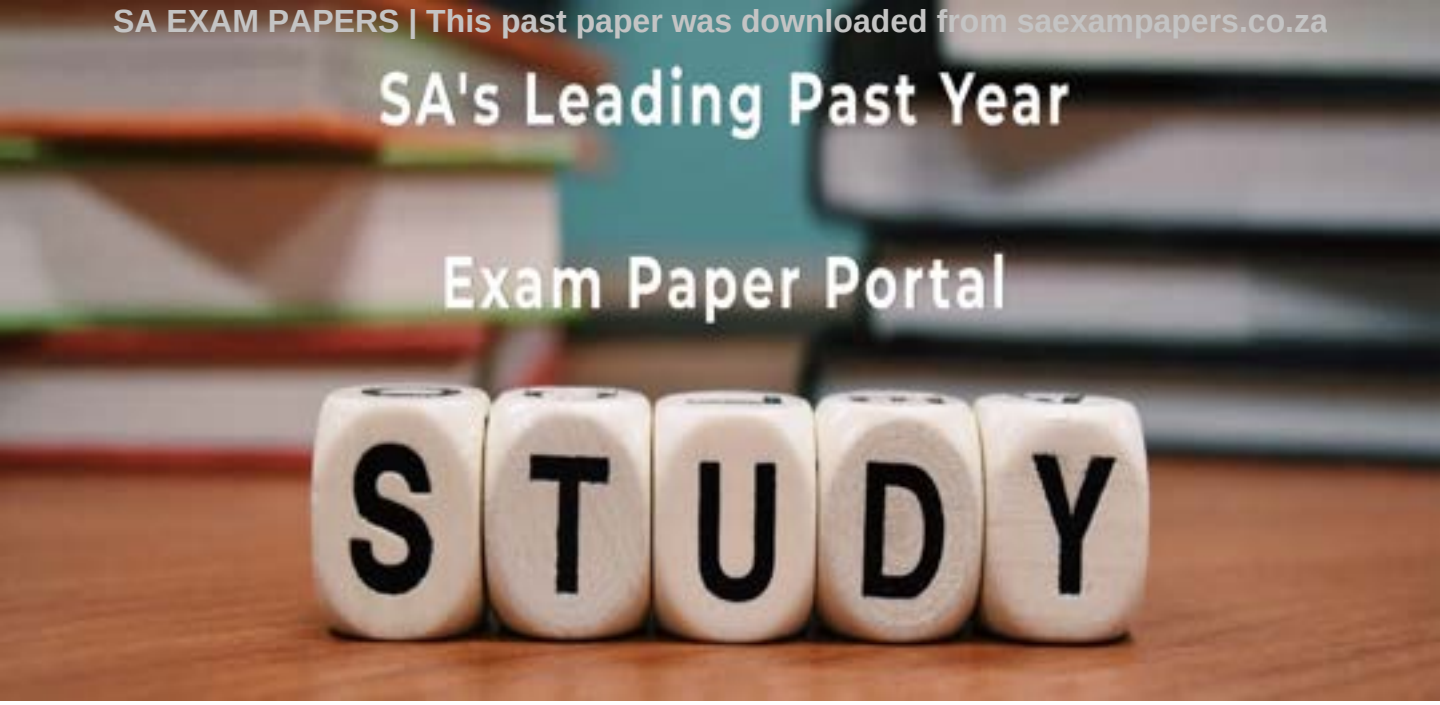


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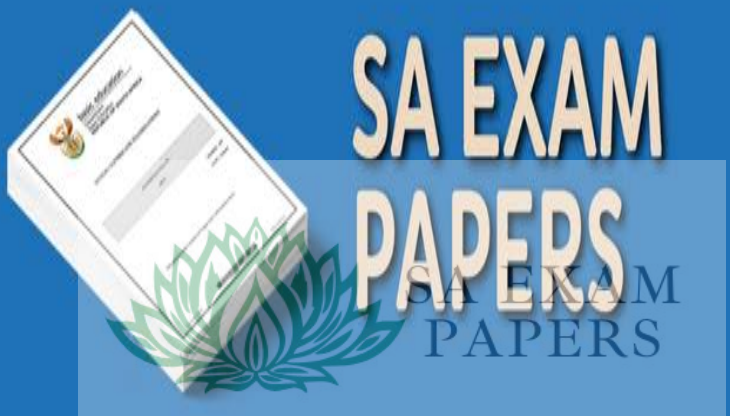

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Porafensie Ya Kapa Botjahabela: Lefapha la Thuto

# NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIORSERTIFIKAAT*

## GRADE/*GRAAD* 12

## SEPTEMBER 2024

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

**[20]**

**QUESTION/*VRAAG 2***

2.1 When the brakes are applied, the truck moves slower/the truck experiences a change in its state of motion, ✓ while the man keeps on moving with the same velocity the truck was moving with. ✓

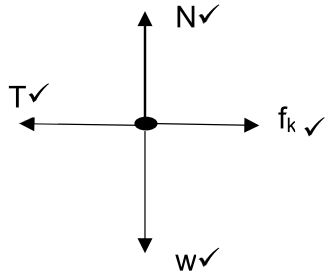
*Wanneer die remme toegepas word, beweeg die trok stadiger/ die trok ervaar 'n verandering in sy toestand van beweging, ✓ terwyl die man aanbeweeg met dieselfde snelheid wat die trok beweeg het.* (2)

2.2 Newton's first law/*Newton se eerste wet* ✓ (1)

2.3 2.3.1 When a net 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 force and inversely proportional to the mass of the object.) ✓✓

*Wanneer 'n 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 netto krag en omgekeerd eweredig aan die massa van die voorwerp.)* (2)

2.3.2




| Marking criteria/*Nasienkriteria* | Labels/ Byskrifte | Marks/ *Punte* |
|---|---|---|
| Correct direction and label of normal force/ *Regte rigting en benoeming van die normale krag* | $N/F_N$ | 1 |
| Correct direction and label of the weight/ *Regte rigting en benoeming van die gewig* | Fg/w | 1 |
| Correct direction and label of horizontal and vertical component of the applied force **OR** Correct direction and label of applied force/ *Regte rigting en benoeming van horisontale en vertikale komponent van die toegepasde krag **OF** Korrekte rigting en benoeming van toegepaste krag* | $F/F_a$ | 1 |
| Correct direction and label of frictional force/ *Regte rigting en benoeming van wrywingskrag* | $f/f_k/F_f$ | 1 |

(4)

2.3.3 $F_{net} = 0$
$N + F_V + w = 0$
$N + F\sin\theta + mg = 0$ } Any ONE/*Enige EEN*
$N = (5)(9,8)$ ✓ $- (25\sin 30°)$ ✓
$N = 36,5$ N ✓ (4)

2.3.4 **Positive marking from QUESTION 2.3.3/*Positiewe nasien vanaf VRAAG 2.3.3***

**For block X/*Vir blok X***
$F_{net} = ma$ ✓
$F_H + T + f_k = ma$
$25\cos30^\circ - T - (0,2)(36,5)$ ✓ $= 5a$ ✓
$-T + 14,35 = 5a$……(equation1/*vergelyking 1*)

**For block Y / *Vir blok Y***
$F_{net} = ma$
$T + f_k = ma$
$T - (0,1)(3)(9,8)$ ✓ $= 3a$ ✓
$T - 2,94 = 3a$……(equation 2/ *vergelyking 1*)

**Add equation 1 and 2 / *Tel vergelyking 1 en 2 op***
$-T + 14,35 = 5a$
$T - 2,94 = 3a$
$11,49 = 8a$
$a = 1,43 m.s^{-2}$ ✓ **(Accept 1,426m.s$^{-2}$ / *Aanvaar 1,426 m.s$^{-2}$*)** (6)

2.3.5 **Positive marking from QUESTION 2.3.4 / *Positiewe nasien vanaf VRAAG 2.3.4***

**OPTION 1 from equation 1/**
***OPSIE 1 vanaf vergelyking 1***
$-T + 14,35 = 5a$
$T = 14,35 - (5)(1,43)$ ✓
$T = 7,22$N ✓
**(Accept/A*anvaar* 7,20N to 7,22N)**

**OPTION 2 from equation 2**
***OPSIE 2 vanaf vergelyking 2***
$T - 2,94 = 3a$
$T = (3)(1,43)$ ✓
$T = 7,22$N ✓

(2)
**[21]**

**QUESTION/*VRAAG 3***

3.1 3.1.1 A system in which the net external force acting on the system is zero. ✓✓
*'n Sisteem waar by die netto eksterne kragte wat op die sisteem toegepas word, nul is.* (2)

3.1.2 The product of an object's mass and its velocity. ✓✓
*Die produk van 'n voorwerp se massa en sy snelheid.* (2)

3.2 Zero/Nul/0 ✓ (1)

3.3 $p = mv$ ✓$= (3 \times 10^{-3})(120)$ ✓ $= 0{,}36\ kg{\cdot}m{\cdot}s^{-1}$ ✓ (3)

3.4 The <u>total linear momentum</u> of an <u>isolated</u> system ✓<u>remains constant</u> (is conserved) in magnitude and direction. ✓
*Die <u>totale lineêre momentum</u> van 'n geïsoleerde sisteem ✓ bly konstant (word behou) in grootte en rigting.* ✓ (2)

3.5 **Positive marking from QUESTION 3.3/ *Positiewe nasien vanaf VRAAG 3.3***
$\Sigma p_i = \Sigma p_f$ ✓
$0{,}36 + 0$ ✓ $= (50 \times 10^{-3})v_f$ ✓
$v_f = 7{,}2\ m{\cdot}s^{-1}$ **(No mark for answer/ *Geen punt vir antwoord*).** (3)

3.6 $K_i = \frac{1}{2}mv^2$
$= \frac{1}{2}(3 \times 10^{-3})(120^2) + 0$ ✓
$= 21{,}6$ J
$K_f = \frac{1}{2}mv^2$
$= \frac{1}{2}(50 \times 10^{-3})(7{,}2)$ ✓
$= 1{,}296$ J
$K_i \neq K_f$ ✓
Therefore, INELASTIC collision./ *Dus ONELASTIESE botsing* ✓ (5)

✓

If a learner starts off with $K_i = K_f$, /
*As die leerder begin met* $K_i = K_f$,
Max./Maks. 3/5

**[18]**

**QUESTION/*VRAAG 4***

4.1 The product of the force applied on an object and the displacement in the direction of the force. ✓✓

*Die produk van die toegepaste krag op 'n voorwerp en die verplasing in die rigting van die krag.* (2)

4.2

**OPTION 1/ *OPSIE 1***

$W_{Fa} = F_a.\Delta x.\cos\theta$
$W_{Fx} = F_x.\Delta x.\cos\theta$
$W_{Fx} = (F.\cos\theta).\Delta x.\cos\theta$ ✓

$W_{Fx} = (15\cos 30^\circ)(5)$ ✓ $\cos 0^\circ$ ✓
$W_{Fx} = 64,95$ J ✓

**OPTION 2/ *OPSIE 2***

$W_{Fa} = F_a.\Delta x.\cos\theta$
$W_{Fx} = (F\cos\theta).\Delta x.\cos\theta$ ✓

$W_{Fx} = 15(5)\cos 0$ ✓
$W_{Fx} = 75$ J

**NOTE: (**2/4) Max./Maks. (4)

4.3 4.3.1 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 stelsel bly konstant.* ✓✓ (2)

4.3.2
$Em(A) = Em(B)$
$(E_P + E_K)_A = (E_P + E_K)_B$ ✓
$(mgh + ½mv^2)_A = (mgh + ½mv^2)_B$
$(1,5)(9,8)(12) + ½(1,5)(0)$ ✓ $= (1,5)(9,8)(7,5) + ½(1,5)v^2$ ✓
$v = 9,39\ m \cdot s^{-1}$ ✓ (4)

4.3.3 The force that opposes the motion of a moving object (relative to a surface) ✓ and acts parallel to the surface. ✓

*Die krag wat teenstand bied teen die rigting van 'n bewegende voorwerp (relatief aan die oppervlakte) en wat parallel met die oppervlakte toegepas word.*

**OR**

The force parallel to the surface that opposes the motion of a moving object ✓ and acts in the direction opposite to the motion of the object. ✓

*Die krag parallel aan die oppervlak wat die beweging van 'n bewegende voorwerp teenstaan en in die rigting teenoor die beweging van die voorwerp inwerk.*

**OR**

The force acting between the two surfaces in contact when an object is moving. ✓✓

*Die krag wat toegepas word tussen die twee oppervlaktes in kontak met mekaar wanneer die voorwerp beweeg.* (2)

4.3.4 No ✓/ *Nee*
**Negative marking / *Negatiewe nasien***
The system is isolated. ✓/ *Die sisteem is geïsoleerd.* (2)

4.3.5 $W_{fk} = f_k \Delta x \text{ Cos } \theta$ ✓
$= (4,41)(2)\cos 180°$ ✓
$= -8,82$ J ✓ (3)

4.3.6 **Positive marking from QUESTION 4.3.5 / *Positiewe nasien vanaf VRAAG 4.3.5***

$P = \frac{W}{\Delta t}$ ✓

$= \frac{8,82}{5}$ ✓

= 1,76 J ✓ (3)
**[22]**

**QUESTION/*VRAAG 5***

5.1 5.1.1 A property of the body by virtue of the body to regain its original shape and size ✓when the deforming force is removed. ✓/

*Die eienskap van die liggaam waardeur die liggaam in staat is om sy oorspronklike vorm en grootte te herstel* ✓ *wanneer die vervormingskrag verwyder word.* ✓ (2)

5.1.2 A *perfectly elastic* body regain it's original shape and size completely when the deforming force is removed. ✓
A *perfectly plastic* body does not regain it's original shape and size when the deforming force is removed. ✓

*'n Volkome elastiese liggaam is 'n liggaam wat sy oorspronklike vorm en grootte volkome herwin wanneer die vervormingskrag verwyder word.* ✓
*'n Volkome plastiese liggaam is 'n liggaam wat nie 'n neiging toon om sy oorspronklike grootte en vorm te verkry wanneer die vervormingskrag verwyder word nie.* ✓ (2)

5.2 5.2.1 $\sigma = \frac{F}{A}$ ✓

$= \frac{12\,000}{9\,500}$ ✓

$=1{,}26\ m^2$ ✓ (3)

5.2.2 $\varepsilon = \frac{\Delta l}{L}$ ✓

$= \frac{0{,}12}{1{,}5}$ ✓ = 0,08 ✓ **Accept/*Aanvaar*** (0,1) (3)

5.3 5.3.1 The property of the fluid to oppose relative motion ✓ between the two adjacent layers. ✓/

*Die eienskap van die vloeistof om relatiewe beweging* ✓ tu*ssen die twee aangrensende vlakke te opponeer.* ✓

**OR/*OF***

Viscosity is the internal property of a fluid ✓ that offers resistance to flow. ✓/
*Viskositiet is die interne eienskap van 'n vloeistof* ✓ *wat weerstand bied aan vloei.* ✓ (2)

5.3.2 Decrease / *Verminder* ✓ (1)
**[13]**

**QUESTION/*VRAAG 6***

6.1 6.1.1 When light falls on a plane surface it is so reflected that the angle of reflection is equal to the angle of incidence. ✓
The incident ray, the reflected ray and normal ALL lie on the same plane. ✓

*Wanneer lig op 'n platvlak val, is dit so geweerkaats dat die weerkaatsingshoek gelyk is aan die invalshoek.* ✓
*Die invalstraal, weerkaatste straal en normaalstraal lê almal op dieselfde vlak.* ✓ (2)

6.1.2 **R** – Normal / *Normaal* ✓
**Q** – Reflected ray / *Weerkaatste straal* ✓ (2)

6.2 6.2.1 The angle of incident in the dense 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***

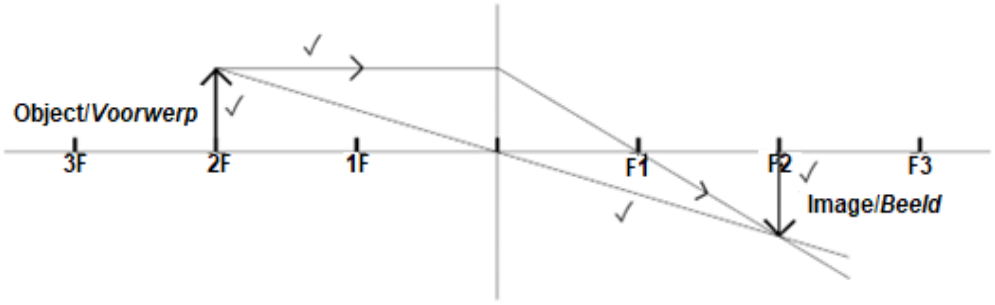
The angle of incidence in the optically dense medium for which the angle of refraction is 90°. ✓✓
*Die invalshoek in die optiese digter medium waarvan die gebreekte hoek 90° is.* (2)

6.2.2 Total internal reflection / *Totale interne weerkaatsing* ✓ (1)

6.2.3 Medium 1 ✓ (1)

6.2.4 $i_3$ ✓ (1)

6.3




**CRITERIA FOR MARKING/*KRITERIA VIR NASIEN***

| | |
|---|---|
| Object (20 mm) at 2F/ *Voorwerp(20 mm) by 2F* ✓ | 1 |
| Parallel line to principle axis / *Parallel lyn na die hoofas* ✓ | 1 |
| Diagonal ray through the optic centre/ *diagonaal/skuinstraal deur die optiese middel* ✓ | 1 |
| Image at $F_2$ same size as object./ *Beeld by $F_2$ dieselfde groote as voorwerp* ✓ | 1 |

(4)

**[13]**

**QUESTION/*VRAAG 7***

7.1 A changing magnetic and electric field mutually perpendicular to each other and the direction of propagation of the wave./
*'n Verandering van magnetiese en elektriese velde onderling loodreg op mekaar en die rigting van die voortplanting van die golf.* ✓✓ (2)

7.2 They have high frequency./ *Hulle het hoë frekwensie* ✓ (1)

7.3 7.3.1 Ultraviolet rays (UV)/ *Ultraviolet-strale* ✓ (1)

7.3.2 Gamma rays / *Gamma-strale* ✓ (1)

7.4 Quantum (packets) of energy./ *Kwantum van energie* ✓ (1)

7.5 **OPTION 1/*OPSIE 1***

$c = f\lambda$
$3,0 \times 10^{8}$ ✓ $= f(5,10 \times 10^{-11})$ ✓
$f = 5,88 \times 10^{18}$ Hz
$E = hf$ ✓
$= 6,63 \times 10^{-34}$ ✓ $\times 5,88 \times 10^{18}$
$= 3,9 \times 10^{-15}$ J ✓

**OPTION 2/*OPSIE 2***

$E = h\frac{c}{\lambda}$ ✓
$= (6,63 \times 10^{-34})$ ✓$\times \frac{3,0 \times 10^{8}}{5,10 \times 10^{-11}}$ ✓✓
$= 3,9 \times 10^{-15}$J ✓ (5)

**[11]**

**QUESTION/*VRAAG 8***

8.1 It is a device for storing electrical charge. ✓✓
*Dit is 'n toestel wat elektriese lading stoor.* (2)

8.2
- Surface area of the plates. / *Oppervlakte van die plate.* ✓
- Distance between the plates./ *Afstand tuseen die plate.* ✓
- Type of dielectric material. / *Tipe diëlektriek materiaal.* ✓ (3)

8.3 Area = 2,0 $cm^2$ $(1/100)^2$ = 2,0 x $10^{-4}$ $m^2$

$$C = \frac{\varepsilon_o A}{d} \checkmark$$

$$= \frac{(8{,}85 \times 10^{-12})\left((2{,}0 \times 10^{-4}\right) \checkmark}{2{,}0 \times 10^{-3} \checkmark}$$

$$= 8{,}85 \times 10^{-13} \text{ F}$$

$$C = \frac{Q}{V} \checkmark$$

$$8{,}85 \times 10^{-13} = \frac{4{,}0 \times 10^{-12}}{V} \checkmark$$

$V$ = 4,5 V ✓ (6)
**[11]**

**QUESTION/*VRAAG* 9**

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

9.2.1 $P = I^2R$ ✓
$36 = I^2(4)$ ✓
$I = 3\ A$ ✓ (3)

9.2.2 **Positive marking from QUESTION 9.2.1/**
***Positiewe nasien vanaf VRAAG 9.2.1***

| **OPTION 1/*OPSIE 1*** | **OPTION 2/*OPSIE 2*** | **OPTION 3/*OPSIE 3*** |
|---|---|---|
| $R = \frac{V}{I}$ ✓<br>$4 = \frac{V}{3}$ ✓<br>V = 12 v ✓ | P = VI ✓<br>36 = V x 3 ✓<br>V = 12 v ✓ | $P = \frac{V^2}{R}$ ✓<br>$36 = \frac{V^2}{4}$ ✓<br>V = 12 v ✓ |

(3)

9.2.3 **Positive marking from QUESTION 9.2.2 / P*ositiewe nasien vanaf VRAAG 9.2.2***

$R = \frac{V}{I}$ ✓

$16$ ✓ $= \frac{12}{I}$ ✓

I = 0,75 A ✓ (4)

**[12]**

**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 teen die effek wat dit produseer.* (2)

10.2 $\emptyset = BA$ ✓
$= (0,4)(2,29\ x\ 10^{-3})$ ✓
$= 9,16 \times 10^{-4}$ Wb ✓ (3)

10.3 **Positive marking from QUESTION 10.1/ *Positiewe nasien vanaf VRAAG 10.1***

$\varepsilon = -N\frac{\Delta\emptyset}{\Delta t}$ ✓

$= -(75)\frac{0 - 9,16 \times 10^{-4}}{0,05}$ ✓

$= 1,37\ V$ ✓ (3)
**[8]**

**TOTAL/*TOTAAL*: 150**