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NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIOR SERTIFIKAAT*

GRADE/*GRAAD* 12

SEPTEMBER 2026

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

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QUESTION / *VRAAG* 1

1.1 D ✓✓ (2)

1.2 B ✓✓ (2)

1.3 A ✓✓ (2)

1.4 D ✓✓ (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)

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QUESTION / *VRAAG 2*

2.1 An object will remain at rest or continue moving at a constant velocity (or at constant speed in a straight line) ✓ unless acted upon by a non-zero external resultant force. ✓ /
'n Voorwerp sal in rus bly of aanhou beweeg teen 'n konstante snelheid (of teen 'n konstante spoed in 'n reguit lyn) ✓ *tensy dit deur 'n nie-nul eksterne resulterende krag inwerk*. ✓ (2)

2.2.1

OPTION / *OPSIE 1*
$F_y = 120\sin30^o$ ✓
$= 60$ N ✓

OPTION / *OPSIE 2*
$F_y = 120\cos60^o$ ✓
$= 60$ N ✓ (2)

2.2.2

OPTION / *OPSIE 1*
Apply positive marking from question 2.2.1 /
Pas positiewe nasien toe van vraag 2.2.1

$f_k = \mu_k N$ ✓
$= 0{,}13$ ✓ $[(12 \times 9{,}8) - 120\sin30^o]$ ✓
$= 7{,}49$ N (to the right/ *na regs*) ✓

NOTE: Credit if $120\sin30^o$ is expressed as 60/
LET WEL: *Gee krediet indien $120\sin 30^o$ as 60 uitgedruk word.*

OPTION / *OPSIE 2*
Apply positive marking from question 2.2.1/
Pas positiewe nasien toe van vraag 2.2.1

$N = mg - F_y$
$N = (12 \times 9{,}8) - 120\sin30^o$ ✓
$= 117{,}6 - 60$
$= 57{,}6$ N

$f_k = \mu_k N$ ✓
$= 0{,}13$ ✓ $\times 57{,}6$

$= 7.49$ N (to the right/ *na regs*) ✓

NOTE: Credit if 57,6 N is expressed as 117.6 – 60/
LET WEL: *Gee krediet indien 57.6N uitgedruk word as 117,6 – 60* (4)

2.2.3 **POSITIVE MARKING FROM QUESTION 2.2.2 / *POSITIEWE NASIEN VAN VRAAG 2.2.2***

$F_{net} = ma$
$F_x + f_k = ma$
Any one/ *Enige een* ✓

$60\cos30° + (-3{,}74)$ ✓ $= 6a$ ✓
$a = 8{,}04$ m.s^{-2} to the left/ *na links* ✓ (4)

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2.3 Decrease ✓

The vertical component (F_y) will increase and thus the normal force will decrease. ✓✓

OR

The force will tend to lift the object from the surface and thus decrease the friction./

Neem af ✓

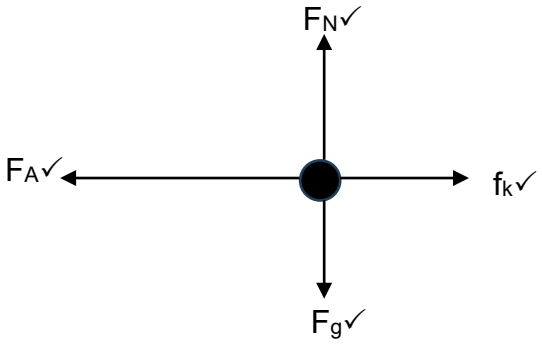
Die vertikale komponent (F_y) sal toeneem en dus sal die normaalkrag afneem. ✓✓

OF

Die krag sal geneig wees om die voorwerp van die oppervlak op te lig en sodoende die wrywing te verminder. (3)

2.4 2.4.1 When object **A** exerts a force on object **B**, object **B** simultaneously exerts an oppositely directed force of equal magnitude on object **A**. ✓✓
*Wanneer voorwerp **A** 'n krag op voorwerp **B** uitoefen, oefen voorwerp **B** gelyktydig 'n teenoorgesteld gerigte krag van gelyke grootte op voorwerp **A** uit.* (2)

2.4.2



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NOTES:
One mark for each force represented by an arrow with a correct label.
Penalise ONCE for each of the following:
- No arrows
- There is no dot
- Gap between the line and the dot
- Dotted lines are used
- A force diagram is given
- Extra force is given /

NOTAS:
Een punt vir elke krag wat deur 'n pyl met 'n korrekte etiket voorgestel word.
Penaliseer EEN KEER vir elk van die volgende:
- *Geen pyle nie*
- *Daar is geen kolletjie nie*
- *Gaping tussen die lyn en die kolletjie*
- *Gestippelde lyne word gebruik*
- *'n Kragtediagram word gegee*
- *Ekstra krag word gegee*

Acceptable labels:
N/F_N: Normal
F_g/w: Force due to gravity/Weight/
F/F_A/F_{car}: Applied force/
f_k/F_f/ *f*: frictional force/

NOTE: ACCEPT if F_T/T is used in place of applied force./

Aanvaarbare etikette:
N/F_N: Normaal
F_g/w: Krag as gevolg van swaartekrag/Gewig/
F/F_A/F_{car}: Toegepaste krag/
f_k/F_f/ f: wrywingskrag/

LET WEL: AANVAAR as F_T/T in plaas van toegepaste krag gebruik word. /

(4)
[21]

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QUESTION / *VRAAG 3*

3.1 The product of the resultant/net force acting on an object and the time the net force acts on the object. ✓✓ /
Die produk van die resulterende/netto krag wat op 'n voorwerp inwerk en die tyd wat die netto krag op die voorwerp inwerk. (2)

3.2

OPTION / *OPSIE 1*

Positive to the right/*Positief na regs*

Impulse = Δp
$F_{net/netto}\Delta t = \Delta p$ } Any one/ *Enige een* ✓
$= m(v_f - v_i)$
$= 0{,}08$✓ $(32.5 - (-20))$ ✓
$= 4.2$ kg·m·s^{-1} to the right./ *na regs* ✓

OPTION / *OPSIE 2*

Positive to the left / *Positief na links*

Impulse = Δp
$F_{net/netto}\Delta t = \Delta p$ } Any one/*Enige een* ✓
$= m(v_f - v_i)$
$= 0{,}08$✓ $(-32.5 - 20)$ ✓
$= -4.2$
$= 4.2$ kg·m·s^{-1} to the right/ *na regs* ✓ (4)

3.3 **POSITIVE MARKING FROM 3.2/ *POSITIEWE NASIEN VAN 3.2***

OPTION / *OPSIE 1*

$$Fnet = \frac{\Delta p}{\Delta t} \checkmark$$
$$= \frac{4.2}{2\times10^{-3}} \checkmark$$
$$= 2100N \checkmark$$

OPTION / *OPSIE 2*

$$Fnet = \frac{\Delta p}{\Delta t} \checkmark$$
$$= \frac{-4.2}{2\times10^{-3}} \checkmark$$
$$= 2100N \checkmark$$

OPTION / *OPSIE 3*

$$a = \frac{v_f - v_i}{\Delta t}$$
$$= \frac{32{,}5-(-20)}{2\times10^{-3}} \checkmark$$
$$= 26250\ m.s^{-2}$$

$$Fnet = ma \checkmark$$
$$= 0{,}08 \times 26250$$
$$= 2100\ N \checkmark$$

(3)

3.4 3.4.1 The total linear momentum in an isolated system ✓ remains constant/is conserved in magnitude and direction. ✓

OR

In an isolated system, the total momentum before a collision/explosion is equal to the total momentum after the collision/explosion in magnitude and direction. /

Die totale lineêre momentum in 'n geïsoleerde stelsel ✓*bly konstant/ word behou in grootte en rigting*. ✓

OF

In 'n geïsoleerde stelsel is die totale momentum voor 'n botsing/ ontploffing gelyk aan die totale momentum na die botsing/ontploffing in grootte en rigting. (2)

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3.4.2 $\Sigma p_{before} = \Sigma p_{after}$

$m_1v_{i1} + m_2v_{i2} = m_1v_{f1} + m_2v_{f2}$ — Any one / Enige een ✓

$(1)(5) + (1,8)(2,5)$ ✓ $= (1)(v_{1f}) + (1,8)(3)$ ✓

$5 + 4,5 = v_{1f} + 5,4$

$4,1 = v$

$\therefore v_{1f} = 4,1\ m\cdot s^{-1}$ to the right ✓/ in the direction of motion./
na regs/ in rigting van beweging (4)

3.4.3 **POSITIVE MARKING FROM 3.4.2 / *POSITIEWE NASIEN VAN 3.4.2***

$\Sigma E_{kbefore/voor} = \frac{1}{2}m_1v_i^2 + \frac{1}{2}m_2v_i^2$ ✓

$= \frac{1}{2}(1)(5)^2 + \frac{1}{2}(1,8)(2,5)^2$ ✓

$= 18,13\text{J}$

$\Sigma E_{kafter/na} = \frac{1}{2}m_1v_f^2 + \frac{1}{2}m_2v_i^2$

$= \frac{1}{2}(1)(4,1)^2 + \frac{1}{2}(1,8) \times (3)^2$ ✓

$= 16,51\text{J}$

$\Sigma E_{k\ before/voor} \neq \Sigma E_{k\ after/na}$ ✓

$\therefore$ Inelastic ✓/ Onelasties (5)

[20]

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QUESTION / VRAAG 4

4.1 4.1.1 Total mechanical energy (sum of gravitational potential energy and kinetic energy) in an isolated system ✓ remains constant. ✓/ *Totale meganiese energie (som van gravitasiepotensiële energie en kinetiese energie) in 'n geïsoleerde stelsel bly konstant.* (2)

4.1.2 $E_p = mgh$ ✓
$= (2)(9,8)(1,2)$ ✓
$= 23,52$ J ✓ (3)

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

$ME = E_p + E_k$ ✓
$= 23,52$ ✓ $+ (½)(2)(0,88)^2$ ✓
$= 24,29$ J ✓ (4)

4.1.4 **POSITIVE MARKING FROM QUESTION 4.1.3 / *POSITIEWE NASIEN VAN VRAAG 4.1.3***

ME at/*by* C = ME at/*by* B
$(E_p + E_k)_{at\ C} = (E_p + E_k)_{at\ B}$ ✓
$0 + (½)(2)v^2$ ✓ $= 24,29$ ✓
$v = 4,93\ m.s^{-1}$ ✓ (4)

4.2 Power is the rate at which work is done. ✓✓

OR

Power is the rate at which energy is expended/ transferred./

Drywing is die tempo waarteen arbeid verrig word.

OF

Drywing is die tempo waarteen energie verbruik/oorgedra word. (2)

4.3 $P_{ave/gemidd} = Fv_{ave/\ gemidd}$ ✓
43000 ✓ $= F(2)$ ✓
$F = 21500$ N ✓ (4)

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QUESTION / *VRAAG 5*

5.1 5.1.1 **OPTION / *OPSIE 1***

$$Area = \frac{\pi D^2}{4}$$
$$= \frac{\pi(2{,}5\times10^{-3})^2}{4} \checkmark$$
$$= 4{,}909 \times 10^{-6} m^2$$

$$\sigma = \frac{F}{A} \checkmark$$
$$= \frac{16}{4{,}909\times10^{-6}} \checkmark$$
$$= 3{,}26 \times 10^6 Pa \checkmark$$

OPTION / OPSIE 2

$$A = \pi r^2$$
$$= \pi(1{,}25 \times 10^{-3})^2 \checkmark$$
$$= 4{,}909 \times 10^{-6} m^2$$

$$\sigma = \frac{F}{A} \checkmark$$
$$= \frac{16}{4{,}909\times10^{-6}} \checkmark$$
$$= 3{,}26 \times 10^6 Pa \checkmark$$

OPTION / *OPSIE 3*

$$\sigma = \frac{F}{A} \checkmark$$
$$= \left[\frac{16}{\pi(\frac{2{,}5\times10^{-3}}{2})^2 \checkmark}\right] \checkmark$$
$$= 3{,}26 \times 10^6 Pa \checkmark$$

OPTION / *OPSIIE 4*

$$\sigma = \frac{F}{A} \checkmark$$
$$= \left[\frac{16}{\pi(1{,}25\times10^{-3})^2 \checkmark}\right] \checkmark$$
$$= 3{,}26 \times 10^6 Pa \checkmark$$

(4)

5.1.2 **OPTION / *OPSIE 1***

$$\varepsilon = \frac{\Delta l}{L} \checkmark$$
$$= \frac{0.5}{3\times10^3} \checkmark$$
$$= 1{,}666 \times 10^{-4} \checkmark$$

NOTE: Penalise if the unit is given./
LET WEL: *Penaliseer as eenheid gegee word*

OPTION / *OPSIE 2*

$$\varepsilon = \frac{\Delta l}{L} \checkmark$$
$$= \frac{5\times10^{-4}}{3} \checkmark$$
$$= 1{,}666 \times 10^{-4} \checkmark$$

NOTE: Penalise if the unit is given./
LET WEL: *Penaliseer as eenheid gegee word*

(3)

5.1.3 **POSITIVE MARKING FROM QUESTION 5.1.1 AND QUESTION 5.1.2/ *POSITIEWE NASIEN VAN VRAAG 5.1.1 EN VRAAG 5.1.2***

$$K = \frac{\sigma}{\varepsilon} \checkmark$$

$$= \frac{3{,}26\times10^6}{1{,}666\times10^{-4}} \checkmark$$

$$= 1{,}956 \times 10^{10} Pa \checkmark$$

(3)

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5.2 5.2.1 Pressure at a particular point is the thrust acting on the unit area around that point. ✓✓

NOTE: Do not penalise if force is used instead of thrust. /

Druk by 'n spesifieke punt is die stukrag wat op die eenheidsoppervlakte rondom daardie punt inwerk.

***LET WEL**: Moenie penaliseer as krag in plaas van stukrag gebruik word nie.* (2)

5.2.2 $P = \frac{F}{A}$ ✓

$= \frac{26}{7{,}855\times10^{-5}}$ ✓

$= 3{,}3099 \times 10^{5} Pa$ ✓ (3)

5.2.3 **OPTION 1 / *OPSIE 1***

$\frac{F_1}{A_1} = \frac{F_2}{A_2}$ ✓

$\frac{26}{7{,}855\times10^{-5}} = \frac{1278}{A_2}$ ✓

$= 3{,}861 \times 10^{-3}$ ✓

OPTION 2 / *OPSIE 2*

$P = \frac{F_2}{A_2}$ ✓

$3{,}3099 \times 10^{5} = \frac{1278}{A_2}$ ✓

$= 3{,}861 \times 10^{-3} Pa$ ✓

(3)

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QUESTION / *VRAAG 6*

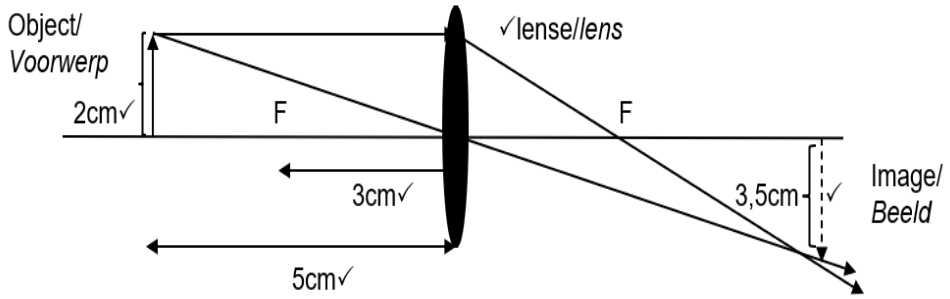
6.1 6.1.1 critical angle ✓ / *grenshoek* (1)

6.1.2 Total internal relfection will take place. ✓✓/
Totale interne weerkaatsing sal plaasvind. (2)

6.1.3 The incident angle must be more than the critical angle. ✓ **ANY ONE**
The light must move from a higher dense medium to a lower dense medium. ✓/

Die invalshoek moet meer as die kritieke hoek wees. **ENIGE EEN**
Die lig moet van 'n hoër digte medium na 'n laer digte medium beweeg. (1)

6.2 6.2.1



(5)

MARKING CRITERIA /*NASIEN KRITERIA*

Object is 2 cm tall upright ✓ / *Voorwerp is 2 cm hoog regop*	1
Object is 5 cm from convex lens midpoint. ✓/ *Voorwerp is 5 cm vanaf die konvekse lens se middelpunt.*	1
Convex lens ✓/ *Konvekse lens*	1
Focal point 3 cm from lens midpoint ✓/ *Fokuspunt 3 cm vanaf die lens se middelpunt*	1
Image is 3 cm-3,6 cm downwards ✓/ *Beeld is 3 cm-3,6 cm afwaarts*	1
Maximum mark/ *Maksimum punt*	**5**

6.2.2
- Image is upside down/inverted ✓/*Beeld is onderstebo/omgekeerd*
- Image is bigger/Enlarged/Magnified ✓/*Beeld is groter/Vergroot*
- Image is real ✓ /*Beeld is werklik* (3)

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QUESTION / *VRAAG 7*

7.1 It is a quantum of energy (light). ✓✓/
Dit is 'n kwantum van energie (lig). (2)

7.2 $E = h f$ ✓
$E = 6{,}63 \times 10^{-34} \times 750 \times 10^{14}$ ✓
$E = 4{,}97 \times 10^{-17}$J ✓ (3)

7.3 (Radiography)To observe bone structures.
(Mammography) used to screen breast cancer.
CT Scans
(Radiotherapy) killing cancer cells.
ACCEPT: Any other correct answer. /

✓ **ANY ONE**

(Radiografie) Om beenstrukture waar te neem.
(Mammografie) word gebruik om borskanker te ondersoek.
CT-skanderings.
(Radioterapie) wat kankerselle doodmaak.
***AANVAAR:** Enige ander korrekte antwoord.* (1)

✓ ***ENIGE EEN***

[6]

QUESTION / *VRAAG 8*

8.1 A device for storing electrical charge. ✓✓/
'n Toestel wat elektriese lading stoor. (2)

8.2 $C = \frac{\varepsilon_0 \times A}{d}$ ✓
$C = \frac{8{,}85 \times 10^{-12} \times 0{,}3}{0.15}$ ✓
$C = 1{,}77 \times 10^{-11}$ F ✓ (3)

8.3 Increase the area. ✓/ *Vergroot die area.*
Decrease the distance between the plates. ✓/*Verminder die afstand tussen die plate.*
Use material with high dielectric constant. ✓/ *Gebruik materiaal met 'n hoë diëlektriese konstante.* (3)

[8]

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QUESTION / *VRAAG 9*

9.1 The potential difference across the conductor is directly proportional to the current in the conductor at constant temperature. ✓✓/
Die potensiaalverskil oor die geleier is direk eweredig aan die stroom in die geleier teen konstante temperatuur. (2)

9.2 9.2.1
$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} \checkmark$$
$$= \frac{1}{4} + \frac{1}{3} \checkmark$$
$$R_p = 1{,}71\ \Omega$$

$$R_t = R_s + R_p$$
$$R_t = 2 + 1{,}71 \checkmark$$
$$R_t = 3{,}71\ \Omega \checkmark$$ (4)

9.2.2 **POSITIVE MARKING FROM QUESTION 9.2.1/**
POSITIEWE NASIEN VAN VRAAG 9.2.1
$$R = \frac{V}{I} \checkmark$$
$$3{,}71 = \frac{24}{I} \checkmark$$
$$I = 6{,}47\ A \checkmark$$ (3)

9.2.3 **POSITIVE MARKING FROM QUESTION 9.2.1 AND QUESTION 9.2.2/**
POSITIEWE NASIEN VAN VRAAG 9.2.1 EN VRAAG 9.2.2
$$R = \frac{V}{I}$$
$$1{,}71 \checkmark = \frac{V}{6{,}47} \checkmark$$
$$V = 11{,}06\ V \checkmark$$ (3)

9.3 The rate at which electrical energy is converted in an electric circuit. ✓✓ /
Die tempo waarteen elektriese energie in 'n elektriese stroombaan omgeskakel word. (2)

9.4 **POSITIVE MARKING FROM QUESTION 9.2.2 AND QUESTION 9.2.3/**
POSITIEWE NASIEN VAN VRAAG 9.2.2 EN VRAAG 9.2.3

OPTION / *OPSIE 1*

$P = I^2R$✓
$=(6{,}47^2)(2)$✓
$= 83{,}72$ W ✓

OPTION / *OPSIE 2*

$V_s = V_t - V_p$
$V_s = 24 - 11{,}06$
$V_s = 12{,}94$ V

$P = \frac{V^2}{R}$ ✓
$= \frac{(12{,}94^2)}{2}$ ✓
$P = 83{,}72$ W ✓

OPTION / *OPSIE 3*

$P = VI$ ✓
$= (12{,}94)(6{,}47)$ ✓
$= 83{,}72$ W ✓

(3)
[17]

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QUESTION / *VRAAG 10*

10.1 10.1.1 Step-up transformer ✓/ *verlagingstransformator* (1)

10.1.2 The input voltage is lower than the output voltage. ✓✓

OR

Primary voltage is lower than secondary voltage./

Die insetspanning is laer as die uitsetspanning.

OF

Primêre spanning is laer as sekondêre spanning. (2)

10.1.3 $\frac{V_s}{V_p} = \frac{N_s}{N_p}$ ✓

$\frac{V_s}{240000} = \frac{50}{500}$ ✓

$V_s = 24000V$ ✓ (3)

10.2 10.2.1 AC motor ✓/ *WS motor* (1)

10.2.2 Electrical energy is converted to mechanical energy. ✓✓ /
Elektriese energie word omgeskakel na meganiese energie. (2)
[9]

TOTAL: 150

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