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**NATIONAL
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GRADE/GRAAD 12

SEPTEMBER 2022

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

MARKS/PUNTE: 150

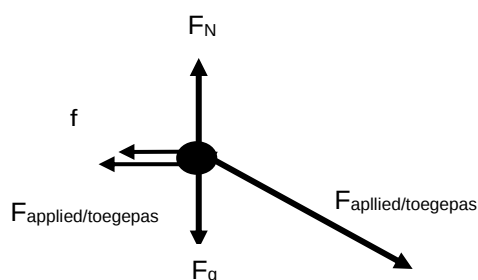
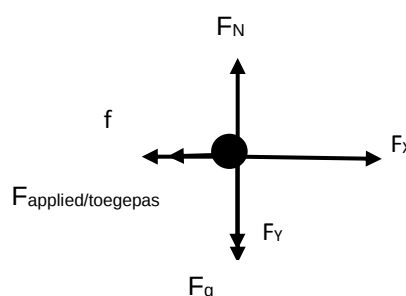
This marking guideline consists of 9 pages.
Hierdie nasienriglyn bestaan uit 9 bladsye.

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**

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

(5)

2.4 **OPTION/OPSIE 1**

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

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

$$= 21 \text{ N}$$

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

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

$$= 5 \text{ N}$$

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

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

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

OPTION/OPSIE 2

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

$$(42 \cos 60^\circ) \checkmark + (-10) + (-6) \checkmark = 2,4a \checkmark$$

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

(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**

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

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

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

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

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

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

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

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

OPTION/OPSIE 2

$$\Sigma p_{initial} = \Sigma p_{after} \quad (\Sigma p_{voor} = \Sigma p_{na}) \checkmark$$

$$m_i v_{1i} + m_2 v_{2i} = m_f v_f$$

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

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

$$\text{to the right / na regs} \checkmark$$

(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, 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

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

$$F_{\text{net}} = \mu N + F \quad \checkmark$$

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

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

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

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

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

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

(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)

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

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

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

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

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

$$= 0,0024$$

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

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

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

(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

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

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

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

OPTION/OPSIE 3

$$\left. \begin{aligned} A_1 &= \pi r^2 = \pi(20 \times 10^{-3})^2 \\ &= 1,257 \times 10^{-3} \text{ m}^2 \\ A_2 &= \pi r^2 = \pi(80 \times 10^{-3})^2 \\ &= 0,02 \text{ m}^2 \end{aligned} \right\} \quad \checkmark$$

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

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

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

OPTION/OPSIE 2

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

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

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

OPTION/OPSIE 4

$$\left. \begin{aligned} A_1 &= \frac{\pi d^2}{4} = \frac{\pi(40 \times 10^{-3})^2}{4} \\ &= 1,257 \times 10^{-3} \text{ m}^2 \\ A_2 &= \frac{\pi d^2}{4} = \frac{\pi(160 \times 10^{-3})^2}{4} \\ &= 0,02 \text{ m}^2 \end{aligned} \right\} \quad \checkmark$$

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

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

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

(4)

- 5.3.3 Bulldozer working system/
 Stootskrapeer 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** **OPTION/OPSIE 2**
- $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓ $R_p = \frac{R_1 \times R_2}{R_1 + R_2}$ ✓
- $\frac{1}{R_p} = \frac{1}{12} + \frac{1}{4}$ ✓ $R_p = \frac{12 \times 14}{12 + 14}$ ✓
- $R_p = 3 \Omega$ ✓ $R_p = 3 \Omega$ ✓ (3)
- 6.2.3 $P = I^2 R$ ✓
 $50 = I^2 (3)$ ✓
 $I = 4,08 \text{ A}$
- $R = \frac{V}{I}$ ✓
 $R = \frac{8}{4,08}$ ✓
 $R = 2,01 \Omega$ ✓ (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 Wb

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

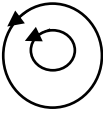
$\varepsilon = -5 \frac{0,125}{10}$ ✓

= 0,06 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)

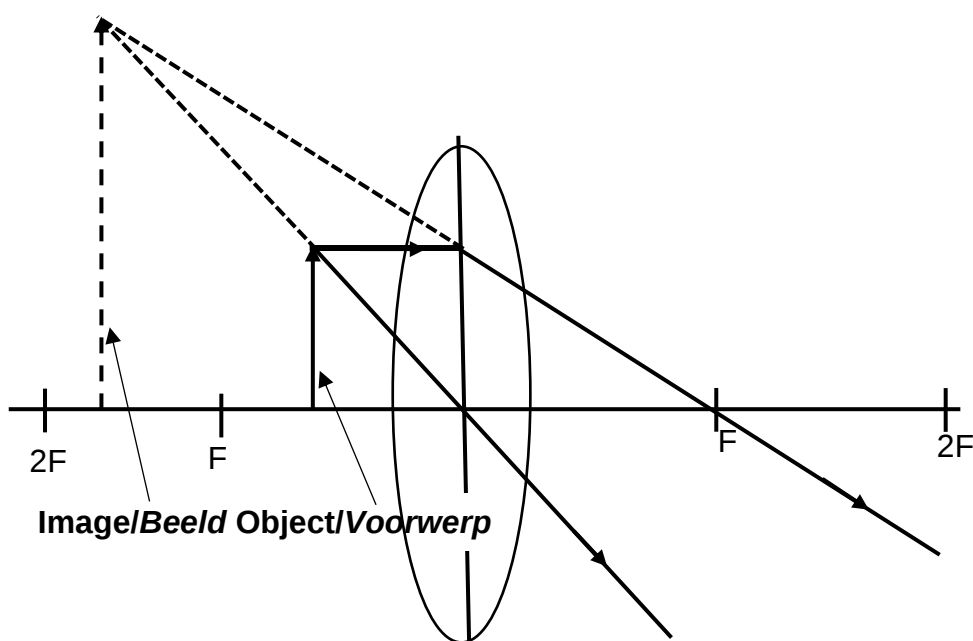
7.2.3 Ensure electrical contact ✓
 Verseker elektriese kontak ✓ (1)

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>	✓
Correct range of image/Korrekte gebeid vir beeld Height/Hoogte (105–110 mm) Distance from lens/Afstand vanaf lens (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 $E = \frac{hc}{\lambda}$ ✓
- $E = \frac{(6,63 \times 10^{-34})(3 \times 10^8)}{1\,000 \times 10^{-9}}$ ✓
- $E = 1,989 \times 10^{-19} \text{ J} \approx 1,99 \times 10^{-19} \text{ J}$ ✓ (4)
- [20]

TOTAL/TOTAAL: 150