basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATIONS/
NATIONAL SENIOR CERTIFICATE EXAMINATIONS/
SENIORSERTIFIKAAT-EKSAMEN/
NASIONALE SENIORSERTIFIKAAT-EKSAMEN

TECHNICAL SCIENCES P1/*TEGNIESE WETENSKAPPE V1*

MAY/JUNE/*MEI/JUNIE* 2026

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 13 pages./
Hierdie nasienriglyne bestaan uit 13 bladsye.

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QUESTION/*VRAAG* 1

1.1	A	✓✓	(2)
1.2	B	✓✓	(2)
1.3	A	✓✓	(2)
1.4	C	✓✓	(2)
1.5	B	✓✓	(2)
1.6	D	✓✓	(2)
1.7	B	✓✓	(2)
1.8	D	✓✓	(2)
1.9	D	✓✓	(2)
1.10	A / B	✓✓	(2)

[20]

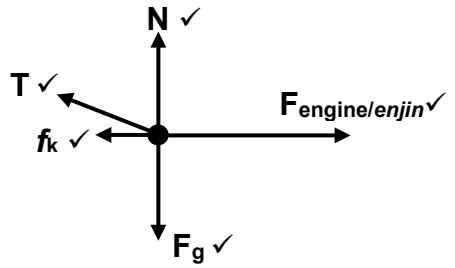
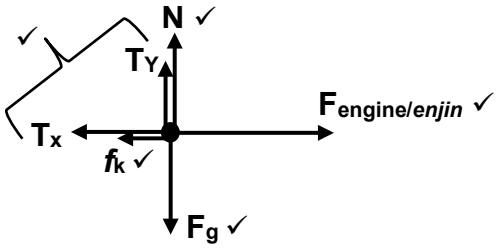
QUESTION/*VRAAG* 2

2.1 A single force which can produce the same effect as two or more forces. ✓✓/
'n Enkele krag wat dieselfde effek as twee of meer kragte teweeg kan bring.

OR/*OF*

A single force that has the same effect as the combined effects of all forces acting at a point./*'n Enkele krag wat dieselfde effek het as die gekombineerde effekte van al die kragte wat op 'n punt inwerk.* (2)

2.2

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
	

ACCEPTABLE LABELS/ *AANVAARBARE ETIKETTE*	**NOTES/*NOTAS***
N/F_N: Normal/*Normaal* F_g/W: Force due to gravity/weight/ *Krag as gevolg van gravitasie/gewig* $F_{engine/enjin}$/F_A/F: Force applied by engine/*Krag toegepas deur enjin*/1 236 N T/*F_T*/Tension/*Spanning*/$F_{boy/seun}$/ Force in rope/*Krag in tou* fk/f/F_f: Kinetic friction/*Kinetiese wrywing*/Frictional force/ *Wrywingskrag*	ONE mark for each force represented by an arrow with a correct label./*EEN punt vir elke krag verteenwoordig deur 'n pyl met 'n korrekte byskrif.* <u>Penalise ONCE for each of the following/*Penaliseer EEN KEER vir elk van die volgende*</u>: • No arrows/*Geen pyltjies* • No dot/*Geen punt* • Gap between the line and the dot/*Gaping tussen die lyn en punt* • Dotted lines used/*Gebroke lyn word gebruik* • A force diagram given/*'n Kragte diagram word gegee* • Additional forces are given/ *Addisionele kragte word gegee*

(5)

2.3.1 $F_{net/netto}$ = ma ✓
= (1 800 x 0,05) ✓
= 90 N ✓ (3)

2.3.2 **POSITIVE MARKING FROM QUESTION 2.3.1/*POSITIEWE NASIEN VANAF VRAAG 2.3.1***

OPTION/*OPSIE* 1 (Right is positive/*Regs is positief*)
$F_{net/netto}$ = ma $F_{net/netto}$ = (+$F_{engine/enjin}$) + (-f_k) + (-Tsinθ) ✓ Any one/*Enige een* 90 ✓= (+1236) – 500 – Tsin79º ✓ T = 658,09 N ✓
OPTION/*OPSIE* 2 (Right is negative/*Regs is positief*)
$F_{net/netto}$ = ma $F_{net/netto}$ = (-$F_{engine/enjin}$) + (f_k) + (Tsinθ) ✓ Any one/*Enige een* -90 ✓= (-1236) + 500 + Tsin79º ✓ T = - 658,09 N = 658,09 N ✓

OPTION/*OPSIE* 3 (Right is positive/*Regs is positief*)
$F_{net/netto}$ = ma $F_{net/netto}$ = (+$F_{engine/enjin}$) + (-f_k) + (-Tcosθ) ✓ Any one/*Enige een* 90 ✓= (+1236) – 500 – Tcos11º ✓ T = 658,09 N ✓
OPTION/*OPSIE* 4 (Right is negative/*Regs is negatief*)
$F_{net/netto}$ = ma $F_{net/netto}$ = (-$F_{engine/enjin}$) + f_k + (Tcosθ) ✓ Any one/*Enige een* -90 ✓= (-1236) + 500 + Tcos11º ✓ T = - 658,09 N = 658,09 N ✓

(4)

2.4.1 Weight/Gravitational force ✓ /*Gewig/Gravitasiekrag*
The force of attraction the earth exerts on any object on or near its surface.✓✓/ *Die aantrekkingskrag wat die aarde uitoefen op enige voorwerp op of naby sy oppervlak.* (3)

2.4.2 When the boy hits the trampoline, the trampoline simultaneously exerts an oppositely directed force ✓ of equal magnitude ✓ on the boy. /*Wanneer die seun die trampolien tref, oefen die trampolien gelyktydig 'n teenoorgestelde krag van gelyke grootte op die seun uit.* (2)

2.4.3 Newton's Third Law of motion ✓ /*Newton se Derde Bewegingswet*
When body **A** exerts a force on body **B**, body **B** simultaneously exerts an oppositely directed force of the same magnitude on body **A**. ✓✓ /*Wanneer liggaam **A** 'n krag op liggaam **B** uitoefen, oefen liggaam **B** gelyktydig 'n krag gelyk in grootte en teenoorgesteld in rigting op liggaam **A** uit.* (3)
[22]

QUESTION/*VRAAG* 3

3.1 Vector quantity ✓/*Vektorhoeveelheid*
It has both magnitude and direction. ✓✓/*Dit het beide grootte en rigting.* (3)

3.2

OPTION/*OPSIE* 1 **(Right is positive/*Regs as positief*)**	**OPTION/*OPSIE* 2** **(Left is positive/*Links as positief*)**
$\sum p_{(i)} = m_A v_A + m_B v_B$ ✓ $= (3)(5)$ ✓$+ (5)(-2)$ ✓ $= \underline{5\ kg{\cdot}m{\cdot}s^{-1}\ \text{right/}regs}$ ✓	$\sum p_{(i)} = m_A v_A + m_B v_B$ ✓ $= (3)(-5)$ ✓ $+ (5)(2)$ ✓ $= -5\ kg{\cdot}m{\cdot}s^{-1}$ $= \underline{5\ kg{\cdot}m{\cdot}s^{-1}\ \text{right/}regs}$ ✓

(4)

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

3.4 **POSITIVE MARKING FROM QUESTION 3.2/*POSITIEWE NASIEN VANAF VRAAG 3.2***

OPTION/*OPSIE* 1 **(Right is positive/*Regs is positief*)**	**OPTION/OPSIE 2** **(Left is positive/*Links is positief*)**
$\sum p_{(i)} = \sum p_{(f)}$ ✓ Any one/*Enige een* $(m_A v_A)_{(i)} + (m_B v_B)_{(i)} = (m_A + m_B)v_f$ 5 ✓$= (m_A+m_B)v_f$ $5 = (3 + 5)v_f$ ✓ $v_f = 0{,}625\ m{\cdot}s^{-1}$ ✓	$\sum p_{(i)} = \sum p_{(f)}$ ✓ Any one/*Enige een* $(m_A v_A)_{(i)} + (m_B v_B)_{(i)} = (m_A + m_B)v_f$ 5 ✓ $= (m_A+m_B)v_f$ $-5 = (3 + 5)v_f$ ✓ $v_f = -0{,}625$ $v_f = 0{,}625\ m{\cdot}s^{-1}$ ✓
OPTION/*OPSIE* 3 ***(Right is positive/Regs is positief)***	**OPTION/OPSIE 4** ***(Left is positive/Links is positief)***
$\sum p_{(i)} = \sum p_{(f)}$ ✓ Any one/*Enige een* $(m_A v_A)_{(i)} + (m_B v_B)_{(i)} = (m_A + m_B)v_f$ $(3)(5) + (5)(-2)$ ✓$= (3 + 5)v_f$ ✓ $v_f = 0{,}625\ m{\cdot}s^{-1}$ ✓	$\sum p_{(i)} = \sum p_{(f)}$ ✓ Any one/*Enige een* $(m_A v_A)_{(i)} + (m_B v_B)_{(i)} = (m_A + m_B)v_f$ $(3)(-5) + (5)(2)$ ✓$= (3 + 5)v_f$ ✓ $v_f = -0{,}625$ $v_f = 0{,}625\ m{\cdot}s^{-1}$ ✓

(4)

3.5 During a collision/*Tydens 'n botsing*:

- Contact time increases ✓as the crumple zone compresses/*Kontaktyd neem toe soos die frommelsone saamgedruk word*
- Net force experienced is reduced ✓/*Netto krag wat ondervind word neem af*
- Change in momentum remains constant ✓/*Verandering in momentum bly konstant* (3)

[16]

QUESTION/*VRAAG* 4

4.1 The force that acts between two surfaces when the object is moving. ✓✓/*Die krag wat uitgeoefen word tussen twee oppervlakke indien die voorwerp in beweging is.*

OR/*OF*

The force that opposes the motion of a moving object relative to the surface./ *Die krag wat die beweging van 'n voorwerp teenwerk relatief tot die oppervlak.* (2)

4.2



ACCEPTABLE LABELS/ *AANVAARBARE ETIKETTE*	**NOTES/*NOTAS***
F_A: $F_{applied/toegepas}$/15 N f_k/f/F_f: Kinetic friction/*Kinetiese wrywing*/Frictional force/ *Wrywingskrag*	ONE mark for each force represented by an arrow with a correct label./*EEN punt vir elke krag verteenwoordig deur 'n pyl met 'n korrekte byskrif.* <u>Penalise ONCE for each of the following/*Penaliseer EEN KEER vir elk van die volgende*</u>: • No arrows/*Geen pyltjies* • No dot/*Geen punt* • Gap between the line and the dot/*Gaping tussen die lyn en punt* • Dotted lines used/*Gebroke lyn word gebruik* • A force diagram given/*'n Kragte-diagram word gegee* • Additional forces are given/ *Addisionele kragte word gegee*

(2)

4.3.1

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
$f_k = \mu_k N$ ✓ = (0,15)(4)(9,8) ✓ = <u>5,88 N left/*links*</u> ✓	N = mg = (4)(9,8) = 39,20 N $f_k = \mu_k N$ ✓ = (0,15)(39,2) ✓ = <u>5,88 N left/*links*</u> ✓

(3)

4.3.2 **POSITIVE MARKING FROM QUESTION 4.3.1/*POSITIEWE NASIEN VANAF VRAAG 4.3.1***

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
$W_{net/netto} = W_{FA} + W_{fk}$ ✓ $W_{net/netto} = F_A \Delta x \cos\theta + f_k \Delta x \cos\theta$ = <u>(15)(3)cos0°</u>✓ + <u>(5,88)(3)cos180°</u>✓ = 27,36 J ✓	$W_{net/netto} = F_{net/netto} \Delta x \cos\theta$ ✓ $W_{net/netto} = (F_A - f_k)\Delta x \cos\theta$ = <u>(15 – 5,88)</u> ✓ (3)(cos0°)✓ = 27,36 J ✓

(4)

4.4 Principle of conservation of mechanical energy ✓/*Beginsel van behoud van meganiese energie* (1)

4.5 $M_E = E_k + E_p$
$M_E = ½mv^2 + mgh$ } ✓ Any correct one/*Enige korrekte een*
$0,27 = ½(m)(0)^2 + (m)(9,8)(2,8)$ ✓
$m = 9,84 \times 10^{-3}$ kg ✓ (3)

4.6.1 Increases ✓/*Neem toe* (1)

4.6.2 **POSITIVE MARKING FROM QUESTION 4.5/*POSITIEWE NASIEN VANAF VRAAG 4.5***

E_p at the point when hitting the toolbox/*E_p by die punt wanneer dit die gereedskapkas tref*
$E_p = mgh$ ✓
$= (0,00984)(9,8)(1,45)$ ✓
$= 0,01398$ J ✓ **RANGE/*REEKS*:** 0,1398 J – 0,1421 J

E_p at highest point after bouncing/*E_p by hoogste punt nadat dit bons*
$E_p = mgh$
$= (0,00984)(9,8)(2,8)$ ✓
$= 0,27$ J ✓

E_p at 1,45 m (top of toolbox/) is smaller than Ep at highest point. ✓ /
E_p by 1,45 m (bokant van gereedskapkas) is kleiner as Ep by hoogste punt.
OR/*OF*
E_p at highest point is greater than Ep at 1,45 m (top of toolbox)./*E_p by hoogste punt is groter as E_p by 1,45 m (bokant van gereedskapkas).* (6)

4.7 **POSITIVE MARKING FROM QUESTION 4.6.1 AND 4.6.2/*POSITIEWE NASIEN VANAF VRAAG 4.6.1 EN 4.6.2***
0,27 J ✓ (1)
[23]

QUESTION/*VRAAG* 5

5.1 Within the limit of elasticity ✓, stress is directly proportional to the strain. ✓/*In die grens van elastisiteit, is spanning direk eweredig aan die rekking.* (2)

5.2.1

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
$\text{Cos } 4° = \frac{10}{½ L_{f\ rope/tou}}$ $½ L_{f\ rope/tou} = \frac{10}{\text{Cos } 4°}$ ✓ $= 10{,}0244$ m $\Delta\ell = L_f - L_i$ $\Delta\ell = (10{,}0244 \times 2)$ ✓ $- 20$ ✓ $\Delta\ell = 0{,}05$ m ✓	$\text{Sin } 86° = \frac{10}{½ L_{f\ rope/tou}}$ $½ L_{f\ rope/tou} = \frac{10}{\text{Sin } 86°}$ ✓ $= 10{,}0244$ m $\Delta\ell = L_f - L_i$ $\Delta\ell = (10{,}0244 \times 2)$ ✓ $- 20$ ✓ $\Delta\ell = 0{,}05$ m ✓
RANGE/*REEKS*: 0,04 m - 0,05 m	

(4)

5.2.2 **POSITIVE MARKING FROM QUESTION 5.2.1/*POSITIEWE NASIEN VANAF VRAAG 5.2.1***

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
$\varepsilon = \frac{\Delta\ell}{L}$ ✓ $= \frac{0{,}05}{20}$ ✓ $= 2{,}50 \times 10^{-3}$ ✓	$\varepsilon = \frac{\Delta\ell}{L}$ ✓ $= \frac{0{,}0488}{20}$ ✓ $= 2{,}44 \times 10^{-3}$ ✓

RANGE/*REEKS*: $2{,}44 \times 10^{-3} - 2{,}50 \times 10^{-3}$ (3)

5.3
- Quartz fire in guitar strings ✓/*Kwartsvuur in kitaarsnare*
- Phosphorus bronze in springs and cables ✓/*Fosforbrons in vere en kabels*
- Elastic/rubber band/*Elastiese/rubberband*
- Bow and arrow/*Pyl en boog* (Any correct two/*Enige korrekte twee*) (2)

[11]

QUESTION/*VRAAG* 6

6.1 The normal force exerted by a liquid at rest on a given surface in contact with it. ✓✓/*Die normaalkrag wat uitgeoefen word deur 'n vloeistof in rus met 'n gegewe oppervlak wat daarmee in kontak is.* (2)

6.2

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
$A = \pi r^2$ $A = \pi(0,28)^2$ ✓ $A = 0,2463\ m^2$ $\frac{F_1}{A_1} = \frac{F_2}{A_2}$ ✓ $\frac{350}{0,02}$ ✓ $= \frac{F_2}{0,2463}$ ✓ $F_2 = 4\,310,25$ N ✓	$\frac{F_1}{A_1} = \frac{F_2}{A_2}$ ✓ $\frac{350}{0,02}$ ✓ $= \frac{F_2}{\pi(0,28)^2}$ ✓ ✓ Substitution / *Substitusie* $F_2 = 4\,310,27$ N ✓
RANGE/*REEKS*: 4 305,00 N - 4 375 N	

OPTION/*OPSIE* 3
$A = \frac{\pi d^2}{4}$ $A = \frac{\pi(560 \times 10^{-3})^2}{4}$ ✓ $A = 0,2463\ m^2$ $\frac{F_1}{A_1} = \frac{F_2}{A_2}$ ✓ $\frac{350}{0,02}$ ✓ $= \frac{F_2}{0,2463}$ ✓ $F_2 = 4\,310,25$ N ✓
RANGE/*REEKS*: 4 305,00 N - 4 375 N

(5)

6.3.1 Remains the same ✓/*Bly dieselfde* (1)

6.3.2 Pressure depends only on force applied and the area. ✓✓/*Druk is slegs afhanklik van die toegepaste krag en die area.*

OR/*OF*

Pressure is independent of the length of the cylinder./*Druk is onafhanklik van die lengte van die silinder.* (2)

6.4
- Vehicle lifts ✓/*Voertuighysers*
- Forklifts/*Vurkhysers*
- Dentist's chair/*Tandarts se stoel*
- Hydraulic jack/*Hidrouliese domkrag*
- Hydraulic brakes/*Hidrouliese remme* (Any correct one/*Enige korrekte een*) (1)

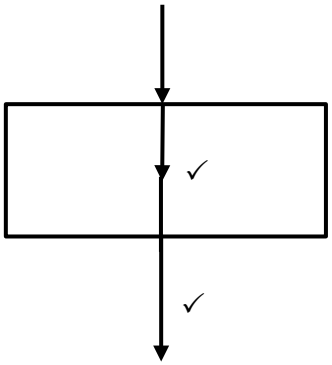
[11]

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QUESTION/*VRAAG* 7

7.1 The bending of light ✓ when it travels from one medium to another ✓ (of different optical density). /*Die buiging van lig wanneer dit vanaf een medium na 'n ander (met verskillende optiese digtheid) beweeg.* (2)

7.2



MARKING CRITERIA/
NASIENKRITERIA
- Ray passes through glass block without bending/*Straal beweeg deur glasblok sonder buiging* (1)
- Ray emerges the glass block without bending/*Straal verlaat die glasblok sonder buiging* (1)

(2)

7.3.1 Refracted ray ✓/*Brekingstraal* (1)

7.3.2 Normal (line) ✓/*Normaal(lyn)* (1)

7.4 Glass ✓/*Glas* (1)

7.5 **NEGATIVE MARKING FROM QUESTION 7.4/NEGATIEWE *NASIEN VANAF VRAAG 7.4***
When a light ray travels from a medium of higher optical density to that of a lower optical density ✓ it bends away from the normal, as it is in the case of ray **1**. ✓/*Wanneer 'n ligstraal vanaf 'n medium met hoër optiese digtheid na daardie met 'n laer optiese digtheid beweeg, buig dit weg vanaf die normaal, soos in die geval van straal **1**.*

OR/*OF*

Total internal reflection occurs in the denser medium, as it is in the case of ray **3**./*Totale interne weerkaatsing vind plaas in die digter medium, soos in die geval van straal **3**.* (2)

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

7.6.2
- The angle of incidence must be greater than the critical angle ✓/*Die invalshoek moet groter wees as die grenshoek.*
- Light must move from a medium of higher to lower optical density ✓/*Lig moet vanaf 'n medium met hoër na laer optiese digtheid beweeg.* (2)

7.7.1 B ✓ (Remote controllers; photography and thermal imaging/ *Afstandbeheerders; fotografie en termiese beelding)*. (1)

7.7.2 A ✓ (Used to treat cancer; sterilise food and instruments/*Gebruik om kanker te behandel; sterilisasie van voedsel en instrumente*). (1)

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7.8 $E = \frac{hc}{\lambda}$ ✓

1×10^{-14} ✓ $= \frac{(6{,}63 \times 10^{-34})(3 \times 10^{8})}{\lambda}$ ✓

$\lambda = 1{,}989 \times 10^{-11}$ m ✓

RANGE/*REEKS*: $1{,}989 \times 10^{-11}$ m to 2×10^{-11} m (4)

7.9.1
- Convex lens is thicker in the middle and thinner at the edges. ✓/*Konvekse lens is dikker in die middel en dunner op die kante.*
- Concave lens is thinner in the middle and thicker at the edges. ✓/*Konkawe lens is dunner in die middel en dikker op die kante.*

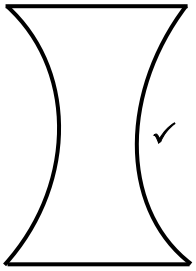
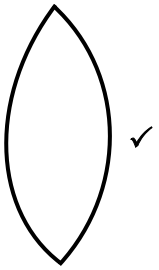
OR/*OF*

- Convex lens converges light rays./*Konvekse lens konvergeer ligstrale.*
- Concave lens diverges light rays./*Konkawe lens divergeer ligstrale.*

OR/*OF*

- Convex lens gives a real and virtual image./*Konvekse lens gee ware en skynbeeld.*
- Concave lens gives a virtual image only./*Konkawe beeld gee slegs 'n skynbeeld.* (2)

7.9.2

Concave/*Konkawe* lens	**Convex/*Konvekse* lens**
 ✓	 ✓

(2)
[22]

QUESTION/*VRAAG* 8

8.1 A device that stores electrical charge. ✓✓/*'n Toestel wat elektriese lading stoor.* (2)

8.2 $C = \frac{\varepsilon_o A}{d}$

$= \frac{(8{,}85 \times 10^{-12})(0{,}04 \times 0{,}04)}{0{,}0025}$ ✓

$= 5{,}664 \times 10^{-12}$ F

One mark to any ONE of the two formulae/*Een punt vir enige EEN van die twee formules*

$C = \frac{Q}{V}$ ✓

$5{,}664 \times 10^{-12}$ ✓ $= \frac{5 \times 10^{-11}}{V}$ ✓

$V = 8{,}83$ V ✓ (5)
[7]

QUESTION/*VRAAG* 9

9.1 Opposition to the flow of electric current. ✓✓/*Teenstand teen die vloei van elektriese stroom.* (2)

9.2.1

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓ $= \frac{1}{4} + \frac{1}{4}$ ✓ Rp = 2 Ω ✓	$R_p = \frac{R_1 \times R_2}{R_1 + R_2}$ ✓ $= \frac{4 \times 4}{4 + 4}$ ✓ = 2 Ω ✓

(3)

9.2.2

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
$W = I^2R\Delta t$ ✓ $= (1,2)^2(3)(3)$ ✓ = 12,96 J ✓	V = IR = 1,2 x 3 = 3,6 V W = VIΔt ✓ $= \frac{(3,6)(1,2)(3)}{}$ ✓ = 12,96 J ✓
OPTION/*OPSIE* 3	**OPTION/*OPSIE* 4**
V = IR = 1,2 x 3 = 3,6 V $W = \frac{V^2\Delta t}{R}$ ✓ $= \frac{(3,6)^2(3)}{3}$ ✓ = 12,96 J ✓	Q = IΔt = 1,2 x 3 = 3,6 C W = VQ ✓ = 3,6 x 3,6 ✓ = 12,96 J ✓

(3)

9.3 Decrease ✓/*Afneem* (1)

[9]

QUESTION/*VRAAG* 10

10.1 The process of generating electricity from motion.✓✓ /*Die proses om elektrisiteit deur beweging op te wek.*

OR/*OF*

The production of an electromotive force (emf) or voltage across an electrical conductor due to relative motion between the conductor and magnetic field./ *Die produksie van 'n elektromotoriese krag (emk) of spanning oor 'n elektriese geleier a.g.v. relatiewe beweging tussen die geleier en magneetveld.* (2)

10.2 $\varepsilon = -\frac{N\Delta\Phi}{\Delta t}$ ✓

0,25 ✓ $= \frac{-250\,(1 \times 10^{-4} - 5 \times 10^{-4})}{\Delta t}$ ✓

Δt = 0,4 s ✓ (4)

10.3 Ensures that current flows in one direction. ✓/*Verseker dat stroom in een rigting vloei.* (1)

10.4.1 Anticlockwise ✓/*Antikloksgewys* (1)

10.4.2 Fleming's left-hand (motor) rule ✓/*Fleming se linkerhand(motor)reël* (1)
[9]

TOTAL/*TOTAAL*: 150

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