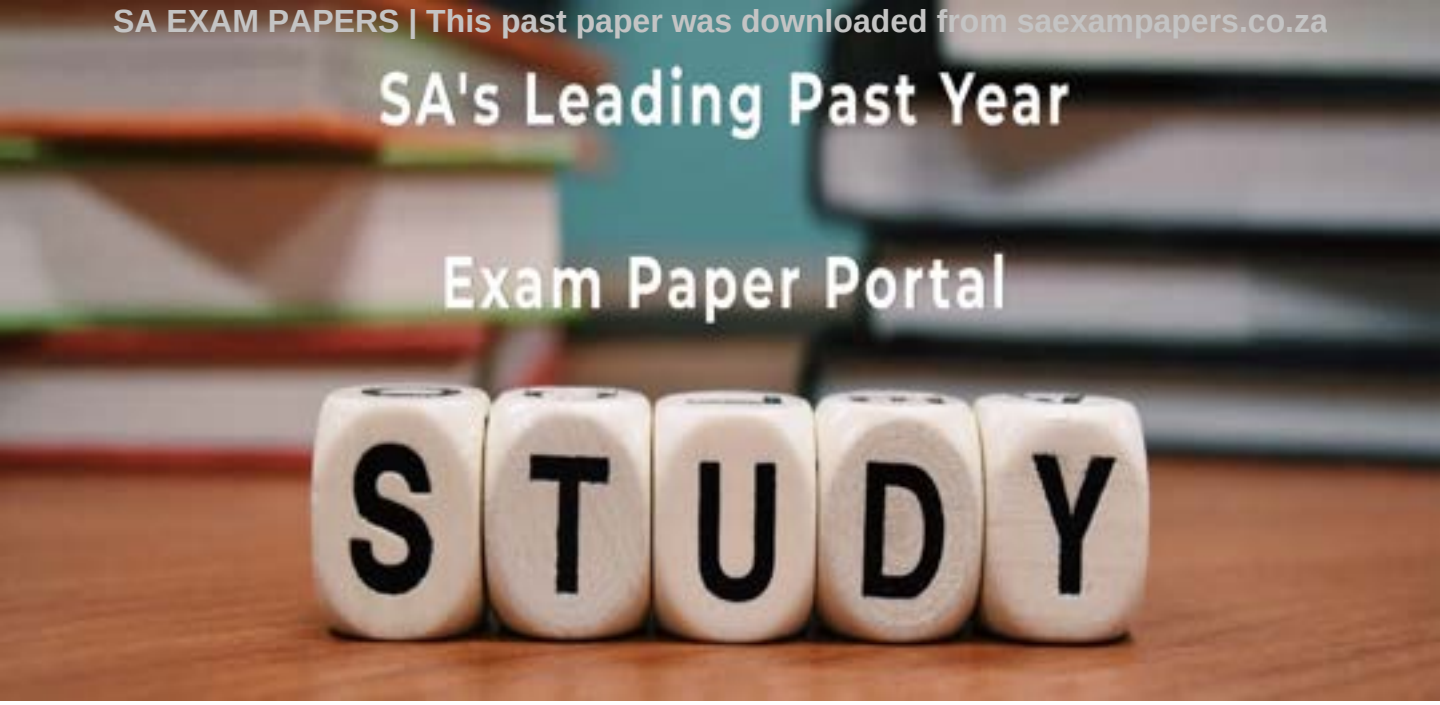

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NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIOR SERTIFIKAAT*

GRADE/*GRAAD* 12

JUNE/*JUNIE* 2025

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

MARKS/*PUNTE*: **150**

This marking guideline consists of 10 pages./
Hierdie nasienriglyn bestaan uit 10 bladsye.

QUESTION/*VRAAG* 1

1.1 A ✓✓ (2)

1.2 B ✓✓ (2)

1.3 C ✓✓ (2)

1.4 C ✓✓ (2)

1.5 D ✓✓ (2)

1.6 D ✓✓ (2)

1.7 B ✓✓ (2)

1.8 D ✓✓ (2)

1.9 C ✓✓ (2)

1.10 D ✓✓ (2)

[20]

QUESTION/*VRAAG* 2

2.1 2.1.1 An object continues in a state of rest or uniform velocity ✓ (moving with constant velocity) unless it is acted upon by an unbalanced force. ✓/

'n Voorwerp gaan voort in 'n toestand van rus of uniforme snelheid ✓ (beweeg met konstante snelheid) tensy 'n ongebalanseerde krag daarop inwerk. ✓

OR/*OF*

An object will remain in its state of rest or continue moving with a constant velocity ✓ unless it is acted on by a resultant force/unbalanced force. ✓/

'n Voorwerp sal in sy rustoestand bly of met 'n konstante snelheid aanhou beweeg ✓ tensy dit deur 'n resulterende krag/ ongebalanseerde krag ingewerk word. ✓ (2)

2.1.2 Zero/*Nul* ✓

OR/*OF*

0 ($m.s^{-1}$) (1)

2.1.3 **OPTION 1/*OPSIE 1***

Choose east to be positive/
Kies oos as positief

$F_{net} = 0$
$F_{net} = ma$
$F_{net} = F_1 + F_2 + F_3$ ✓Any ONE/*Enige EEN*
$0 = -64 + F_2 + 160$ ✓
$F_2 = -96$ N
$F_2 = 96$ N west/*wes* ✓

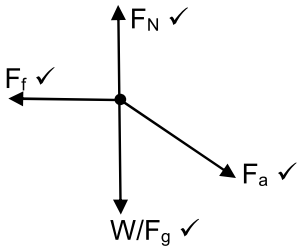
OPTION 2/*OPSIE 2*

Choose east to be negative/
Kies oos as negatief

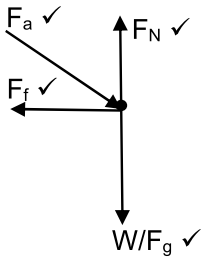
$F_{net} = 0$
$F_{net} = ma$
$F_{net} = F_1 + F_2 + F_3$ ✓Any ONE/*Enige EEN*
$0 = 64 + F_2 + (-160)$ ✓
$F_2 = 96$ N west/*wes* ✓

ACCEPT/AANVAAR
(Maximum: 2 marks/*Maksimum: 2 punte)*
$F_2 = F_3 - F_1$
$F_2 = 160 - 64$ ✓
$F_2 = 96$ N west/*wes* ✓ (3)

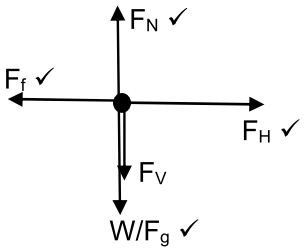
2.2 2.2.1 **OPTION 1/*OPSIE 1***



OPTION 2/*OPSIE 2*



OPTION 3/*OPSIE 3*



(3)

NOTES:
One mark for each arrow with correct label
Penalise (once) for each:

- No arrows
- No dot
- Gap between the line and the dot
- Dotted lines are used
- Additional force is included
- A force diagram is given

NOTAS:
Een punt vir elke pyltjie met korrekte byskrif
Penaliseer (eenkeer) vir elk:

- *Geen pyltjies*
- *Geen punt*
- *Spasie tussen lyn en punt*
- *Stippellyne word gebruik*
- *Additionele kragte is ingesluit*
- *'n Kragte diagram is gegee*

2.2.2

OPTION 1/*OPSIE 1*

$F_f = \mu_k F_N$ ✓
$= \mu_k(F_g + F_v)$
$= 0,24$ ✓$(50 \times 9,8) + (280 \sin 30^\circ)$ ✓
$= 151,20$ N ✓

OPTION 2/*OPSIE 2*

$F_N = F_g + F_v$
$F_N = 50 \times 9,8 + 280 \sin 30^\circ$ ✓
$F_N = 630$ N
$F_f = \mu_k F_N$ ✓
$= 0,24 \times 630$ ✓
$= 151,20$ N ✓ (4)

2.2.3 False/*Onwaar* ✓✓ (2)

2.2.4 **POSITIVE MARKING FROM 2.2.2/ *POSITIEWE NASIEN VANAF 2.2.2***

OPTION 1/*OPSIE 1*

$F_{net} = ma$
$F_{net} = F_H + F_f$ ✓ Any ONE/*Enige EEN*
$F_H + F_f = ma$
$(280 \cos 30^\circ) + (-151,20)$ ✓ $= 50a$ ✓
$\therefore a = 1,83\ m.s^{-2}$ ✓

OPTION 2/*OPSIE 2*

$F_{net} = F_H + F_f$
$= 280 \cos 30^\circ + (-151,20)$ ✓
$= 91,29$ N
$F_{net} = ma$ ✓
$91,29 = 50a$ ✓
$\therefore a = 1,83\ m.s^{-2}$ ✓ (4)

2.2.5 Decrease/*Verminder* ✓✓ (2)
[22]

QUESTION/*VRAAG* 3

3.1 3.1.1 Momentum is defined as the product of an object's mass and its velocity. ✓✓/
Momentum word gedefinieer as die produk van 'n voorwerp se massa en sy snelheid. (2)

3.1.2 Yes/*Ja* ✓ (1)

3.1.3 East as positive/ *Oos as positief*

$\Sigma p_i = \Sigma p_f$ ✓ Any ONE/ *Enige EEN*
$m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$
$(10)(8) + (6)(0)$ ✓$= (10)(-0,50) + (6)v_{2f}$ ✓
$v_{2f} = 14,17\ m.s^{-1}$ east / *oos* ✓ (4)

3.1.4 Law of conservation of momentum ✓
Total linear momentum of an isolated system remains constant (is conserved) in magnitude and direction. ✓✓/

Wet van behoud van momentum ✓
Totale lineêre momentum van 'n geïsoleerde stelsel bly konstant (is behoue) in grootte en rigting. ✓✓ (3)

3.2 3.2.1 Impulse is the product of the net force acting on an object ✓ and the time the net force acts on the object. ✓/

Impuls is die produk van die netto krag wat op 'n voorwerp inwerk ✓ *en die tyd wat die netto krag op die voorwerp inwerk.* ✓ (2)

3.2.2 Directly proportional / *Direk eweredig* ✓✓ (2)

3.2.3 From impulse-momentum theorem, it follows that the net force exerted on an object is inversely proportional to the contact time. ✓✓
Accept mathematical expression: $F_{net} \propto \frac{1}{\Delta t}$ /

Uit impuls-momentumstelling volg dit dat die netto krag wat op 'n voorwerp uitgeoefen word inverse eweredig is aan die kontaktyd. ✓✓
Aanvaar wiskundige uitdrukking: : $F_{net} \propto \frac{1}{\Delta t}$ (2)

3.2.4

OPTION 1/*OPSIE 1*

$F_{net}\Delta t = \Delta p$
$F_{net}\Delta t = p_f - p_i$
$F_{net}\Delta t = m(v_f - v_i)$
✓ Any ONE/*Enige EEN*
$F_{net}(0{,}007)$ ✓ $= 0{,}29(-15{,}70 - 24{,}69)$ ✓
$F_{net} = -1\,673{,}30$ N
$F_{net} = 1\,673{,}30$ N
Away from the batman /
Weg van die kolwer ✓

OPTION 2/*OPSIE 2*

$F_{net} = \frac{\Delta p}{\Delta t}$
$F_{net} = \frac{m(v_f - v_i)}{\Delta t}$
✓ Any ONE
Enige EEN
F_{net}
$= \frac{0{,}29(15{,}70 - (-24{,}69)\ ✓}{0{,}007\ ✓}$
$F_{net} = -1\,673{,}30$ N
$F_{net} = 1\,673{,}30$ N
Away from the batman /
Weg van die kolwer ✓ (4)

3.2.5 **Positive marking from 3.2.4/*Positiewe nasien vanaf 3.2.4***
1 673,30 N ✓ towards the batsman / *na die kolwer* ✓ (2)

3.2.6 Newton's Third Law of motion. ✓
When object A exerts a force on object B, object B simultaneously exerts an oppositely directed force of equal magnitude on object A. ✓✓/

Newton se Derde bewegingswet. ✓
Wanneer voorwerp A 'n krag op voorwerp B uitoefen, oefen voorwerp B gelyktydig 'n teenoorgestelde gerigte krag van gelyke grootte op voorwerp A uit. ✓✓ (3)
[25]

QUESTION/*VRAAG* 4

4.1 4.1.1 Kinetic energy is the energy of an object due to its motion. ✓✓/
Kinetiese energie is die energie van 'n voorwerp as gevolg van sy beweging. (2)

4.1.2 The total mechanical energy (sum of gravitational potential energy and kinetic energy) in an isolated system ✓ remains constant. ✓

Die totale meganiese energie (som van gravitasie potensiële energie en kinetiese energie) in 'n geïsoleerde sisteem ✓ bly konstant. ✓ (2)

4.1.3 $(E_m)_{top} = E_p + E_k$
$ME = E_p + E_k$
$ME = mgh + ½ mv^2$
} ✓ Any ONE/ *Enige EEN*

$ME = (5)(9,8)(4) + ½ (5)(0)^2$ ✓
ME = 196 J ✓ (3)

4.1.4 **POSITIVE MARKING FROM Q4.1.3/ *POSITIEWE NASIEN VANAF V4.1.3***

OPTION 1/ *OPSIE 1*

$(ME)_{2m} = (ME)_{top}$
$(E_p + E_k)_{2m} = (ME)_{top}$
} ✓Any ONE/ *Enige EEN*

$(5)(9,8)(2) + E_k = 196$ J ✓
$E_k = 98$ J
$½ mv^2 = 98$
$½ (5)v^2 = 98$ ✓
$v = 6,26$ m.s^{-1} ✓

POSITIVE MARKING FROM Q4.1.3/*POSITIEWE NASIEN VANAF V4.1.3*

OPTION 2/ *OPSIE 2*

$(ME)_{2m} = (ME)_{top}$
$(E_p + E_k)_{2m} = (ME)_{top}$
} ✓ Any ONE/ *Enige EEN*

$\underline{(5)(9,8)(2) + ½ (5)v^2}$ ✓= 196 ✓
$98 + 2,5 v^2 = 196$
$v^2 = 39,2$
v = 6,26 m.s^{-1} ✓ (4)

4.1.5 **POSITIVE MARKING FROM Q4.1.3/ *POSITIEWE NASIEN VANAF V4.1.3***
$E_k = 196$ J

The system is isolated. ✓ The kinetic energy at the bottom is equal to the gravitational potential energy at the top. ✓/
Die stelsel is geïsoleer. ✓ *Die kinetiese energie aan die onderkant is gelyk aan die gravitasie potensiële energie aan die bokant.* ✓

OR/*OF*

The mechanical energy is conserved ✓ because the system is isolated. ✓
Die meganiese energie is behoue ✓ *omdat die sisteem geïsoleerd is.* ✓ (3)

4.2 4.2.1 Work done is the product of the force applied on an object and the displacement ✓ in the direction of the force. ✓/
Arbeid verrig is die produk van die krag wat op 'n voorwerp toegepas word en die verplasing ✓ *in die rigting van die krag.* ✓ (2)

4.2.2 $W_f = F_f \Delta x \cos \theta$ ✓
$W_f = (20)(4,5)\cos 180^\circ$ ✓
$W_f = -90$ J ✓ (3)

4.2.3 0 J ✓✓ (2)

4.2.4 **OPTION 1/*OPSIE 1***
$W_{net} = F_{net}\Delta x \cos \theta$ ✓
$W_{net} = (100 - 20)$ ✓$(4,5)\cos 0^\circ$ ✓
$W_{net} = 360$ J ✓

OPTION 2/ *OPSIE 2*
POSITIVE MARKING FROM Q4.2.2/
POSITIEWE NASIEN VANAF V4.2.2
$W_{net} = W_f + W_F$ ✓
$W_{net} = F_f\Delta x \cos 180^\circ + F_a\Delta x \cos 0^\circ$
$W_{net} = (20)(4,5)(-1)$ ✓$+ (100)(4,5)(1)$ ✓
$W_{net} = 360$ J ✓ (4)

[25]

QUESTION/*VRAAG* 5

5.1 A body which regains its original shape and size completely when the deforming force is removed. ✓✓/
'n Liggaam wat sy oorspronklike vorm en grootte heeltemal herwin wanneer die vervormende krag verwyder word. ✓✓ (2)

5.2 The internal restoring force per unit area is called stress. ✓✓/
Die interne herstelkrag per oppervlakte-eenheid word spanning genoem. ✓✓ (2)

5.3 5.3.1 Stress is directly proportional to strain. ✓✓/
Druk is direk eweredig aan spanning. ✓✓ (2)

5.3.2 Hooke's law/ *Hooke se wet* ✓ (1)

5.3.3 Substance **A**/ *Stof **A***

$m_A = \frac{5,4 \times 10^9 - 0}{3 \times 10^{-2} - 0}$ ✓

$m_A = 1,80 \times 10^{11} Pa$ ✓

Substance **B**/ *Stof **B***

$m_B = \frac{10,44 \times 10^9 - 0}{3 \times 10^{-2} - 0}$ ✓

$m_B = 3,48 \times 10^{11} Pa$ ✓

Substance **B** has the highest modulus of elasticity. ✓/*Stof **B** het die hoogste elastisiteits-modulus.* (5)

5.4 5.4.1 The property of a fluid to oppose relative motion between the two adjacent layers. ✓✓/
Die eienskap van 'n vloeistof om relatiewe beweging tussen die twee aangrensende lae teen te werk. ✓✓ (2)

5.4.2 Vinegar ✓
The lower the viscosity, the faster the flow. ✓/
Asyn ✓
Hoe laer die viskositeit, hoe vinniger die vloei. ✓ (2)

5.4.3 As the temperature of the fluid increases, its viscosity decreases. ✓✓/
Soos die temperatuur van die vloeistof toeneem, neem die viskositeit daarvan af. ✓✓ (2)

5.5 5.5.1 Pascal's law states that in a continuous liquid at equilibrium, the pressure applied at a point is transmitted equally to the other parts of the liquid. ✓✓/
Pascal se wet bepaal dat in 'n kontinue vloeistof by ewewig is, die druk wat by 'n punt toegepas word, eweredig na die ander dele van die vloeistof oorgedra word. ✓✓ (2)

5.5.2 $\frac{F_1}{A_1} = \frac{F_2}{A_2}$ ✓
$\frac{882{,}5}{142 \times 10^{-6}}$ ✓$= \frac{F_2}{253{,}5 \times 10^{-6}}$ ✓
$F_2 = 1\,575{,}45$ N ✓ (4)

5.5.3 INCREASES/*VERMEERDER* ✓ (1)

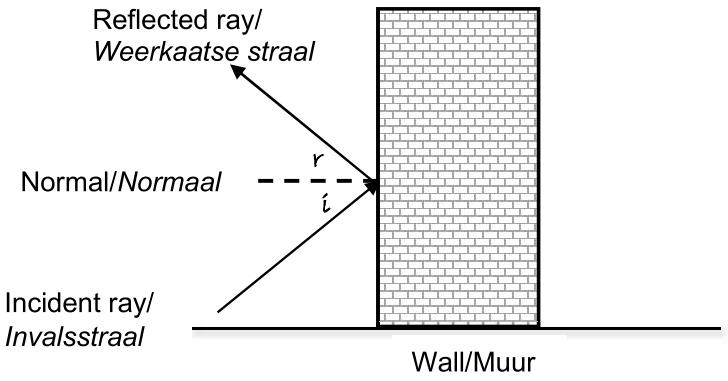
5.5.4
- Bulldozer's working system/*Stootskraper se werkstelsel*
- Dentist chair/T*andartsstoel*
- Hydraulic lifts used to lift heavy loads/*Hidrouliese hysbakke wat gebruik word om swaar vragte op te lig*
- Car jacks/*Motordomkragte* ✓✓ (Any TWO/*Enige TWEE*) (2)

[27]

QUESTION/*VRAAG* 6

6.1 The change in direction of a wave upon striking the interface between two materials. ✓✓/
Die verandering in rigting van 'n golf wanneer dit die raakvlak tussen twee materiale tref. (2)

6.2



Criteria for marking diagram/ *Kriteria vir die nasien van diagram*	**Marks/ *Punte***
• Angle of reflection correctly indicated /*Hoek van weerkaatsing korrek aangedui*	✓
• Reflected ray correctly drawn/*Weerkaatse straal korrek geteken*	✓
• Incident ray, normal and reflected ray meet at the same wall/ *Invallende straal, normale en weerkaatse straal ontmoet by dieselfde muur*	✓

(3)

6.3 6.3.1 The ratio of speed of light in a vacuum to the speed of light in the medium. ✓✓/
Die verhouding van spoed van lig in 'n vakuum tot die spoed van lig in die medium. ✓✓ (2)

6.3.2 Medium **A** ✓✓ (2)

6.3.3 FALSE. ✓ It has the lowest refractive index, meaning less optical dense. ✓✓/
ONWAAR. Dit het die laagste brekingsindeks, d.w.s minder opties dig. (3)

6.3.4 Towards the normal. ✓
Speed of light in medium C is faster than the speed of light in medium D. ✓
The refractive index of medium C is higher than medium D. ✓

Na die normale. ✓
Spoed van lig in medium C is vinniger as die spoed van lig in medium D. ✓
Die brekingsindeks van medium C is hoër as medium D. ✓

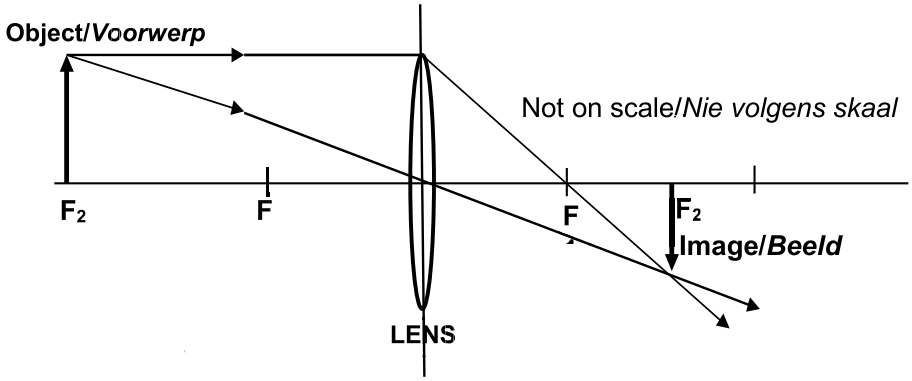
OR/*OF*
Light is moving from optically less dense to optically denser medium.
Lig beweeg van opties minder dig na opties digter medium. (3)

[15]

QUESTION/*VRAAG* 7

7.1 7.1.1 When an object is placed between the focus and optical centre. ✓✓/ *Wanneer 'n voorwerp tussen die fokus en optiese middelpunt geplaas word.* ✓✓ (2)

7.1.2



Criteria for Marking Diagram/ Kriteria vir Nasiendiagram	Marks/ *Punte*
• Lens with centre line/*Lens met middellyn.*	✓
• 2F or F_2 on respective sides of the lens. /*2F of F_2 op onderskeie kante van die lens*	✓
• Principal axis with the position of the focal point F on both sides of the lens at equal distance from optical centre. / *Hoof-as met die posisie van die fokuspunt F aan beide kante van die lens op gelyke afstand van optiese middelpunt.*	✓✓
• Parallel incident ray to the principal axis refracts and goes through to the focal point. /*Parallelle invallende straal met die hoof-as breek en gaan deur na die fokuspunt.*	✓✓
• The ray passes through to the optical centre of the lens without being refracted. /*Die straal gaan deur na die optiese middelpunt van die lens sonder om gebreek te word.*	✓✓

(8)

7.1.3 Position of the image = 28–30 mm from lens (further than 2F) ✓
Size of the image = 10–12 mm high ✓
Nature of the image = real, inverted and enlarged. ✓ (Any one) /
Posisie van die beeld = 28–30 mm vanaf lens (verder as 2F) ✓
Grootte van die beeld = 10–12 mm hoog ✓
Aard van die beeld = werklik, omgekeerd en vergroot. ✓*(Enige een)* (3)

7.2
- Magnifying glasses/*Vergrootglase*
- Microscope/M*ikroskoop*
- Cameras/K*ameras*
- Telescopes/*Teleskope*
- Projectors/*Projektors*
- Binoculars/*Verkykers*

✓✓✓ *(*Any THREE/*Enige DRIE)* (3)

[16]

TOTAL/*TOTAAL*: 150