



Province of the  
**EASTERN CAPE**  
EDUCATION



**NATIONAL  
SENIOR CERTIFICATE/  
NASIONALE SENIOR  
SERTIFIKAAT**

**GRADE/GRAAD 12**

**SEPTEMBER 2022**

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

**MARKS/PUNTE: 150**

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This marking guideline consists of 9 pages.  
*Hierdie nasienriglyn bestaan uit 9 bladsye.*

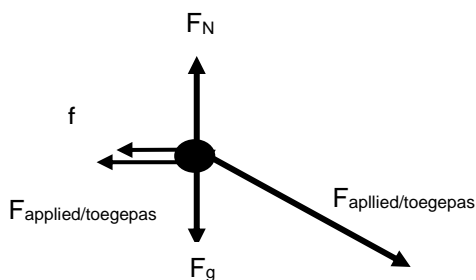
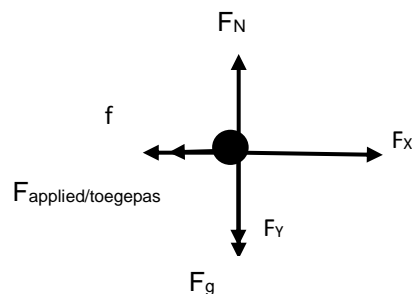
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**QUESTION/VRAAG 1**

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

**QUESTION/VRAAG 2**

- 2.1 The block has resistance to its state of rest (and/or) motion. ✓✓  
*Die blok oefen weerstand uit op sy toestand van rus (en/of) beweging.* ✓✓ (2)
- 2.2 When a net force acts on an object, the object will accelerate in the direction of the net force. ✓ Acceleration is directly proportional to the net force and inversely proportional to the mass of the object. ✓  
*Indien 'n netto krag op 'n voorwerp 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 **OPTION/OPSIE 1****OPTION/OPSIE 2**

<b>Acceptable Forces and Labels</b>		<b>Aanvaarbare Kragte en Byskrifte</b>	
$F_N / N$	Normal Force	$F_N / N$	<i>Normaalkrag</i>
$F_g / W / W_g$	Weight	$F_g / W / W_g$	<i>Gewig</i>
$F_f / f$	Frictional Force	$F_f / f$	<i>Wrywingskrag</i>
$F_{\text{applied}} / F_a$	Applied Force	$F_{\text{toeg}} / F_a$	<i>Toegepaste krag</i>

(5)

2.4 **OPTION/OPSIE 1**

$$F_{AH} = F \cos \theta \checkmark$$

$$= 42 \cos 60^\circ \checkmark$$

$$= 21 \text{ N}$$

$$F_{net} = F_{AH} + F_Y + F_f$$

$$= 21 + (-10) + (-6) \checkmark$$

$$= 5 \text{ N}$$

$$F_{net} = ma \checkmark$$

$$5 = 2,4 a \checkmark$$

$$a = 2,08 \text{ m}\cdot\text{s}^{-2} \checkmark$$

**OPTION/OPSIE 2**

$$F_{net} = ma \checkmark$$

$$(42\cos60^\circ) \checkmark + (-10) + (-6) \checkmark = 2,4a \checkmark$$

$$a = 2,08 \text{ m}\cdot\text{s}^{-2} \checkmark$$

(5)  
[14]

**QUESTION/VRAAG 3**

3.1 3.1.1 A system on which the net external force acting on the system is zero. / No net external forces  $\checkmark\checkmark$   
*’n Sisteem waarop die netto eksterne kragte wat daarop inwerk nul is./*  
*Geen netto eksterne kragte  $\checkmark\checkmark$*

(2)

3.1.2 NO / NEE  $\checkmark$

(1)

3.1.3 **OPTION/OPSIE 1**

$$p_i = mv \text{ (Any formula/Enige formule) } \checkmark$$

$$= (2 \times 10^{-3})(140) \checkmark$$

$$= 0,28 \text{ kg m}\cdot\text{s}^{-1}$$

$$p_{after/na} = mv$$

$$p_{after/na} = (56 + 2) \times 10^{-3} v_{after/na}$$

$$\sum p_{initial} = \sum p_{after}$$

$$0,28 = (56 + 2) \times 10^{-3} v_{after/na} \checkmark$$

$$v_{after/na} = 4,83 \text{ m}\cdot\text{s}^{-1} \checkmark \text{ to the right/na regs } \checkmark$$

**OPTION/OPSIE 2**

$$\sum p_{initial} = \sum p_{after} \text{ (} \sum p_{voor} = \sum p_{na} \text{)}$$

$$m_1v_{1i} + m_2v_{2i} = m_1v_f$$

$$(2 \times 10^{-3})(140) \checkmark + 0 = (58 \times 10^{-3})v_f \checkmark$$

$$v_f = 4,83 \text{ m}\cdot\text{s}^{-1} \checkmark$$

to the right / na regs  $\checkmark$

(5)

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.  $\checkmark\checkmark$   
*Impuls is die produk van die netto krag wat op ’n voorwerp inwerk en die tyd waarin die krag op die voorwerp inwerk.  $\checkmark\checkmark$*

(2)

3.2.2  $F_{net}\Delta t = \Delta p \checkmark$   
 $-1,6 \times 10^{-3}\Delta t \checkmark = 800 (0 - 20) \checkmark$   
 $\Delta t = 0,1 \text{ s } \checkmark$

**OR/OF**

$F_{net}\Delta t = \Delta p \checkmark$   
 $1,6 \times 10^{-3}\Delta t = 800 (20 - 0)$   
 $\Delta t = 0,1 \text{ s } \checkmark$  **(2/4)**

(4)

3.2.3 **SMALLER THAN/KLEINER AS**  $\checkmark$

The mattresses offer a longer contact time  $\checkmark$   
 For the same change in momentum  $\checkmark$  the longer the time of contact the smaller the force  $\checkmark$

*Die matrasse bied ’n langer kontaktyd.  $\checkmark$*   
*Vir dieselfde verandering in momentum,  $\checkmark$  hoe langer is die kontaktyd hoe kleiner is die krag.  $\checkmark$*

(4)

[18]

## QUESTION/VRAAG 4

4.1 4.1.1 Ability to do work. ✓✓  
*Vermoë om arbeid te verrig.* ✓✓ (2)

4.1.2 Weight ✓/Gravitational force  
 Normal ✓  
*Gewig ✓/ Gravitasiëkrag*  
*Normaal ✓* (2)

4.1.3  $W_{\text{girl}} = F \cdot \Delta x \cdot \cos \theta$  ✓ /  $W_{\text{meisie}} = F \cdot \Delta x \cdot \cos \theta$  ✓  
 $W = (20)(0,2) \cos 0^\circ$  ✓  
 $W = 4 \text{ J}$  ✓ (3)

4.1.4 **POSITIVE MARKING FROM QUESTION 4.1.3**  
**POSITIEWE MERK VAN VRAAG 4.1.3**

**OPTION/OPSIE 1**

$$F_f = \mu N = \mu(mg) \checkmark$$

$$= 0,1 (6,5 \times 9,8) \checkmark$$

$$= 6,37 \text{ N}$$

$$W_f = f \cdot \Delta x \cdot \cos \theta$$

$$= (6,37)(0,2) \cos 180^\circ \checkmark$$

$$= -1,27 \text{ J}$$

$$W_{\text{net}} = W_{\text{girl}} + W_f$$

$$= 4 + (-1,27) \checkmark$$

$$= 2,73 \text{ J} \checkmark$$

**OPTION/OPSIE 2**

$$\left. \begin{array}{l} F_{\text{net}} = -f + F \\ F_{\text{net}} = \mu N + F \end{array} \right\} \text{Any one / Enige een} \checkmark$$

$$F_{\text{net}} = \mu mg + F$$

$$F_{\text{net}} = (0,1)(6,5)(9,8) \checkmark + 20 \checkmark$$

$$F_{\text{net}} = 13,63 \text{ N}$$

$$W_{\text{net}} = F_{\text{net}} \cdot \Delta x \cdot \cos \theta$$

$$W_{\text{net}} = (13,63)(0,2) \cos 0^\circ \checkmark$$

$$W_{\text{net}} = 2,73 \text{ J} \checkmark$$

(5)

4.2 4.2.1 The total mechanical energy (sum of gravitational potential energy and kinetic energy) in an isolated system remains constant. ✓✓  
*Die totale meganiese energie (som van die gravitasie potensiële energie en kinetiese energie) in 'n geïsoleerde sisteem bly konstant.* ✓✓ (2)

4.2.2  $(E_k + E_p)_{\text{top/bo}} = (E_k + E_p)_{\text{bottom/onder}} \checkmark$   
 $(0 + (1500)(9,8)(3)) \checkmark = (1500)(9,8)(1) + \frac{1}{2}(1500)v^2 \checkmark$   
 $44100 = 14700 + 750v^2$   
 $\therefore v = 6,26 \text{ m s}^{-1} \checkmark$  (4)

4.3  $P_{\text{ave/gem}} = Fv_{\text{ave/gem}} \checkmark$   
 $P_{\text{ave/gem}} = (5 \times 10^3)(72 \times \frac{1}{3,6}) \checkmark$   
 $P_{\text{ave/gem}} = 1 \times 10^5 \text{ W}$   
 $746 \text{ W} = 1 \text{ hp (pk)} \checkmark$   
 $1 \times 10^5 \text{ W} = 134,05 \text{ hp} \checkmark 134,05 \text{ pk}$  (4)

**[22]**

## QUESTION/VRAAG 5

5.1 5.1.1 Within the limit of elasticity, ✓ stress is directly proportional to the strain. ✓ *Binne die grense van elastisiteit, ✓ is druk direk eweredig aan die rekking.* ✓ (2)

$$5.1.2 \quad \delta = \frac{F}{A} \checkmark$$

$$\delta = \frac{6000 \checkmark}{5 \times 10^{-4}}$$

$$= 1,2 \times 10^7 \text{ N}\cdot\text{m}^{-2} / \text{Pa}$$

$$\varepsilon = \frac{\Delta l}{L} \checkmark$$

$$\varepsilon = \frac{0,0024 \checkmark}{1}$$

$$= 0,0024$$

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

$$K = \frac{1,2 \times 10^7}{0,0024} \checkmark$$

$$K = 5 \times 10^9 \text{ N} \cdot \text{m}^{-2} / \text{Pa} \checkmark$$

(7)

5.2 5.2.1 **B** ✓ (1)

5.2.2 Viscosity is rated as 10 at 0°C ✓ W is Winter ✓

*Viskositeit word gegradeer as 10 by 0° C ✓ W is Winter ✓*

(2)

5.3 5.3.1 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 sê dat in 'n kontinue vloeistof in ewewig die druk wat by enige punt toegepas word eweredig na die ander dele van die vloeistof versprei word.* ✓✓

(2)

5.3.2 **OPTION/OPSIE 1**

$$\frac{F_1}{A_1} = \frac{F_2}{A_2} \checkmark$$

$$\frac{260 \checkmark}{\pi(20 \times 10^{-3})^2 \checkmark} = \frac{F_2}{\pi(80 \times 10^{-3})^2 \checkmark}$$

$$F_2 = 4160 \text{ N} \checkmark$$

**OPTION/OPSIE 3**

$$A_1 = \pi r^2 = \pi(20 \times 10^{-3})^2$$

$$= 1,257 \times 10^{-3} \text{ m}^2 \checkmark$$

$$A_2 = \pi r^2 = \pi(80 \times 10^{-3})^2$$

$$= 0,02 \text{ m}^2 \checkmark$$

$$\frac{F_1}{A_1} = \frac{F_2}{A_2} \checkmark$$

$$\frac{260}{1,257 \times 10^{-3}} = \frac{F_2}{0,02} \checkmark$$

$$F_2 = 4160 \text{ N} \checkmark$$

**OPTION/OPSIE 2**

$$\frac{F_1}{A_1} = \frac{F_2}{A_2} \checkmark$$

$$\frac{260 \checkmark}{\frac{\pi(40 \times 10^{-3})^2}{4} \checkmark} = \frac{F_2}{\frac{\pi(160 \times 10^{-3})^2}{4}}$$

$$F_2 = 4160 \text{ N} \checkmark$$

**OPTION/OPSIE 4**

$$A_1 = \frac{\pi d^2}{4} = \frac{\pi(40 \times 10^{-3})^2}{4}$$

$$= 1,257 \times 10^{-3} \text{ m}^2 \checkmark$$

$$A_2 = \frac{\pi d^2}{4} = \frac{\pi(160 \times 10^{-3})^2}{4}$$

$$= 0,02 \text{ m}^2 \checkmark$$

$$\frac{F_1}{A_1} = \frac{F_2}{A_2} \checkmark$$

$$\frac{260}{1,257 \times 10^{-3}} = \frac{F_2}{0,02} \checkmark$$

$$F_2 = 4160 \text{ N} \checkmark$$

(4)

- 5.3.3 Bulldozer working system/  
*Stootskraper se werkende remme*  
 Hydraulic power breaks  
*Hidroliese krag remme*  
 Dentists chair / *Tandarts-stoel*  
 Hydraulic lifts/*Hidroliese hysers*
- } Any three  
*Enige drie*  
 ✓✓✓
- (3)  
**[21]**

### QUESTION/VRAAG 6

- 6.1 6.1.1 The amount of charge stored per volt. ✓✓  
*Die hoeveelheid lading wat per volt gestoor word.* ✓✓ (2)

6.1.2  $C = \frac{\epsilon_0 A}{d}$  ✓  
 $C = \frac{(8,85 \times 10^{-12})(4 \times 10^{-4})}{0,06}$  ✓  
 $= 5 \times 10^{-14} \text{ V}$  ✓ (3)

- 6.1.3 Size of the conductors/plates/*Grootte van die geleiers/plate*  
 The size of gap between conductors/plates/*Grootte van spasie tussen geleiers/plate*  
 The type of dielectric material/*Tipe diëlektriese materiaal*  
 (ANY TWO / *ENIGE TWEE* ✓✓) (2)

- 6.2 6.2.1 Rate of doing work / *Tempo waarteen arbeid verrig word* ✓✓  
 OR/OF Work done per unit time/*werk verrig per eenheidtyd* (2)

#### 6.2.2 OPTION/OPSIE 1

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} \checkmark$$

$$\frac{1}{R_p} = \frac{1}{12} + \frac{1}{4} \checkmark$$

$$R_p = 3 \Omega \checkmark$$

#### OPTION/OPSIE 2

$$R_p = \frac{R_1 \times R_2}{R_1 + R_2} \checkmark$$

$$R_p = \frac{12 \times 14}{12 + 14} \checkmark$$

$$R_p = 3 \Omega \checkmark$$

(3)

- 6.2.3  $P = I^2 R$  ✓  
 $50 = I^2 (3)$  ✓  
 $I = 4,08 \text{ A}$

$$R = \frac{V}{I} \checkmark$$

$$R = \frac{8}{4,08} \checkmark$$

$$R = 2,01 \Omega \checkmark$$

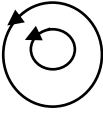
(5)

- 6.2.4 INCREASES ✓  
 Total resistance of the circuit decreases ✓✓  
*TOENEEM* ✓  
*Totale weerstand van die stroombaan neem af.* ✓✓ (3)

- 6.2.5 EMF/emf *EMK/emk* ✓ (1)

**[21]**

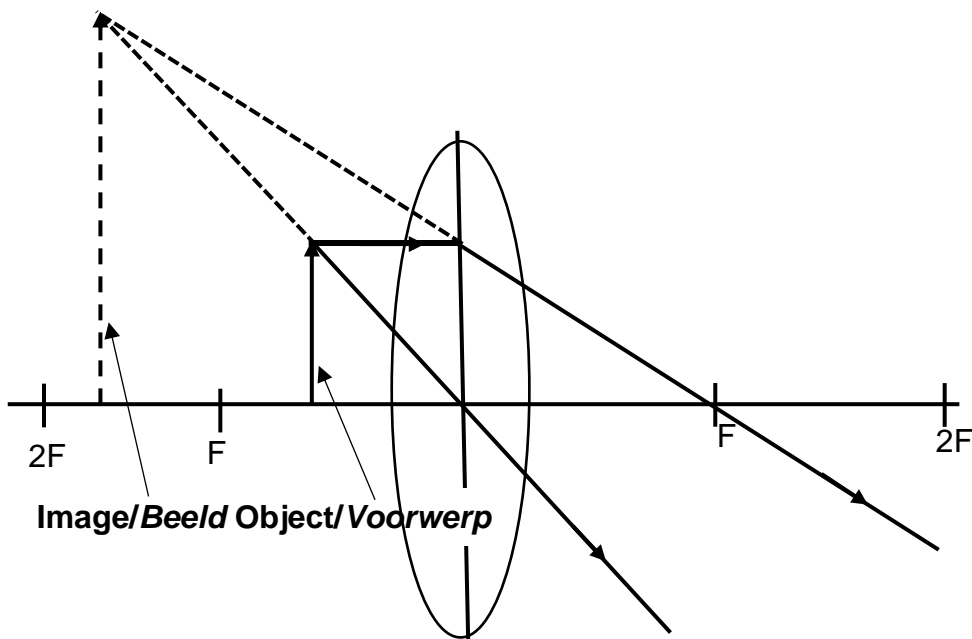
## QUESTION/VRAAG 7

- 7.1 7.1.1 The number of field lines perpendicular to a given surface area. ✓✓  
 Die aantal veldlyne loodreg tot die gegewe oppervlak area. ✓✓ (2)
- 7.1.2  $\Phi = \Delta B \cdot A$  ✓ Accept/Aanvaar =  $(B_f - B_i)A$   
 $= (1 - 0,5)(0,5 \times 0,5)$  ✓  
 $= 0,125 \text{ Wb}$   
 $\varepsilon = -N \frac{\Delta\Phi}{\Delta t}$  ✓  
 $\varepsilon = -5 \frac{0,125}{10}$  ✓  
 $= 0,06 \text{ V}$  ✓ **Accept/Aanvaar**  $6,25 \times 10^{-2} \text{ V}$  (6)
- 7.2 7.2.1 DC motor/GS-motor ✓ Accept Motor/Aanvaar Motor (1)
- 7.2.2 Electrical energy to mechanical energy ✓✓  
 Elektriese energie na meganiese energie ✓✓ (2)
- 7.2.3 Ensure electrical contact ✓  
 Verseker elektriese kontak ✓ (1)
- 7.2.4  ✓ Shape/Vorm  
 ✓ Direction/Rigting (2)
- [14]

## QUESTION/VRAAG 8

- 8.1 8.1.1 Breaking of white light into its component colours. ✓✓  
*Die opbreek van witlig in sy saamgestelde (komponent) kleure. ✓✓* (2)
- 8.1.2 Red (light) / Rooi (lig) ✓ (1)
- 8.1.3 When speed decreases wavelength decreases proportionally. ✓✓  
*Wanneer die spoed afneem, verlaag die golflengte proporsioneel. ✓✓* (2)
- 8.2 8.2.1 Converging (lens) / Konvergerende (lens) ✓ (1)

8.2.2



Marking criteria/Nasienkriteria	Mark allocation Punte- toekenning
Focal length is 40mm <i>Brandpunt afstand is 40 mm</i>	✓
Object height and distance <i>Voorwerp hoogte (40 mm) en afstand (25 mm)</i>	✓
Ray line through midpoint of a lens <i>Ligstraal deur middelpunt van die lens</i>	✓
Ray line through focal point on the other side of a lens/ <i>Ligstraal deur die brandpunt aan die anderkant van die lens</i>	✓
<b>Correct range of image/Korrekte gebeid vir beeld</b> Height/ <i>Hoogte</i> (105–110 mm) Distance from lens/ <i>Afstand vanaf lens</i> (68–73 mm)	✓✓
Arrows (at least one per light ray) <i>Pylpunte (ten minste een per ligstraal)</i>	✓

(7)



- 8.3 8.3.1 Radio waves/*Radiogolwe* ✓ (1)
- 8.3.2 X-rays/*X-strale* ✓ (1)
- 8.3.3 Packets of energy of light / *Pakkies ligenergie.* ✓ (1)
- 8.4 8.3.4  $E = \frac{hc}{\lambda}$  ✓ (4)  
 $E = \frac{(6,63 \times 10^{-34})(3 \times 10^8)}{1\,000 \times 10^{-9}}$  ✓ [20]  
 $E = 1,989 \times 10^{-19} \text{ J} \approx 1,99 \times 10^{-19} \text{ J}$  ✓

**TOTAL/TOTAAL: 150**