



# education

Department of  
Education  
FREE STATE PROVINCE

**EXAMINATION / EKSAMEN**

**GRADE 10 / GRAAD 10**

**TECHNICAL SCIENCES  
TEGNIJSE WETENSKAPPE**

**MEMORANDUM**

**NOVEMBER 2017**

**TIME/TYD: 3 HOURS/URE**

**MARKS/PUNTE: 200**

**This memorandum consists of 10 pages.  
*Hierdie memorandum bestaan uit 10 bladsye.***

**QUESTION 1 / VRAAG 1:**

- |     |   |      |   |      |   |
|-----|---|------|---|------|---|
| 1.1 | B | 1.6  | A | 1.11 | A |
| 1.2 | D | 1.7  | C | 1.12 | C |
| 1.3 | B | 1.8  | D | 1.13 | B |
| 1.4 | A | 1.9  | B | 1.14 | A |
| 1.5 | B | 1.10 | A | 1.15 | C |

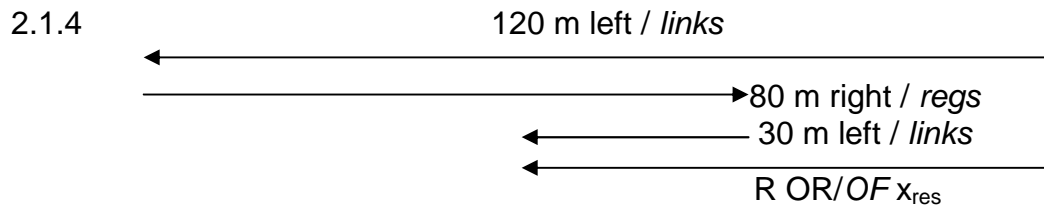
[15 x 2 = 30]

**QUESTION 2 / VRAAG 2**

2.1.1 A physical quantity with magnitude only. ✓  
'n Fisiese hoeveelheid met slegs grootte. (1)

2.1.2 110 s ✓ (1)

2.1.3  $x_{AD} = x_{AB} + x_{BC} + x_{CD}$   
 $= 120 + 80 + 30$  ✓  
 $= 230$  m ✓ (2)



R OR/OF  $x_{res}$  OR similar/OF soortgelyk = 70 m left/links

MARKING CRITERIA / NASIENRIGLYNE	MARK PUNT
Correct measurement of magnitude of TWO of the vectors 120m, 80 m or 30 m. <i>Korrekte afmeting van grootte van TWEE van die vektore 120 m, 80 m of 30 m.</i>	1
Correct measurement of ALL THREE vectors. <i>Korrekte afmeting van AL DRIE vektore.</i>	1
Each of the above-mentioned vectors has correct direction and label. <i>Elk van bogenoemde vektore het regte rigting en byskrif.</i>	1
Tail-to-head method correctly applied. <i>Stert-by-kopmetode korrek gebruik.</i>	1
Resultant is labelled and answer is correct. <i>Resultant is benoem en antwoord is korrek.</i>	1

(5)

**2.1.5 POSITIVE MARKING FROM 2.1.2 AND 2.1.3.**  
**POSITIEWE NASIEN VANAF 2.1.2 EN 2.1.3.**

$$\begin{aligned}\text{Speed/Spood} &= \frac{\text{Distance/Afstand}}{\text{Time/Tyd}} \checkmark \\ &= \frac{230}{110} \checkmark \\ &= 2,09 \text{ m.s}^{-1} \checkmark\end{aligned}\quad (3)$$

**2.1.6 POSITIVE MARKING FROM 2.1.5 / POSITIEWE NASIEN VANAF 2.1.5**

$$2,09 \times \frac{3600}{1000} \checkmark = 7,52 \checkmark (7,52 \sim 7,53) (\text{km.h}^{-1}) \quad (3)$$

**2.1.7 Less than / Kleiner as**  $\checkmark$



Displacement is less than the distance  $\checkmark$ ; time the same.  $\checkmark$   
*Verplasing is kleiner as afstand; tyd dieselfde.*

(3)

**2.2.1 Constant speed/constant velocity**  $\checkmark$   
*Konstante spoed/konstante snelheid*

(1)

**2.2.2**  $f = \frac{n}{\Delta t} \checkmark$

$$= \frac{125}{5} \checkmark$$

$$= 25 \text{ Hz} \checkmark$$

NB: 126 dots  $\Rightarrow$  125 spaces  
NB: 126 kolle  $\Rightarrow$  125 spasies

(4)

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

$$T = \frac{1}{f} \checkmark$$

$$= \frac{1}{25} \checkmark$$

$$= 0,04 \text{ s}$$

$$\text{Speed/Spood} = \frac{\text{Distance/Afstand}}{\text{Time/Tyd}}$$

$$= \frac{0,075}{5 \times 0,04} \checkmark$$

$$= 0,38 \text{ m} \cdot \text{s}^{-1} \checkmark$$

(5)

[28]

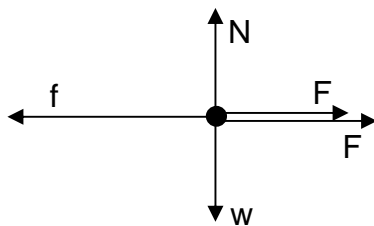
### QUESTION 3 / VRAAG 3

3.1  $w = mg$  ✓  
 $= 120 \times 9,8$  ✓  
 $= 1\,176\text{ N}$  ✓ (3)

3.2 There is a (normal) force acting on the box (by the table) ✓;  
 equal in magnitude to the weight ✓ but opposite in direction. ✓

*Daar is 'n (normaal)krag wat op die boks inwerk (deur die tafel) ✓;  
 gelyk in grootte aan die gewig ✓, maar teenoorgesteld in rigting ✓.* (3)

3.3.1



Arrow plus label: one mark  
*Pyl plus byskrif: een punt*

Ignore comparative lengths of  
 arrows.  
 Ignoreer vergelykende lengte  
 van pyle.

	Acceptable labels <i>Aanvaarbare byskrifte</i>
w	$F_w / F_g / mg / F_{\text{weight}} / \text{Weight} /$ Gravitational force / Force of gravity  $F_w / F_g / mg / F_{\text{gewig}} / \text{Gewig} /$ <i>Gravitasiekrag</i>
N	$F_N / F_{\text{normal}} / \text{Normal force}$ $F_N / F_{\text{normaal}} / \text{Normaalkrag}$
F	$F_{\text{applied}} / F_{\text{toegepas}} / 120\text{ N}$
F	$F_{\text{applied}} / F_{\text{toegepas}} / 80\text{ N}$
f	$F_{\text{friction}} / F_f / \text{Friction} / \text{Frictional force} /$ Force of friction $F_{\text{wrywing}} / F_f / \text{Wrywing} / \text{Wrywingskrag}$

(5)

3.3.2  $F_{\text{net}} = F_1 + F_2$  ✓  
 $= 120 + 80$  ✓  
 $= 200\text{ N}$  ✓  
 $F_{\text{net}} = 200\text{ N}; \text{right} / \text{regs}$  ✓

Accept R for  $F_{\text{net}}$ . / *Aanvaar R vir  $F_{\text{net}}$ .*

"Right" is only acceptable direction.  
*"Regs" is enigste aanvaarbare rigting.*

(4)

3.3.3 The resultant force/80 N and 120 N is equal ✓ to the (static) frictional force ✓  
 but opposite in direction. ✓

The resultant force/80 N and 120 N is less than ✓ the maximum (static)  
 frictional force ✓ but opposite in direction. ✓

*Die resultante krag/80 N en 120 N is gelyk aan ✓ die (statiese)  
 wrywingskrag ✓ maar teenoorgesteld in rigting. ✓*

*Die resultante krag/80 N en 120 N is kleiner as ✓ die maksimum (statiese)  
 wrywingskrag ✓ maar teenoorgesteld in rigting. ✓* (3)

3.3.4 Equilibrant / *Ekwilibrant* ✓ (1)  
**[19]**

### QUESTION 4 / VRAAG 4

- 4.1.1 A: Fulcrum / *Draaipunt/Steunpunt* ✓  
B: Effort / *Mag/Krag* ✓  
C: Load / *Las* ✓

(3)

- 4.1.2 3 ✓

(1)

- 4.1.3 The ratio ✓ of load to effort ✓.  
*Die verhouding van las tot mag/krag.*

(2)

4.1.4

$$\begin{aligned} \text{MA / MV} &= \frac{\text{Effort distance / Kragafstand}}{\text{Load distance / Lasafstand}} \checkmark \\ &= \frac{50}{130} \checkmark \\ &= 0,38 \checkmark \end{aligned}$$

Kragafstand = kragarm  
Lasafstand = lasarm

(3)

- 4.1.5 Increase effort distance / *Vergroot kragarm.* (✓✓)

(2)

- 4.2.1 For a body in equilibrium ✓ the sum of the clockwise moments about a point is equal to the sum of the anticlockwise moments about the same point. ✓

*Vir 'n liggaam in ewewig is die som van die kloksgewyse (krag)momente om 'n punt gelyk aan die som van die antikloksgewyse (krag)momente om dieselfde punt.*

(2)

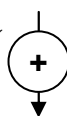
4.2.2

$$\begin{aligned} \Sigma \Gamma(\text{clock/klok}) &= \Sigma \Gamma(\text{anticlock/antiklok}) \checkmark \\ 10F_P \checkmark &= (20)(5) \checkmark + (7)(15) \checkmark \\ F_P &= 20,5 \text{ N} \checkmark \end{aligned}$$

(5)

4.2.3

$$\begin{aligned} F_{\text{net}} &= F_p + 20 + F_R + (-15) = 0 \\ 0 &= (-20,5) + 20 + F_R - 15 \checkmark \\ F_R &= 15,5 \text{ N} \checkmark \end{aligned}$$



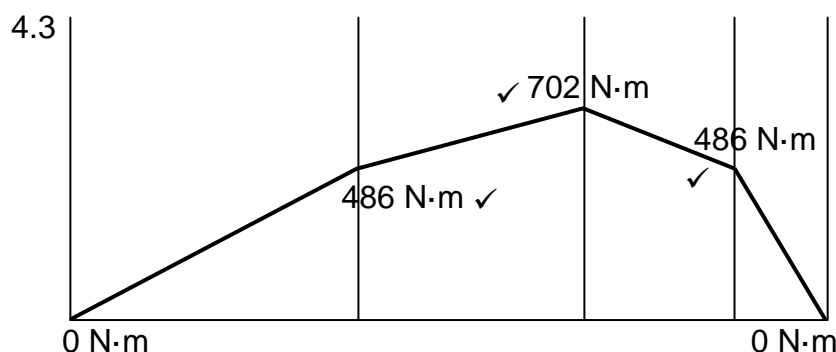
Up positive; adjust signs.  
*Op positief; pas tekens aan.*

OR/OF

$$\begin{aligned} \Sigma \Gamma(\text{clock/klok}) &= \Sigma \Gamma(\text{anticlock/antiklok}) \\ (20)(5) + 10F_R \checkmark &= (17)(15) \checkmark \\ F_R &= 15,5 \text{ N} \checkmark \end{aligned}$$

OR: Moments taken about another point.  
OF: Momente om 'n ander punt geneem.

(3)



Penalise omitted unit once. / *Penaliseer weggelate eenheid een keer.*

Shape/Vorm: ✓

Both zeros / *Beide nulle* ✓

(5)  
[26]

### QUESTION 5 / VRAAG 5

5.1 The energy an object has ✓ due to its motion. ✓  
*Die energie wat 'n voorwerp het as gevolg van sy beweging.* (2)

5.2  $E_K = \frac{1}{2}mv^2$  ✓  
 $250 = \frac{1}{2}(0,5)v^2$  ✓  
 $v = 31,62 \text{ m.s}^{-1}$  ✓ (4)

5.3.1 0 J/0/Nil/Nul/Zero (✓✓) (2)

5.3.2  $E_p = mgh$  ✓  
 $= (1300)(9,8)(110)$  ✓  
 $= 1\,401\,400 \text{ J}$  ✓ (3)

5.3.3 **POSITIVE MARKING FROM 5.3.2 / POSITIEWE NASIEN VANAF 5.3.2**

$E_M = E_K + E_p$  ✓  
 $= 5\,000 + 1\,401\,400$  ✓  
 $= 1,41 \times 10^6 \text{ J}$  ✓ (3)  
**[14]**

### QUESTION 6 / VRAAG 6

6.1.1 Positive / Positief (✓✓) (2)

6.1.2 Same magnitude ✓; oppositely charged ✓  
*Dieselfde grootte; teenoorgesteld gelaa* (2)

6.1.3  $n = \frac{Q}{Q_{e-}}$  ✓  $n = \frac{Q}{Q_{e-}}$  ✓  
 $= \frac{4 \times 10^{-9}}{1,6 \times 10^{-19}}$  ✓ OR/OF  $= \frac{-4 \times 10^{-9}}{-1,6 \times 10^{-19}}$  ✓  
 $= 2,5 \times 10^{10}$  ✓  $= 2,5 \times 10^{10}$  ✓ (3)

6.2.1 X to Y / X na Y ✓ (1)

6.2.2 The net charge of an isolated system stays constant ✓ during any physical process. ✓  
*Die netto lading van 'n geïsoleerde sisteem bly konstant gedurende enige fisiese proses.* (2)

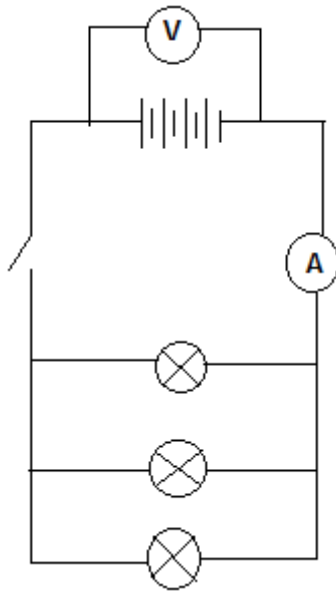
6.2.3  $Q = \frac{Q_1 + Q_2}{2}$  ✓  $Q = \frac{Q_1 + Q_2}{2}$  ✓  
 $= \frac{4 + 6}{2}$  ✓ OR / OF  $= \frac{4 \times 10^{-9} + 6 \times 10^{-9}}{2}$  ✓  
 $= 5 \text{ nC}$  ✓  $= 5 \times 10^{-9} \text{ C}$  ✓ (3)  
**[13]**

## QUESTION 7 / VRAAG 7

7.1.1 The rate ✓ of flow of charge ✓  
*Die tempo van vloei van lading.*

(2)

7.1.2

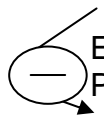


MARKING CRITERIA NASIENRIGLYNE	MARK /PUNT
4 cells in series <i>4 selle in serie</i>	1
Ammeter in series to measure main current. <i>Ammeter in serie om hoofstroom te meet.</i>	1
Voltmeter in parallel across all resistors. <i>Voltmeter in parallel oor al drie resistors.</i>	1
Three bulbs in parallel <i>Drie gloeilampe in parallel</i>	1
Switch is optional/not required. <i>Skakelaar is opsioneel/word nie vereis nie.</i>	(4)

7.1.3 Do not keep the switch closed for too long. ✓  
*Moenie die skakelaar te lank aangeskakel hou nie.*

(1)

7.1.4 Increase / Toeneem ✓



Effective resistance/total resistance decrease ✓  
Potential difference constant ✓.

*Effektiewe weerstand/totale weerstand neem af. ✓*  
*Potensiaalverskil bly dieselfde. ✓*

(3)

7.2.1 Emf /  $\mathcal{E}$  ✓ (1)

7.2.2  $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$  ✓  
 $= \frac{1}{2} + \frac{1}{6}$  ✓  
 $R_p = 1,5 \, \Omega$  ✓ (3)

7.2.3 **POSITIVE MARKING FROM 7.2.2 / POSITIEWE NASIEN VANAF 7.2.2.**

$$\begin{aligned} R_T &= R_s + R_p \checkmark \\ &= 4 + 1,5 \checkmark \\ &= 5,5 \, \Omega \checkmark \end{aligned} \quad (3)$$

7.2.4 **POSITIVE MARKING FROM 7.2.2 / POSITIEWE NASIEN VANAF 7.2.2.**

$$\begin{aligned} R &= \frac{V}{I} \checkmark \\ 1,5 \checkmark &= \frac{4}{I} \checkmark \\ I &= 2,67 \, \text{A} \checkmark \end{aligned} \quad (4)$$

7.2.5 **POSITIVE MARKING FROM 7.2.4 / POSITIEWE NASIEN VANAF 7.2.4.**

$$\begin{aligned} R &= \frac{V_2}{I} \\ 4 \checkmark &= \frac{V_2}{2,67} \checkmark \\ V_2 &= 10,68 \, \text{V} \, (10,67 \sim 10,68) \\ V_1 &= V_p + V_2 \checkmark \\ &= 4 + 10,68 \checkmark \\ &= 14,68 \, \text{V} \checkmark \, (14,67 \sim 14,68) \end{aligned} \quad \begin{matrix} (5) \\ [26] \end{matrix}$$



### QUESTION 8 / VRAAG 8

8.1.1 Insulator / *Isolator* ✓ Brittle / *Bros* ✓ (2)

8.1.2 When an object can be hammered (worked/pressed) into a shape ✓  
without breaking (or cracking). ✓

*Wanneer 'n voorwerp in 'n vorm gehammer (vervorm/bewerk/gedruk/gepers)  
kan word sonder om te breek (of te kraak).* (2)

8.1.3 Nickel ✓ / Cobalt ✓ / Iron (ANY TWO)  
*Nikkel / Kobalt / Yster (ENIGE TWEE)* (2)

8.2.1 Fluorine / *Fluoor* ✓ (1)

8.2.2 Atom / *Atoom* ✓

— Number of protons and electrons are the same. ✓  
Aantal protone en elektrone is dieselfde. (2)

8.2.3 9 ✓ (1)

8.2.4 19 ✓ (1)

8.2.5 2p 

↑	↓
---	---

↑	↓
---	---

↑
---

 ✓

2s 

↑	↓
---	---

 ✓

1s 

↑	↓
---	---

 ✓

If energy levels (1s, 2s & 2p) are not indicated, -1 maximum.  
*As energievlakke (1s, 2s & 2p) nie aangedui is nie, maksimum -1.*

(3)

8.2.6 Halogens / *Halogene* ✓ (1)

8.2.7 Non-metal / *Nie-metaal* ✓ (1)  
**[16]**

**QUESTION 9 / VRAAG 9**

9.1.1  $\text{Ca} \checkmark \text{CO}_3 \checkmark$  (2)

9.1.2  $\text{Al} \checkmark (\text{OH})_3 \checkmark$  (2)

9.1.3  $\text{Na} \checkmark \text{NO}_3 \checkmark$  (2)

9.2 A substance made up of two or more elements  $\checkmark$  in a specific ratio  $\checkmark$ .

*'n Stof wat gevorm word deur twee of meer elemente in 'n spesifieke verhouding.* (2)

9.3.1 Sulphur  $\checkmark$  dioxide  $\checkmark$  / Swawel  $\checkmark$  dioksied  $\checkmark$  (2)

9.3.2 Iron  $\checkmark$  (III)  $\checkmark$  sulphate  $\checkmark$  / Yster  $\checkmark$  (III)  $\checkmark$  sulfaat  $\checkmark$  (3)

9.4.1  $2 \text{NO} + \text{O}_2 \checkmark \rightarrow 2 \text{NO}_2 \checkmark$  (2)

9.4.2  $2 \text{HCl} + \text{F}_2 \checkmark \rightarrow 2 \text{HF} + \text{Cl}_2 \checkmark$  (2)

9.4.3  $2 \text{Al}_2\text{O}_3 \checkmark \rightarrow 4 \text{Al} + 3 \text{O}_2 \checkmark$  (2)

**[19]**

**QUESTION 10 / VRAAG 10**

10.1 P: Thermometer / *Termometer*  $\checkmark$   
Q: Tripod / *Driepoot*  $\checkmark$   
R: Bunsen burner / *Bunsenbrander*  $\checkmark$  (3)

10.2 It is flammable. / *Dit is brandbaar/vlambaar.*  $\checkmark$  (1)

10.3 480  $\checkmark$  (s) (1)

10.4 Not all solid particles have been converted to liquid yet.  $\checkmark$   
*Alle vastestofdeeltjies is nog nie heeltemal na vloeistof omgeskakel nie.* (1)

10.5  $70^\circ\text{C} \checkmark$  (1)

10.6  $66 + 273 \checkmark = 339 \checkmark (\text{K})$  (2)

**[9]**

**GRAND TOTAL / GROOTTOTAAL: 200**