3)

3.4 3.4.1 An isolated system is one on which the net external force acting on the system is zero. ✓✓
'n Geïsoleerde stelsel is een waarop die netto eksterne krag wat op die stelsel inwerk nul is. (2)

3.4.2 **POSITIVE MARKING FROM 3.2/ *POSITIEWE NASIEN VAN VRAAG 3.2***

$\Sigma E_{ki} = \frac{1}{2} m_{minibus} v_{i\ minibus}^2 + \frac{1}{2} m_{car/\text{motor}} v_{i\ car/motor}^2$

$= \frac{1}{2}(1500)(33{,}33)^2 + \frac{1}{2}(1100)(-16{,}67)^2$ ✓

= 985 255,65J

✓

$\Sigma E_{kf} = \frac{1}{2} m_{minibus} v_{f\ minibus}^2 + \frac{1}{2} m_{car/motor} v_{f\ car/\ motor}^2$

$= \frac{1}{2}(1500)(20{,}3)^2 + \frac{1}{2}(1100)(5{,}32)^2$ ✓

= 324 633,82 J

$\Sigma E_{ki} \neq \Sigma E_{kf}$ /(Kinetic energy is not conserved/*Kinetiese energie is nie behoue*) ✓
Therefore, the collision is inelastic. /
Daarom is die botsing onelasties ✓
NOTE: if $\Sigma E_{ki} = \Sigma E_{kf}$ is used (4/5 max)
NOTAS: *as $\Sigma E_{ki} = \Sigma E_{kf}$ gebruik word (4/5 mak)* (5)

3.5 3.5.1 Inversely proportional./*Omgekeerd eweredig* ✓✓

OR

$F_{net} = \frac{1}{\Delta t}$

OR

When the contact time increases/decrease, the net force decreases/ increase. /
Wanneer die kontaktyd toeneem/afneem, verminder/vermeerder die netto krag.

NOTE: Give full mark for mathematical expression
LET WEL: *Gee volle punt vir wiskundige uitdrukking* (2)

3.5.2 Equal to/ *Gelyk aan* ✓ (1)

3.5.3
- Impulse remains constant. ✓
- Airbags increase the contact time during the crash. ✓
- The longer the contact time, the smaller the force ✓ exerted by the occupants on the vehicle and the lesser is the extent of injuries. ✓ /

- *Impuls bly konstant.*
- *Lugsakke verhoog die kontaktyd tydens die ongeluk.* ✓
- *Hoe langer die kontaktyd, hoe kleiner die krag* ✓ *wat die insittendes op die voertuig uitoefen en die omvang van beserings is minder.* ✓

(3)

3.5.4

OPTION 1/ *OPSIE 1*

Direction towards the tree be positive./ *Rigting na die boom positief wees*.

$F_{net}\Delta t = \Delta p$

$F_{net}\Delta t = m(v_f - v_i)$ ✓

$-57\,500\Delta t$ ✓ $= 1\,150(0 - 15)$ ✓

$\Delta t = 0{,}30$ s ✓

OPTION 2/ *OPSIE 2*

Direction towards the tree be negative. / *Rigting na die boom negatief wees.*

$F_{net}\Delta t = \Delta p$

$F_{net}\Delta t = m(v_f - v_i)$

$57\,500\Delta t = 1\,150\{0 - (-15)\}$

$\Delta t = 0{,}30$ s

(4)
[24]

QUESTION/*VRAAG* 4

4.1 4.1.1 The sum of gravitational potential energy and kinetic energy of an isolated system remains constant. ✓✓

OR

The total mechanical energy in an isolated system remains constant.

Die som van gravitasie potensiële energie en kinetiese energie van 'n geïsoleerde sisteem bly konstant.

OF

Die totale meganiese energie in 'n geïsoleerde stelsel bly konstant. (2)

4.1.2 $M_E = E_P + E_K$
$= mgh + ½mv^2$ ✓
$= (0,55)(9,8)(8) + 0$ ✓
$= 43,12$ J ✓ (3)

4.1.3 **POSITIVE MARKING FROM 4.1.2 /** ***POSITIEWE NASIEN VAN 4.1.2***

$M_{E\,(3,5m)} = M_{E\,(8m)}$
$mgh + ½mv^2 = M_{E\,(8m)}$ ✓

$(0,55)(9,8)(3,5)$ ✓ $+ ½(0,55)v^2$ ✓ $= 43,12$ ✓
$v = 9,39\ m{\cdot}s^{-1}$ ✓ (5)

4.1.4 43,12 J ✓
Mechanical energy remains constant, ✓ and E_p is zero. ✓
Meganiese energie bly konstant, en E_p is nul. (3)

4.2 4.2.1 $F_g = mg$
$= (200)(9,8)$ ✓
$= 1\ 960$ N ✓ (2)

4.2.2 **POSITIVE MARKING FROM 4.2.1/*POSITIEWE NASIEN VAN 4.2.1***
$W = F\Delta y \cos\theta$ ✓
$W = F\Delta x \cos\theta$ (**Accept/** ***Aanvaar***)
$= (1\ 960)$ ✓ $(3)\cos 0°$ ✓
$= 5\ 880$ J ✓ (4)

4.2.3 **POSITIVE MARKING FROM 4.2.1 OR 4.2.2 /**
POSITIEWE NASIEN VAN 4.2.1 OF 4.2.2

OPTION 1/*OPSIE 1*

$P_{ave} = Fv_{ave}$ ✓
$= 1960 \times 4$ ✓
$= 7840$ W ✓

OPTION 2/*OPSIE 2*

$v = \frac{\Delta x}{\Delta t}$
$4 = \frac{3}{\Delta t}$
$\Delta t = 0,75$s
$P = \frac{W}{\Delta t}$ ✓
$= \frac{5880}{0,75}$ ✓
$= 7840$ W ✓ (3)

[22]

QUESTION/*VRAAG* 5

5.1 A force which changes the shape and size of a body. ✓✓
'n Krag wat die vorm en grootte van 'n liggaam verander. (2)

5.2 $\sigma = \frac{F}{A}$ ✓
$= \frac{(10)(9,8)}{\pi(0.001)^2}$ ✓ ✓
= 31194368,85 Pa ✓ (**ACCEPT/*ANVAAR***: 3,12 x 10^7Pa) (4)

5.3 $\varepsilon = \frac{\Delta\ell}{L}$ ✓
$= \frac{3 \times 10^{-4}}{1.8}$ ✓
$= 1.67 \times 10^{-4}$ ✓ (3)

5.4 A body that regains its original shape and size when the deforming force is removed. ✓✓
Any correct examples such as steel, springs, etc. ✓

'n Liggaam wat sy oorspronklike vorm en grootte herwin wanneer die vervormende krag verwyder word.
Enige korrekte voorbeelde soos staal, vere, ens. (3)
[12]

QUESTION/*VRAAG* 6

6.1 6.1.1 Refraction/*Breking* ✓ (1)

6.1.2 The bending of light when it passes from one medium to another. ✓✓
Die buiging van lig wanneer dit van een medium na 'n ander medium beweeg. (2)

6.2 6.2.1 Behind the object/*Agter die voorwerp* ✓
ACCEPT: Between the lens and F.
AANVAAR: *Tussen die lens en F.* (1)

6.2.2 **Virtua**l (Cannot be projected on the screen)
Upright (Same orientation as object)
Magnified (Enlarged/Larger than the object.)
Behind the object (On the same side as the object)
} Any 3

Virtueel *(Kan nie op die skerm geprojekteer word nie)*
Regop *(Dieselfde oriëntasie as voorwerp)*
Vergroot *(Vergroot/Groter as die voorwerp.)*
Agter die voorwerp *(Aan dieselfde kant as die voorwerp)*
} *Enige 3* (3)

6.2.3 Telescope/*Teleskoop* ✓
Binoculars/*Verkyker* ✓
ACCEPT: Any correct answers / ***AANVAAR:*** *Enige korrekte antwoorde* (2)

6.3 6.3.1 At infinity ✓ (**ACCEPT**: No image formed)
*By oneindigheid (**AANVAAR**: Geen beeld word gevorm)* (1)

6.3.2 This is because the object is placed exactly at the focal point, where the lens cannot converge the light rays to form a real image. ✓✓

OR

The line passing through the (optical) centre and the line passing through the focal point are parallel/never meet.

Dit is omdat die voorwerp presies by die fokuspunt geplaas is, waar die lens nie die ligstrale kan konvergeer om 'n werklike beeld te vorm nie.

OF

Die lyn wat deur die (optiese) middelpunt gaan en die lyn wat deur die fokuspunt gaan, is parallel/ontmoet mekaar nooit nie. (2)

[12]

QUESTION/*VRAAG* 7

7.1 7.1.1 An electromagnetic wave as a changing magnetic and electric field mutually perpendicular to each other and the direction of propagation of the wave. ✓✓

'n Elektromagnetiese golf as 'n veranderende magnetiese en elektriese veld onderling loodreg op mekaar en die voortplantingsrigting van die golf. (2)

7.1.2 $E = h.\frac{c}{\lambda}$ ✓

$1{,}989 \times 10^{-17}$ ✓ $= 6{,}63 \times 10^{-34}.\frac{3x10^{8}}{\lambda}$ ✓

$\lambda = 0{,}00000001\ m / 1{,}0 \times 10^{-8}\ m$ ✓ (4)

7.1.3 **Any 2** ✓✓

- Radiotherapy/Treatment of cancer. ✓
- Radiographs/Internal images of objects/people. ✓ (E.g. to examine broken bones.)
- Used in airport and other security systems

Enige 2

- *Radioterapie/Behandeling van kanker.*
- *Radiografieë/Interne beelde van voorwerpe/mense. (Byvoorbeeld om gebreekte bene te ondersoek.)*
- *Word in lughawe- en ander sekuriteitstelsels gebruik.* (2)

[8]

QUESTION/*VRAAG* 8

8.1 8.1.1 *Capacitance* is the amount of charge it can store per volt. ✓✓
Kapasitansie is die hoeveelheid lading wat dit per volt kan stoor. (2)

8.1.2 Farad ✓ (1)

8.1.3
$$C = \frac{\varepsilon_o A}{d} \checkmark$$
$$100 \times 10^{-6} = \frac{8,85 \times 10^{-12} A}{0,02} \checkmark$$
$$A = 225988,70\ m^2 \checkmark$$
(3)

8.2 **Any 3** ✓✓✓
- Decrease the distance between the plates.
- Increase the area of the plates.
- Use a dielectric material with a higher dielectric constant.
- Increase number of plates.

Enige 3
- *Verminder die afstand tussen die plate.*
- *Vergroot die oppervlakte van die plate.*
- *Gebruik 'n diëlektriese materiaal met 'n hoër diëlektriese konstante.*
- *Vermeerder die aantal plate* (3)

[9]

QUESTION/*VRAAG* 9

9.1 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 in die geleier ✓ by konstante temperatuur. ✓ (2)

9.2 **OPTION 1/*OPSIE 1***

$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$
$\frac{1}{R_P} = \frac{1}{55} + \frac{1}{80}$ ✓

$R_P = 32{,}5926 + 20$
$\therefore R_T = 52{,}5926\ \Omega$

$R = \frac{V}{I}$ ✓

$I = \frac{12}{52{,}5926}$ ✓

$I = 0{,}23A$ ✓

OPTION 2/*OPSIE 2*

$R_P = \frac{R_1 \times R_2}{R_1 + R_2}$

$= \frac{55 \times 80}{55 + 80}$

$R_P = 32{,}5926 + 20$
$\therefore R_T = 52{,}5926\ \Omega$

$R = \frac{V}{I}$ ✓

$I = \frac{12}{52{,}5926}$ ✓

$I = 0{,}23A$ ✓ (4)

9.3 $W = I^2R\Delta t$ ✓
$= (0.23)^2 \times 20$ ✓ $\times 120$ ✓
$= 126{,}96J$ ✓ (4)

9.4 Cost = energy used x tariff/*Koste = energie gebruik x tarief* ✓

= $1{,}5 \times \left(\frac{7{,}5}{60} \times 30\right)$ ✓ $\times 30$ ✓
= R168,75 ✓ (4)
[14]

QUESTION/*VRAAG* 10

10.1 Faraday's law of electromagnetic induction. / ✓
Faraday se wet van elektromagnetiese induksie. (1)

10.2 Faraday's law states that when the magnetic flux linked with the coil changes, an emf is induced in the coil. ✓ The magnitude of the induced emf is directly proportional to the rate of change of the magnetic flux. ✓

Faraday se wet staaf wanneer die magnetiesevloed wat met die spoel verbind is, verander, 'n emk in die spoel geïnduseer word. Die grootte van die geïnduseerde emk is direk eweredig aan die tempo van verandering van die magnetiesevloed. (2)

10.3 $\varepsilon = -N\frac{\Delta\emptyset}{\Delta t}$ ✓
$20 = -11\frac{\Delta\emptyset}{0,5}$ ✓
$\Delta\emptyset = -0,909Wb$ ✓ (3)
[6]

TOTAL/*TOTAAL*: 150