



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE
NASIONALE
SENIOR SERTIFIKAAT**

GRADE/GRAAD 12

**TECHNICAL SCIENCES P1
TEGNIJSE WETENSKAPPE V1**

NOVEMBER 2025

MARKING GUIDELINES/NASIENRIGLYNE

MARKS/PUNTE: 150

**These marking guidelines consist of 12 pages.
Hierdie nasienriglyne bestaan uit 12 bladsye.**

QUESTION/VRAAG 1

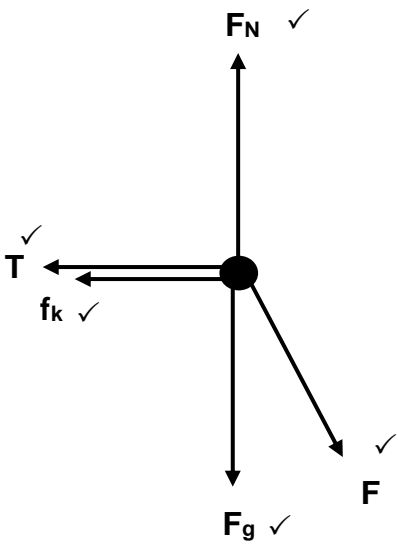
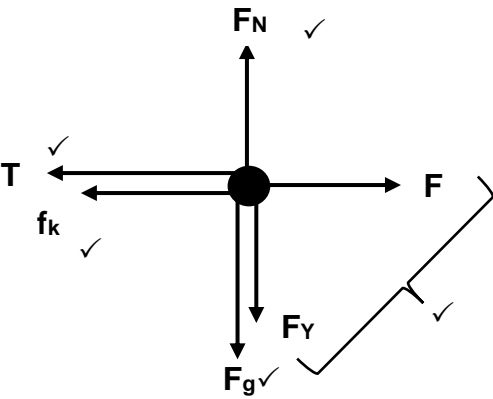
1.1	C	✓✓	(2)
1.2	C	✓✓	(2)
1.3	B	✓✓	(2)
1.4	A	✓✓	(2)
1.5	C	✓✓	(2)
1.6	B	✓✓	(2)
1.7	B	✓✓	(2)
1.8	B	✓✓	(2)
1.9	C	✓✓	(2)
1.10	C / D	✓✓	(2)
			[20]

QUESTION/VRAAG 2

- 2.1 When a net/resultant force is applied to an object of mass, m , it accelerates the object in the direction of the net force. ✓✓ The acceleration is directly proportional to the net/resultant force and inversely proportional to the mass of the object./Wanneer 'n resulterende/netto krag op 'n voorwerp met massa, m , inwerk, versnel die voorwerp in die rigting van die netto krag. Die versnelling is direk eweredig aan die resulterende/netto krag en omgekeerd eweredig aan die massa van die voorwerp.

(2)

2.2

OPTION/OPSIE 1	OPTION/OPSIE 2
	
<p>NOTES/AANTEKENINGE: Mark allocated for arrow and label./ Punt toegeken vir pyl en byskrif. Penalise once if:/Penaliseer een keer indien:</p> <ul style="list-style-type: none"> • No arrows/Geen pyltjies • No dot/Geen kol nie • Gap between the line and dot/Gaping tussen die lyn en kol • Dotted lines are used/Stippellyne word gebruik • A force diagram given/'n Kragtediagram word gegee • Additional forces are given/Addisionele kragte word gegee • Do not penalise if arrow lengths are not drawn to scale/Moenie penaliseer indien pyllengtes nie volgens skaal geteken is nie. 	<p>Acceptable labels/Aanvaarbare etikette:</p> <ul style="list-style-type: none"> • Normal force/Normaalkrag: $N/F_N/F_{\text{normal/normaal}}$ • Applied force/Toegepaste krag: $F/F_A/65\text{ N}$ • Gravitational force/Gravitasie krag: $w/F_g/F_{\text{gravity/gravitasie/Weight/Gewig}}$ • Vertical component/Vertikale komponent: $F_v/F_y/F_{A_y}$ • Horizontal component/Horizontale komponent: $F_H/F_x/F_{A_x}$ • Frictional force/Wrywingskrag: $f/f_k/F_t/1,76\text{ N}$ • $T/F_T/Tension/Spanning$

(5)

2.3.1 $N = w + F_Y$
 $= mg + F_Y$
 $F_N = mg + F \sin \theta$
 $= (18)(9,8) \checkmark + 65 \sin 25^\circ \checkmark$
 $= 203,87 \text{ N} \checkmark \text{ (upwards/opwaarts)}$ (3)

2.3.2 **POSITIVE MARKING FROM QUESTION 2.3.1/POSITIEWE NASIEN VANAF VRAAG 2.3.1**

$f_k = \mu_k N \checkmark$
 $= (0,02)(203,87) \checkmark$
 $= 4,08 \text{ N} \checkmark \text{ (left/links)}$ (3)

2.3.3 **POSITIVE MARKING FROM QUESTION 2.3.2/POSITIEWE NASIEN VANAF VRAAG 2.3.2**

For 9 kg block/Vir 9 kg-blok

$F_{\text{net/netto}} = ma$
 $T + (-f_k) = ma$ } \checkmark Any one/Enige een
 $T - 1,76 \checkmark = 9a$
 $T = 9a + 1,76 \dots (1)$

For 18 kg block/Vir 18 kg-blok

$F_{\text{net/netto}} = ma$
 $F_x + (-T) + (-f_k) = ma$
 $F \cos \theta - T - f_k = ma$
 $65 \cos 25^\circ - T - 4,08 \checkmark = 18a$
 $(65 \cos 25^\circ) - (9a + 1,76) - 4,08 = 18a$
 $a = 1,97 \text{ m} \cdot \text{s}^{-2} \checkmark \text{ (to the right/na regs)}$ \checkmark Any one/Enige een (5)

2.4 Decreases \checkmark /Neem af (1)
[19]

QUESTION/VRAAG 3

3.1 The total linear momentum of an isolated system \checkmark remains constant (is conserved) in both magnitude and direction. \checkmark /Die totale lineêre momentum van 'n geïsoleerde sisteem bly konstant (word behou) in grootte en rigting. (2)

3.2.1

OPTION/OPSIE 1 (Take right as positive/Neem regs as positief)	
$\sum p_{\text{before/voor}} = \sum p_{\text{after/na}}$ $(m_A v_A)_i + (m_B v_B)_i = (m_A v_A)_f + (m_B v_B)_f$ $(1\,500 \times 30) + (1\,800 \times 0) \checkmark = 1\,500 \times (-5) + 1\,800 v_f \checkmark$ $v_f = 29,17 \text{ m} \cdot \text{s}^{-1} \text{ right/regs} \checkmark$	\checkmark (Any one/Enige een)
OPTION/OPSIE 2 (Take right as negative/Neem regs as negatief)	
$\sum p_{\text{before/voor}} = \sum p_{\text{after/na}}$ $(m_A v_A)_i + (m_B v_B)_i = (m_A v_A)_f + (m_B v_B)_f$ $(1\,500 \times -30) + (1\,800 \times 0) \checkmark = (1\,500 \times 5) + (1\,800 v_f) \checkmark$ $v_f = -29,17 \text{ m} \cdot \text{s}^{-1}$ $v_f = 29,17 \text{ m} \cdot \text{s}^{-1} \text{ right/regs} \checkmark$	\checkmark (Any one/Enige een)

(4)

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

OPTION/OPSIE 1	OPTION/OPSIE 2
$F_{\text{net/netto}} = \frac{\Delta p}{\Delta t}$ $= m \frac{(v_f - v_i)}{\Delta t}$ $= 1\,800 \checkmark \frac{(29,17 - 0)}{0,5} \checkmark$ $= 105\,012 \text{ N right/regs} \checkmark$	$a = \frac{v_f - v_i}{\Delta t}$ $= \frac{29,17 - 0}{0,5} \checkmark$ $= 58,34 \text{ m.s}^{-2}$ $F_{\text{net/netto}} = ma \checkmark$ $= (1\,800) \checkmark (58,34)$ $= 105\,012 \text{ N right/regs} \checkmark$
(Range/Reeks: 105 000 N – 105 012 N)	

(4)

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

$$\begin{aligned} \Sigma E_{k(\text{before/voor})} &= (\tfrac{1}{2}mv^2)_A + (\tfrac{1}{2}mv^2)_B \leftarrow \checkmark \text{ Any one/Enige een} \\ &= \tfrac{1}{2}(1\,500)(30)^2 + \tfrac{1}{2}(1\,800)(0)^2 \checkmark \\ &= 675\,000 \text{ J} \\ \Sigma E_{k(\text{after/na})} &= (\tfrac{1}{2}mv^2)_A + (\tfrac{1}{2}mv^2)_B \leftarrow \checkmark \text{ Any one/Enige een} \\ &= \tfrac{1}{2}(1\,500)(-5)^2 + \tfrac{1}{2}(1\,800)(29,17)^2 \checkmark \\ &= 784\,550,01 \text{ J} \\ \Sigma E_{k(\text{before/voor})} &\neq \Sigma E_{k(\text{after/na})} \checkmark \\ \text{Inelastic} &\checkmark / \text{Onelasties} \end{aligned}$$

(5)

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

105 012 N \checkmark

(1)

3.5 Newton's third law of motion \checkmark / *Newton se derde bewegingswet*

(1)

- 3.6
- airbags \checkmark // lugsakke
 - crumple zones/vrommelsones
 - padded dashboards/opgestopte paneelborde
 - safety belts/veiligheidsgordels
 - head rests/kopstutte

(Any one/Enige een)

(1)

[18]

QUESTION/VRAAG 4

- 4.1 A system in which the net external force acting on the system is zero. ✓✓
/’n Sisteem waarop die netto eksterne krag wat op die sisteem inwerk, nul is. (2)

4.2.1 $W = F\Delta x \cos\theta$ ✓
 $= (460)(\cos 40^\circ)(100)(\cos 0^\circ)$ ✓
 $= 35\,238,04 \text{ J}$ ✓ (3)

4.2.2 $W = F\Delta x \cos\theta$
 $= (325)(100)\cos 180^\circ$ ✓
 $= -32\,500,00 \text{ J}$ ✓ (2)

- 4.2.3 **POSITIVE MARKING FROM QUESTION 4.2.1 AND QUESTION 4.2.2/
POSITIEWE NASIEN VANAF VRAAG 4.2.1 EN VRAAG 4.2.2**

OPTION/OPSIE 1	OPTION/OPSIE 2
$W_{\text{net/netto}} = W_{\text{Applied/toegepas}} - W_f$ $= 35\,238,04 - 32\,500,00$ ✓ $= 2738,04 \text{ J}$ ✓	$F_{\text{net/netto}} = F_x + (-f)$ $= F \cos\theta + (-f)$ $= (460)(\cos 40^\circ) + (-325)$ $= 27,38044 \text{ N}$ $W_{\text{net/netto}} = F_{\text{net/netto}} \Delta x \cos\theta$ $= (27,38044)(100)(\cos 0^\circ)$ ✓ $= 2738,04 \text{ J}$ ✓

- 4.3.1 Yes ✓ /Ja

NEGATIVE MARKING / NEGATIEWE NASIEN

There are no net external forces acting on the system. ✓✓ /Daar is geen netto eksterne kragte wat op die stelsel inwerk nie.

OR/OF

The system is isolated./Die stelsel is geïsoleerd.

OR/OF

No friction/Geen wrywing./No air resistance/Geen lugweerstand

OR/OF

The track is frictionless./Die baan is wrywingloos. (3)

4.3.2 $M_{E(A)} = M_{E(B)}$
 $E_{P(A)} + E_{K(A)} = E_{P(B)} + E_{K(B)}$
 $mgh_{(A)} + \frac{1}{2}mv_{(A)}^2 = mgh_{(B)} + E_{K(B)}$ } ✓ (Any one/Enige een)
 $(5)(9,8)(8) + \frac{1}{2}(5)(0)^2 = (5)(9,8)(0) + E_{K(B)}$
 $E_{K(B)} = 392 \text{ J}$ ✓ (5)

- 4.3.3 **POSITIVE MARKING FROM QUESTION 4.3.2/POSITIEWE NASIEN VANAF
VRAAG 4.3.2**

$M_{E(C)} = M_{E(B)}$
 $(mgh + \frac{1}{2}mv^2)_C = (mgh + \frac{1}{2}mv^2)_B$ } ✓ (Any one/Enige een)
 $(5)(9,8)(2) + \frac{1}{2}(5)(v^2) = 392$ ✓
 $v = 10,84 \text{ m}\cdot\text{s}^{-1}$ ✓ (4)

[21]

QUESTION/VRAAG 5

5.1 A measure of the ability of a material to withstand changes in length ✓ when subjected to lengthwise tension or compression. ✓ / In 'n Meting van die vermoë van 'n materiaal om veranderinge in lengte te weerstaan wanneer dit aan trekking of drukking in die lengte onderwerp word. (2)

5.2.1 Similar to ✓ / Soortgelyk (1)

5.2.2 **NEGATIVE MARKING FROM QUESTION 5.2.1/NEGATIEWE NASIEN VANAF VRAAG 5.2.1**

Similar material will have the same modulus (of elasticity) ✓ that will allow uniform transfer of load across the repaired section. ✓ / Soortgelyke materiaal sal dieselfde modulus (van elasticiteit) hê wat eenvormige lasoordrag oor die herstelde gedeelte toelaat. (2)

5.3 $K = \frac{\sigma}{\epsilon}$ ✓
 $K = \frac{1,6 \times 10^8}{1,78 \times 10^{-2}}$ ✓
 $K = 8,99 \times 10^9 \text{ Pa}$ ✓ (3)
[8]

QUESTION/VRAAG 6

6.1 In a continuous liquid at equilibrium, the pressure applied at a point is transmitted equally to the other parts of the liquid. ✓✓ / In 'n kontinue vloeistof by ewewig, sal die druk by 'n punt eweredig oorgedra word na al die ander dele van die vloeistof. (2)

6.2

OPTION 1	OPTION 2
$P = \frac{F}{A}$ ✓ $2,67 \times 10^6 \text{ ✓} = \frac{F}{\pi(0,046)^2 \text{ ✓}}$ $= 17\,749,12 \text{ N ✓}$	$A = \pi r^2$ $= \pi(0,046)^2$ $= 6,6476 \times 10^{-3} \text{ m}^2$ $P = \frac{F}{A}$ ✓ $2,67 \times 10^6 \text{ ✓} = \frac{F}{6,6476 \times 10^{-3} \text{ ✓}}$ $F = 17\,749,09 \text{ N ✓}$
Range/Reeks: 17 749,09 N - 17 749,12 N	

(4)

6.3 Greater than ✓ / Groter as (1)

6.4.1 Oil with lower viscosity. ✓ / Olie met laer viskositeit. (1)

6.4.2 NEGATIVE MARKING FROM QUESTION 6.4.1/NEGATIEWE NASIEN VANAF VRAAG 6.4.1

The oil with a lower viscosity would flow easily ✓ in a colder environment and will require a force of a lower magnitude ✓ to operate the machine. /Die olie met 'n laer viskositeit sal makliker vloei in 'n kouer omgewing en sal 'n krag van kleiner grootte benodig om die masjien te laat werk.

(2)

6.5 Decreases ✓/Neem af

NEGATIVE MARKING/NEGATIEWE NASIEN

The temperature of the hydraulic oil increases ✓✓ (as the machine is in operation), therefore the viscosity decreases. /Tydens die werking van die masjien, Die temperatuur van die hidrouliese olie neem toe (tydens die werking van die masjien), dus neem die viskositeit af.

(3)

[13]**QUESTION/VRAAG 7**

7.1.1 The change in direction of a wave upon striking the interface between two materials. ✓✓ /Die verandering in rigting van 'n golf wanneer dit die vlak tussen twee materiale tref.

(2)

7.1.2  ✓✓

(2)

- 7.1.3
- Image formed is virtual ✓ /'n Skynbeeld beeld vorm
 - Laterally inverted ✓ /Sydelings omgekeer
 - Same size as the object/Dieselfde grootte as die voorwerp
 - Upright/Regop
 - Image is the same distance from the mirror to the object/Beeld is dieselfde afstand vanaf die spieël tot die voorwerp

(Any two/Enige twee)

(2)

7.2.1 The angle of incidence in a denser medium such that the refracted ray just passes through the surface of separation of the two media. ✓✓ /Die invalshoek in die digter medium sodat die gebreekte straal net deur die oppervlak wat die twee media skei, gaan.

OR/OF

The angle of incidence in the optically denser medium for which the angle of refraction is 90°. /Die invalshoek in die opties digter medium waar die brekingshoek 90° is.

(2)

7.2.2 Angle of incidence should be between 47° and 90°. ✓✓ /Die invalshoek moet tussen 47° en 90° wees.

OR/OF

$$47^\circ < \theta < 90^\circ$$

(2)

7.3 By accelerating electric charges ✓✓

OR/OF

By changing magnetic field and electric field ✓✓ (mutually perpendicular to each other and in the direction of propagation of the wave). / *Deur 'n verandering van magnetiese en elektriese velde, (onderling loodreg op mekaar en in die rigting van die voortplanting van die golf).*

(2)

7.4.1 Quantum/Packet of energy. ✓✓ / *Kwantum/Pakkie van energie.*

(2)

7.4.2 $3 \times 10^8 \text{ m} \cdot \text{s}^{-1}$ ✓

(1)

7.4.3 $E = hf$ ✓
 $3,32 \times 10^{-19} = (6,63 \times 10^{-34})f$ ✓
 $f = 5,01 \times 10^{14} \text{ Hz}$ ✓

(3)

7.5.1 Microwaves ✓ / *Mikrogolwe*

(1)

7.5.2 Gamma rays ✓ / *Gammastrale*

(1)

7.6 As wavelength increases, frequency decreases. ✓✓ / *Soos golflengte toeneem, neem frekwensie af.*

OR/OF

As wavelength decreases, frequency increases. / *Soos golflengte afneem, neem golflengte toe.*

OR/OF

$$\lambda \propto \frac{1}{f}$$

(2)

[22]

QUESTION/VRAAG 8

8.1 The amount of charge that a capacitor can store per volt. ✓✓ / *Die hoeveelheid lading wat 'n kapasitor kan stoor per volt.*

(2)

8.2 • (Two) metal plates ✓ / *(Twee) metaalplate*

• Dielectric (insulating) material / *Diëlektriese (isolator) materiaal*

(Any one/Enige een)

(1)

8.3.1 $C = \frac{Q}{V}$ ✓

$$0,0003 = \frac{0,033}{V} \quad \checkmark$$

$$V = 110 \text{ V} \quad \checkmark$$

No ✓ / *Nee, (the new capacitor will not be operational/die nuwe kapasitor sal nie in werking wees nie).*

(4)

8.3.2 • Decrease the area of the metal plates. ✓ / *Verklein die area van die metaalplate.*

• Increase the separation distance between the metal plates. / *Vergroot die skeidingsafstand tussen die metaalplate.*

• Use a dielectric with a lower dielectric constant. / *Gebruik 'n diëlektries met 'n laer diëlektriese konstante.*

(Any one/Enige een)

(1)

[8]

QUESTION/VRAAG 9

- 9.1
- Length (of the conductor) ✓ / *Lengte (van die geleier)*
 - Thickness/cross sectional area (of the conductor)/ *Dikte/deursnit (van die geleier)*
 - Temperature (of the conductor)/ *Temperatuur (van die geleier)*
 - Type of material (of the conductor)/ *Tipe materiaal (van die geleier)*
- (Any one/ *Enige een*) (1)

9.2.1

OPTION/OPSIE 1	OPTION/OPSIE 2
$P = I^2 R$ ✓ $= (3)^2(4)$ ✓ $= 36 \text{ W}$ ✓	$V = IR$ $= (3)(4)$ $= 12 \text{ V}$ $P = VI$ ✓ $= (12)(3)$ ✓ $= 36 \text{ W}$ ✓

OPTION/OPSIE 3
$V = IR$ $= (3)(4)$ $= 12 \text{ V}$ $P = \frac{V^2}{R}$ ✓ $= \frac{(12)^2}{4}$ ✓ $= 36 \text{ W}$ ✓

(3)

9.2.2

OPTION/OPSIE 1	OPTION/OPSIE 2
$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓ $= \frac{1}{3} + \frac{1}{6}$ ✓ $R_P = 2 \Omega$ $V = IR_P$ ✓ $= (3)(2)$ ✓ $= 6 \text{ V}$ ✓	$R_P = \frac{R_1 \times R_2}{R_1 + R_2}$ ✓ $R_P = \frac{3 \times 6}{3 + 6}$ ✓ $R_P = 2 \Omega$ $V = IR_P$ ✓ $= (3)(2)$ ✓ $= 6 \text{ V}$ ✓

(5)
[9]**QUESTION/VRAAG 10**

- 10.1 The direction of the induced emf in the coil opposes the effect that produces it. ✓✓ / Die rigting van die geïnduseerde emk in die spoel sodanig is dat dit die aksie wat dit veroorsaak, teenstaan. (2)

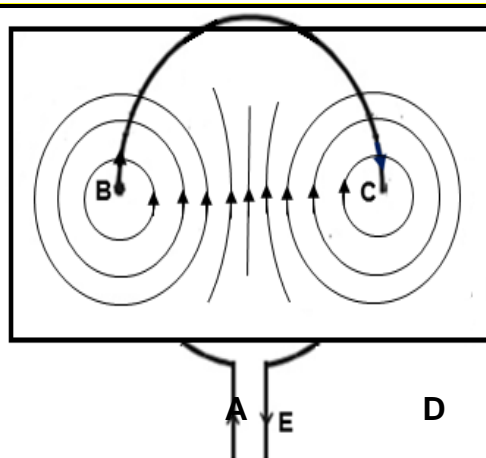
- 10.2.
- Electromagnetic braking (in trains, machinery or roller coasters). ✓ / *Elektromagnetiese remming (in treine, masjinerie en tuimeltreine).*
 - Induction cooking pots ✓ / *Induksie kookpote*
 - Electric motors/*Elektriese motors*
 - Electric generators/*Elektriese generators*
 - Transformers/*Transformators*
 - Metal detectors/*Metaalopspoorder*

(Any correct one/*Enige korrekte een*) (2)

10.3.1 Clockwise ✓ / *Kloksgewys*

(1)

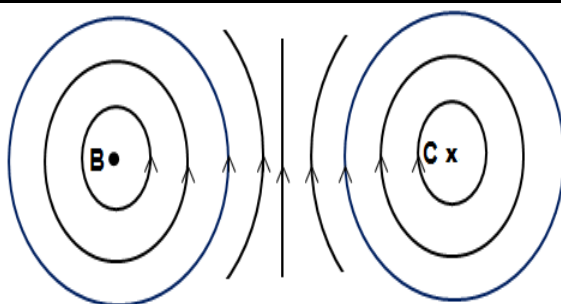
10.3.2 **OPTION/OPSIE 1**



Marking criteria/Nasienkriteria:

- Magnetic field pattern drawn around both point **B** and **C** ✓ / *Magnetiese veldpatroon geteken rondom beide punte **B** en **C***
- Direction of the induced magnetic field ✓ / *Rigting van die geïnduseerde magneetveld*
- Shape of the induced magnetic field between **B** and **C** ✓ / *Vorm van die geïnduseerde magneetveld tussen **B** en **C***

OPTION/OPSIE 2



Marking criteria/Nasienkriteria:

- Magnetic field pattern drawn around both point **B** and **C** ✓ / *Magnetiese veldpatroon geteken rondom beide punte **B** en **C***
- Direction of the induced magnetic field ✓ / *Rigting van die geïnduseerde magneetveld*
- Shape of the induced magnetic field between **B** and **C** ✓ / *Vorm van die geïnduseerde magneetveld tussen **B** en **C***

(3)

$$\begin{aligned} 10.4 \quad \frac{V_S}{V_P} &= \frac{N_S}{N_P} \checkmark \\ \frac{276}{V_P} \checkmark &= \frac{150}{100} \checkmark \\ V_P &= 184 \text{ V } \checkmark \end{aligned}$$

(4)
[12]

TOTAL/TOTAAL: 150