



Province of the  
**EASTERN CAPE**  
EDUCATION

**NATIONAL  
SENIOR CERTIFICATE  
NASIONALE SENIOR  
SERTIFIKAAT**

**GRADE / GRAAD 12**

**JUNE / JUNIE 2018**

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

**MARKS /  
PUNTE:** 150

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

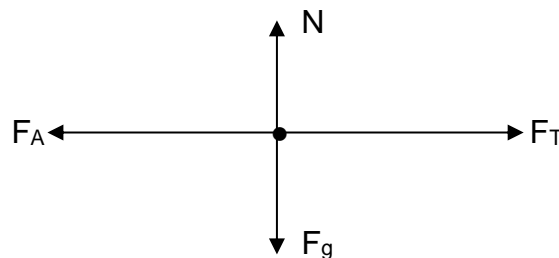
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**QUESTION / VRAAG 1: MULTIPLE CHOICE/MEERVOUDIGEKEUSE-VRAE**

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

**QUESTION / VRAAG 2**

2.1



Accepted Labels / Aanvaarbare Byskrifte

F<sub>g</sub> W/F<sub>w</sub>/Weight/gravitational force / Gewig/GravitasiekragN F<sub>N</sub>/ F<sub>normal</sub> / normal force / F<sub>normaal</sub> / NormaalkragT F<sub>T</sub> / Tension / SpanningF<sub>A</sub> Applied force/ F<sub>applied</sub>/ 24 N / Toegepaste krag / F<sub>toeg</sub>

(4)

- 2.2 When a non-zero resultant force acts on an object, the object will accelerate in the direction of the resultant force. This acceleration is directly proportional to the force and inversely proportional to the mass of the object. ✓✓

*Indien 'n nie-nul resulterende krag op 'n voorwerp inwerk, sal die voorwerp versnel in die rigting van die resulterende krag. Hierdie versnelling is direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp. ✓✓*

(2)

2.3 For object **A**/Vir voorwerp **A**

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

$$F + (-T) = (5)(a) \checkmark$$

$$24 - T = 5a \dots\dots\dots(1)$$

For object **B**/Vir voorwerp **B**

$$F_{net} = ma$$

$$T = 3a \dots (2) \checkmark$$

Substitute (T) in (1) / Stel T in (1):

$$24 - 3a = 5a$$

$$a = \frac{24}{8} = 3 \text{ m}\cdot\text{s}^{-2} \checkmark$$

**Accept (3 marks) / Aanvaar (3 punte)**

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

$$F_{app} = (m_A + m_B)a$$

$$24 = (5+3)(a) \checkmark$$

$$a = 3 \text{ m}\cdot\text{s}^{-2} \checkmark \tag{4}$$

2.4 **POSITIVE MARKING FROM 2.3/ Positiewe nasien vanaf Vr. 2.3**

**Option / Opsie 1**

From eqn (2) / Vanaf vgl (2):

$$T = 3a \checkmark$$

$$T = (3)(3) \checkmark$$

$$T = 9 \text{ N} \checkmark$$

**Option / Opsie 2**

From equation (1) / Vanaf vgl (1):

$$24 - T = 5a \checkmark$$

$$24 - T = (5)(3) \checkmark$$

$$T = 9 \text{ N} \checkmark \tag{3}$$

2.5 2.5.1 Decreases / Verminder  $\checkmark$  (1)

2.5.2 Increases / Vermeerder  $\checkmark$  (1)

**[15]**

**QUESTION / VRAAG 3**

3.1 3.1.1 Q.  $\checkmark$

Gradient of graph **Q** is greater than that of graph **P**  $\checkmark$  or  
 Graph **Q** is steeper than graph **P**.  $\checkmark$   
*Helling van grafiek Q is groter as dié van grafiek P*  $\checkmark$  of  
*Grafiek Q is steiler as grafiek P.*  $\checkmark$  (2)

3.1.2 Gradient of graph P/ *Helling van grafiek P:*

$$\begin{aligned}
 m_P &= \frac{\Delta y}{\Delta x} \\
 &= \frac{0,4 - 0}{12 - 0} \checkmark \quad (\text{Accept any two sets of correct values}) \\
 &\quad (\text{Aanvaar enige 2 stelle korrekte waardes}) \\
 &= 0,033 \checkmark \\
 \frac{1}{m} &= 0,033 \checkmark \quad \therefore m = 30 \text{ kg} \checkmark
 \end{aligned}
 \tag{4}$$

3.2 3.2.1 Force exerted by John on Tom:

*Krag toegepas deur John op Tom:*

$$\begin{aligned}
 F_{\text{net J on T}} &= ma \checkmark \\
 &= (45)(0,2) \checkmark \\
 &= 9 \text{ N} \checkmark
 \end{aligned}
 \tag{3}$$

3.2.2 **Positive marking from 3.2.1/ Positiewe nasien vanaf 3.2.1**

$$F_{\text{net T on J}} = 9 \text{ N right / regs} \checkmark \tag{1}$$

3.2.3 Newton's third law./ *Newton se derde wet* ✓

When object **A** exerts a force on object **B**, object **B** simultaneously exerts an opposite directed force of equal magnitude on object **A**.  
✓✓

*Indien voorwerp A 'n krag uitoefen op voorwerp B, oefen voorwerp B gelyktydig 'n krag van dieselfde grootte maar in die teenoorgestelde voorwerp op A.* ✓✓

(3)  
**[13]**

#### QUESTION / VRAAG 4

4.1 Impulse is defined as the product of net force acting on the object and time during which the force is in action  
Impulse is defined as the change in momentum. } Any one ✓✓  
*Impuls word gedefinieer as die produk van die netto krag op die voorwerp en die tyd wat die krag in werking is.* } Enige een ✓✓  
*Impuls is gedefinieer as die verandering in momentum* } ✓✓

(2)

4.2 Impulse =  $F_{\text{net}}\Delta t$  ✓  
*Impuls* = (7)(0,005) ✓  
= 0,035 N.m ✓

(3)

4.3 **Positive marking from 4.2 / Positiewe nasien vanaf 4.2**

$$\begin{aligned}
 \text{Impulse} &= \Delta p \\
 \text{Impuls} &= mv_f - mv_i \quad \checkmark \quad \text{Any one/Enige een} \\
 0,035 \checkmark &= 0,005(v_f - 0) \checkmark \\
 v_f &= 7 \text{ m}\cdot\text{s}^{-2} \checkmark
 \end{aligned}$$

**Option/Opsie 2**

$$\begin{aligned}
 F_{\text{net}} &= ma \checkmark \\
 7 &= (5 \times 10^{-3})(a) \checkmark \\
 a &= 1400 \text{ m}\cdot\text{s}^{-2} \\
 v_f &= v_i + a\Delta t \\
 v_f &= 0 + (1400)(0,005) \checkmark \\
 v_f &= 7 \text{ m}\cdot\text{s}^{-1} \checkmark
 \end{aligned}$$

(4)  
**[9]**

**QUESTION / VRAAG 5**

- 5.1 The total linear momentum in an isolated (closed) system remains constant. ✓✓  
*Die totale lineêre momentum in 'n geïsoleerde (geslote) sisteem bly konstant.* ✓✓ (2)
- 5.2  $\Sigma p_i = \Sigma p_f$  ✓  
 $m_b v_{bi} + m_{bc} v_{bci} = m_b v_{bf} + m_{bc} v_{bcf}$   
 $(0,023)(230) + (2)(0) \checkmark = (0,023)(170) + (2)(v_{bcf}) \checkmark$   
 $v_f = 0,69 \text{ m}\cdot\text{s}^{-1}$  in the direction of motion of the bullet  
*in die rigting van die beweging van die koeël* ✓ (4)
- 5.3 Kinetic energy is not conserved as the collision is inelastic. ✓✓  
*Kinetiese energie bly nie behoue as die botsing onelaties is nie.* ✓✓ (2)
- [8]**

**QUESTION / VRAAG 6**

- 6.1 6.1.1 The total mechanical energy of an isolated system remains constant. ✓✓  
*Die totale meganiese energie van 'n geïsoleerde (geslote) sisteem bly konstante.* ✓✓ (2)
- 6.1.2  $E_{PA} = mgh$  ✓  
 $E_{PA} = (30)(9,8)(40)$  ✓  
 $= 11760 \text{ J}$  ✓ (3)
- 6.1.3  $(E_p + E_k)_A = (E_p + E_k)_C$  ✓  
 $(mgh + \frac{1}{2}mv^2)_A = (mgh + \frac{1}{2}mv^2)_C$   
 $11760 + 0 \checkmark = 0 + \frac{1}{2}(30)(v^2) \checkmark$   
 $v = 28 \text{ m}\cdot\text{s}^{-1}$ . ✓ (4)
- 6.1.4 **Positive marking from 6.1.3 / Positiewe nasien vanaf 6.1.3**
- | <b>Option / Opsie 1</b>                 | <b>Option / Opsie 2</b>                 |
|---|---|
| $a = \frac{v_f - v_i}{\Delta t}$ ✓      | $v_f = v_i + a\Delta t$ ✓               |
| $a = \frac{0 - 28}{10}$ ✓               | $(0)^2 = (28)^2 + (a)(10)$ ✓            |
| $a = -78,4 \text{ m}\cdot\text{s}^{-2}$ | $a = -78,4 \text{ m}\cdot\text{s}^{-2}$ |
| $F_{\text{net}} = ma$ ✓                 | $F_{\text{net}} = ma$ ✓                 |
| $F_{\text{net}} = (30)(-78,4)$          | $F_{\text{net}} = (30)(-78,4)$          |
| $F_{\text{net}} = -2352 \text{ N}$ ✓    | $= -2352 \text{ N}$ ✓                   |
- (4)
- 6.2.1 Rate at which work is done. } Any one  
 Rate of transfer of energy. } ✓✓  
*Tempo waarteen arbeid verrig word* } *Enige een*  
*Tempo waarteen energie oorgedra word.* } ✓✓ (2)

$$\begin{aligned}
 6.2.2 \quad P &= Fv \quad \checkmark \\
 &= (10000)(55) \quad \checkmark \\
 &= 550000 \text{ W} \quad \checkmark \\
 P &= \frac{550000}{746} = 737,27 \text{ hp / (pk)} \quad \checkmark
 \end{aligned}
 \tag{4}$$

$$\begin{aligned}
 6.2.3 \quad F_f &= 3181 \text{ N} \quad \checkmark \\
 &\text{Opposite to the direction of motion of the locomotive.} \\
 &\text{Locomotive is moving with constant velocity.} \\
 &\text{In die teenoorgestelde rigting as die beweging van die} \\
 &\text{lokomotief.} \\
 &\text{Lokomotief beweeg teen 'n konstante snelheid.}
 \end{aligned}
 \tag{2}$$

} Any one  
 }  $\checkmark$   
 } Enige  
 } een  
 }  $\checkmark$

[21]

**QUESTION / VRAAG 7**

7.1 Work is defined as the product of the force applied on an object and the displacement in the direction of the force.  
*Arbeid word gedefinieer as die produk van die krag op 'n voorwerp toegepas en die verplasing in die rigting van die krag.*  $\checkmark\checkmark$

(2)

$$7.2 \quad f_k = \mu_k N = \underline{(0,1)} \underline{(100)} \underline{(9,8)} = 147 \text{ N}$$

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

$$F + f_k = ma$$

$$F + (-147) \checkmark = (100)(0,5) \quad \checkmark$$

$$F = 197 \text{ N} \quad \checkmark$$

(6)

**Positive marking from 7.2 / Positiewe nasien vanaf 7.2**

$$7.3 \quad W = F\Delta\cos\theta \quad \checkmark$$

$$W = (197)(5)(\cos 0^\circ) \quad \checkmark$$

$$W = 985 \text{ J} \quad \checkmark$$

(3)

[11]

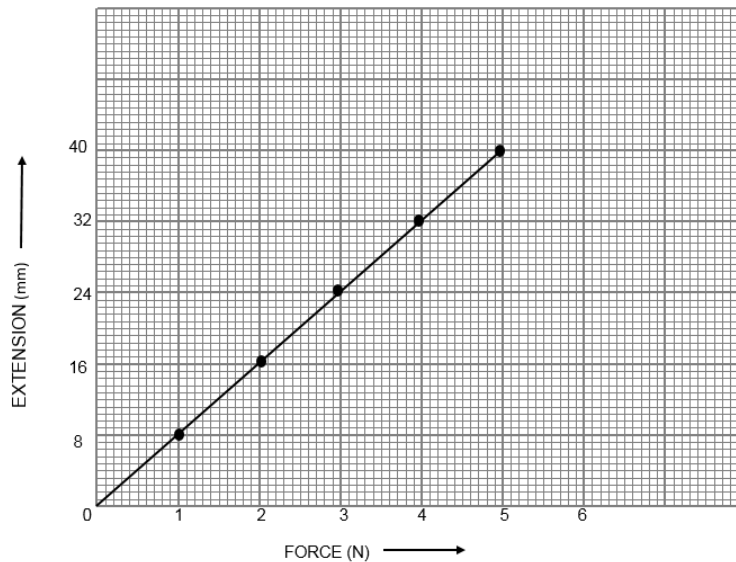
## QUESTION / VRAAG 8

8.1.1 50 mm ✓

(1)

8.1.2

Extension vs Force



Axes / Asse ✓

Any two points plotted correctly  
*Enige twee punte korrekte geplot* } ✓✓  
 Correct shape / Korrekte vorm ✓

(4)

8.1.3 The maximum force that can be applied to a body so that the body regains its original form completely on removal of the force.

*Die maksimum krag wat op 'n voorwerp toegepas kan word sodat die voorwerp sy oorspronklike vorm sal herwin indien die krag verwyder word.* ✓✓

(2)

8.1.4 3,7 N ✓✓ Accept / Aanvaar 3,8 N

(2)

8.2 8.2.1 Hooke's law states that within the limit of elasticity, stress is directly proportional to the strain. ✓✓

*Hooke se wet sê dat binne grense van elasticiteit, druk is direk eweredig aan rekking is.*

(2)

8.2.2 Stress / Spanning:  $\sigma = \frac{F}{A}$  ✓

$$F = mg = (1)(9,8) = 9,8 \text{ N} \quad \checkmark$$

$$A = \pi r^2 = \pi(0,00018)^2 = 1,02 \times 10^{-7} \text{ m}^2 \quad \checkmark$$

$$\sigma = \frac{9,8}{1,02 \times 10^{-7}} \quad \checkmark = 9,61 \times 10^7 \text{ N.m}^2 \quad \checkmark$$

(5)

$$8.2.3 \quad \epsilon = \frac{\Delta l}{L} \checkmark$$

$$\epsilon = \frac{0,0018}{4} \checkmark = 4,5 \times 10^{-4} \checkmark \quad (3)$$

$$8.2.4 \quad K = \frac{\sigma}{\epsilon} \checkmark$$

$$K = \frac{9,61 \times 10^7}{4,5 \times 10^{-4}} \checkmark = 2,14 \times 10^{11} \text{ Pa} \checkmark \quad (3)$$

**[22]**

### QUESTION / VRAAG 9

9.1 9.1.1 Viscosity is the property of the fluid to oppose relative motion between the two adjacent layers.  
*Viskositeit is die eienskap van die vloeistof om die relatiewe beweging tussen die twee aangrensende lae te weerstaan* ✓✓ (2)

9.1.2 Viscosity decreases with increase in temperature.  
*Viskositeit neem af met toename in temperatuur.* ✓✓ (2)

9.1.3 This means that the oil acts as an SAE 20 when it is cold, for easy cold starting ✓ and it acts like an SAE 50 oil (which is thicker than SAE 20) when it is hot. ✓  
*Dit beteken dat die olie soos SAE 20 optree indien dit koud is, vir maklike koue aanskakeling ✓ en dan soos 'n SAE 50 olie (wat dikker as SAE 20) indien dit warm is.* ✓ (2)

9.2 9.2.1 Pascal's law states that in a continuous liquid at equilibrium, the pressure applied at any point is transmitted equally to the other parts of the liquid.  
*Pascal se wet: In 'n deurlopende vloeistof in ewewig is die druk wat by enige punt toegepas word, na die ander dele van die vloeistof versprei.* ✓✓ (2)

9.2 9.2.2  $\frac{F_1}{A_1} = \frac{F_2}{A_2} \checkmark$

$$\frac{1176}{0,03} = \frac{F}{0,5} \checkmark$$

$$F = 19600 \text{ N} \checkmark \quad (3)$$

9.2.3  $F = mg$   
 $19600 = m(9,8) \checkmark$   
 $m = 2000 \text{ kg} \checkmark \quad (2)$

9.2.4  $W = F \Delta x \cos \theta \checkmark$   
 $W = (19600) (1,2) \cos 0 \checkmark$   
 $= 23520 \text{ J} \checkmark \quad (3)$



- 9.2.5 Hydraulic braking system / *Hidroliese remstelsel* } (Any two)  
 Hydraulic jack / *Hidroliese hysers* } (Enige twee)  
 Dentist chair / *tandarts stoel* } ✓✓ (2)

**[18]****QUESTION / VRAAG 10**

- 10.1 A semiconductor is a material which has electrical conductivity between that of a conductor and an insulator.  
*’n Halfgeleier is materiaal wat elektriese geleidingsvermoë het tussen die van ’n geleier en ’n insulator* ✓✓ (2)

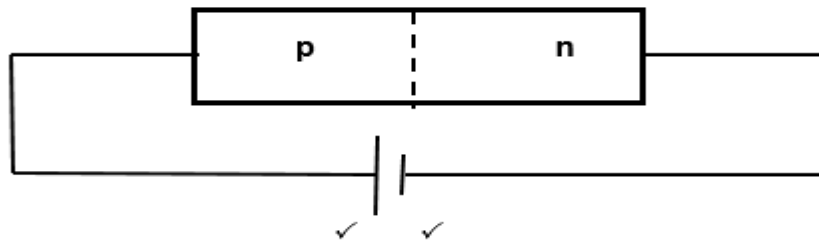
- 10.2.1 A pure semiconductor is called an intrinsic semiconductor.  
*’n Suiwer halfgeleier word ’n intrinsieke halfgeleier genoem* ✓✓ (2)

- 10.2.2 Doping is a process of adding impurities to a pure semiconductor.  
*Doktering is ’n proses waarby onsuiverhede gevoeg word tot ’n suiwer halfgeleier* ✓✓ (2)

- 10.2.3 n-type / *n-tipe* ✓ (1)

- 10.2.4 Electron / *elektron* ✓ (1)

10.3.1



(2)

- 10.3.2
- the free electrons in the n-type material will be repelled by the negative terminal voltage supply. / *die vrye elektrone in die n-tipe materiaal sal afgestoot word deur die negatiewe terminaal spannings toevoer* ✓
  - the electrons will move and break through the junctions and start flowing towards the positive terminal and it seems as if the holes are moving towards negative terminal. / *die elektrone sal beweeg en deur die sperlae breek en vloei dan na die positiewe terminaal en dit lyk as of die holtes na die negatiewe terminaal beweeg* ✓
  - the junction region becomes smaller and the break over voltage is overcome and the diode will begin to conduct. / *die sperlaag word kleiner en meer ladingdraers word toegelaat om oor die sperlaag te beweeg wat die diode in staat stel om stroom te gelei.* ✓

(3)

**[13]****TOTAL: 150**