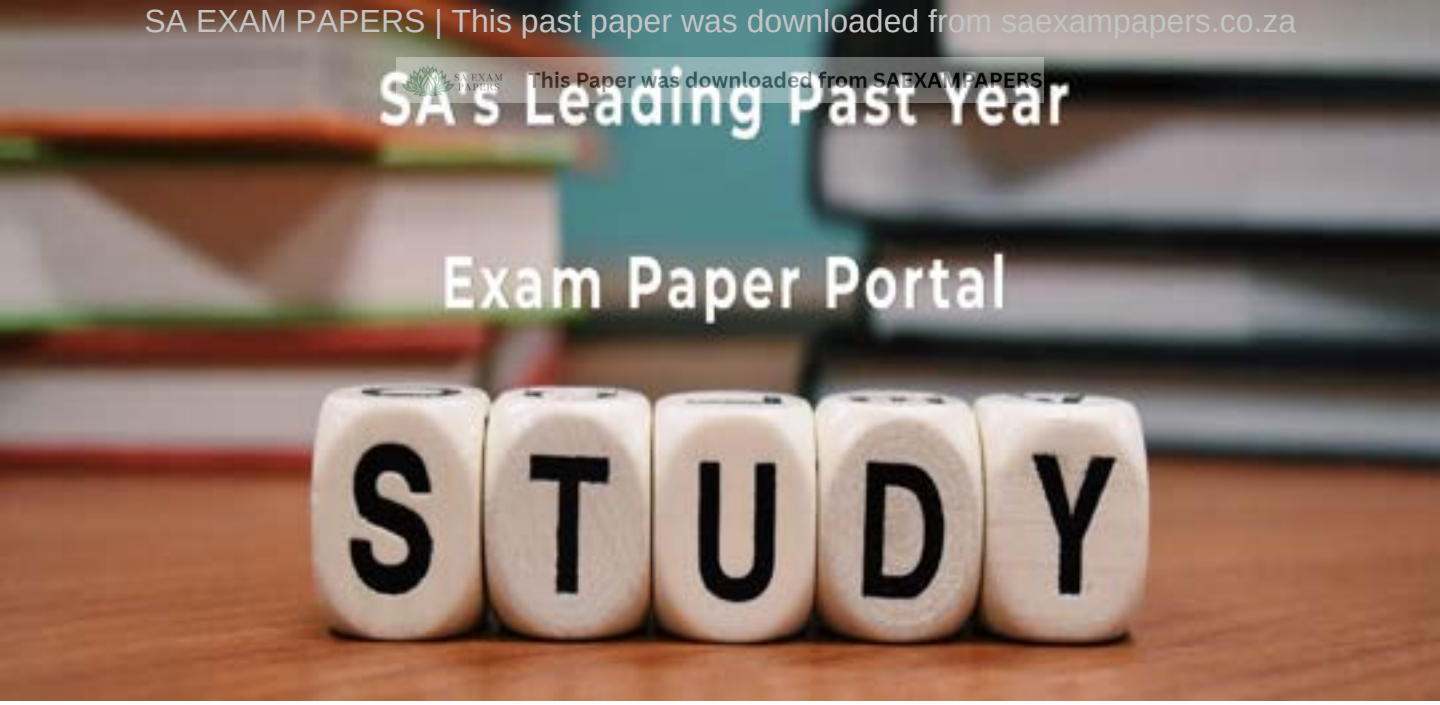


basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE
NASIONALE SENIOR SERTIFIKAAT

GRADE/*GRAAD 12*

TECHNICAL SCIENCES P1
TEGNIESE WETENSKAPPE V1

NOVEMBER 2025

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 12 pages.
Hierdie nasienriglyne bestaan uit 12 bladsye.

QUESTION/*VRAAG* 1

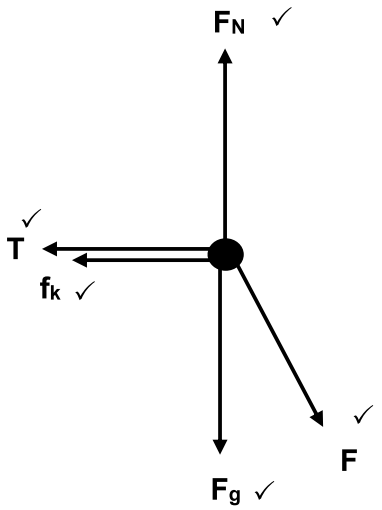
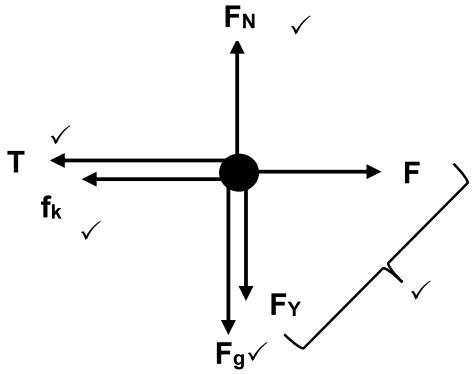
1.1	C	✓✓	(2)
1.2	C	✓✓	(2)
1.3	B	✓✓	(2)
1.4	A	✓✓	(2)
1.5	C	✓✓	(2)
1.6	B	✓✓	(2)
1.7	B	✓✓	(2)
1.8	B	✓✓	(2)
1.9	C	✓✓	(2)
1.10	C / D	✓✓	(2)

[20]

QUESTION/*VRAAG* 2

2.1 When a net/resultant force is applied to an object of mass, m, it accelerates the object in the direction of the net force. ✓✓ The acceleration is directly proportional to the net/resultant force and inversely proportional to the mass of the object./*Wanneer 'n resulterende/netto krag op 'n voorwerp met massa, m, inwerk, versnel die voorwerp in die rigting van die netto krag. Die versnelling is direk eweredig aan die resulterende/netto krag en omgekeerd eweredig aan die massa van die voorwerp.* (2)

2.2

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
	
NOTES/*AANTEKENINGE*: Mark allocated for arrow and label./ *Punt toegeken vir pyl en byskrif.* Penalise once if:/*Penaliseer een keer indien*: • No arrows/*Geen pyltjies* • No dot/*Geen kol nie* • Gap between the line and dot/*Gaping tussen die lyn en kol* • Dotted lines are used/ *Stippellyne word gebruik* • A force diagram given/*'n Kragtediagram word gegee* • Additional forces are given/ *Addisionele kragte word gegee* • Do not penalise if arrow lengths are not drawn to scale/*Moenie penaliseer indien pyllengtes nie volgens skaal geteken is nie.*	**Acceptable labels/*Aanvaarbare etikette*:** • Normal force/*Normaalkrag*: N/F_N/$F_{normal/normaal}$ • Applied force/*Toegepaste krag*: F/ F_A/ 65 N • Gravitational force/*Gravitasie krag*: w/F_g/$F_{gravity/gravitasie}$/ Weight/*Gewig* • Vertical component/*Vertikale komponent*: F_v/F_y/F_{Ay} • Horizontal component/ *Horisontale komponent*: F_H/F_x F_{Ax} • Frictional force/*Wrywingskrag*: f/f_k/F_f/ 1,76 N • T/F_T/Tension/*Spanning*

(5)

2.3.1 $N = w + F_Y$
$= mg + F_Y$
$F_N = mg + F\sin\theta$
$= (18)(9,8)$ ✓ $+ 65\sin25°$ ✓
$= 203,87$ N ✓ (upwards/*opwaarts*) (3)

2.3.2 **POSITIVE MARKING FROM QUESTION 2.3.1/*POSITIEWE NASIEN VANAF VRAAG 2.3.1***
$f_k = \mu_k N$ ✓
$= (0,02)(203,87)$ ✓
$= 4,08$ N ✓ (left/*links*) (3)

2.3.3 **POSITIVE MARKING FROM QUESTION 2.3.2/*POSITIEWE NASIEN VANAF VRAAG 2.3.2***
For 9 kg block/*Vir 9 kg-blok*
$F_{net/netto} = ma$
$T + (-f_k) = ma$ ✓ Any one/*Enige een*
$T - 1,76$ ✓ $= 9a$
$T = 9a + 1,76$ .....(1)

For 18 kg block/*Vir 18 kg-blok*
$F_{net/netto} = ma$
$F_x + (-T) + (-f_k) = ma$
$F\cos\theta - T - f_k = ma$
$65\cos25° - T - 4,08$ ✓ $= 18a$ .....(2) ✓ Any one/*Enige een*
$(65\cos25°) - (9a + 1,76) - 4,08 = 18a$
$a = 1,97$ m·s^{-2} ✓ (to the right/*na regs*) (5)

2.4 Decreases ✓ /*Neem af* (1)
[19]

QUESTION/*VRAAG* 3

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

3.2.1

OPTION/*OPSIE* 1 (Take right as positive/*Neem regs as positief*)
$\sum p_{before/voor} = \sum p_{after/na}$ $(m_A v_A)_i + (m_B v_B)_i = (m_A v_A)_f + (m_B v_B)_f$ ✓ (Any one/*Enige een*) $(1\,500 \times 30) + (1\,800 \times 0)$ ✓ $= 1\,500 \times (-5) + 1\,800 v_f$ ✓ $v_f = 29,17$ m·s^{-1} right/*regs* ✓
OPTION/*OPSIE* 2 (Take right as negative/*Neem regs as negatief*)
$\sum p_{before/voor} = \sum p_{after/na}$ $(m_A v_A)_i + (m_B v_B)_i = (m_A v_A)_f + (m_B v_B)_f$ ✓ (Any one/*Enige een*) $(1\,500 \times -30) + (1\,800 \times 0)$ ✓ $= (1\,500 \times (5)) + (1\,800 v_f)$ ✓ $v_f = -29,17$ m·s^{-1} $v_f = 29,17$ m·s^{-1} right/*regs* ✓

(4)

3.2.2 **POSITIVE MARKING FROM QUESTION 3.2.1/*POSITIEWE NASIEN VANAF VRAAG 3.2.1***

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
$F_{net/netto} = \frac{\Delta p}{\Delta t}$ $= m\frac{(v_f - v_i)}{\Delta t}$ ✓ (Any one/*Enige een*) $= 1\,800$ ✓ $\frac{(29{,}17 - 0)}{0{,}5}$ ✓ $= 105\,012$ N right/*regs* ✓	$a = \frac{v_f - v_i}{\Delta t}$ $= \frac{29{,}17 - 0}{0{,}5}$ ✓ $= 58{,}34\ m.s^{-2}$ $F_{net/netto} = ma$ ✓ $= (1\,800)$ ✓$(58{,}34)$ $= 105\,012$ N right/*regs* ✓
(Range/*Reeks*: 105 000 N – 105 012 N)	

(4)

3.3 **POSITIVE MARKING FROM QUESTION 3.2.1/*POSITIEWE NASIEN VANAF VRAAG 3.2.1***

$\sum E_{k(before/voor)} = (½mv^2)_A + (½mv^2)_B$
$= ½(1\,500)(30)^2 + ½(1\,800)(0)^2$ ✓
$= 675\,000$ J

$\sum E_{k(after/na)} = (½mv^2)_A + (½mv^2)_B$
$= ½(1\,500)(-5)^2 + ½(1\,800)(29{,}17)^2$ ✓
$= 784\,550{,}01$ J

✓ Any one/*Enige een*

$\sum E_{k(before/voor)} \neq \sum E_{k(after/na)}$ ✓
Inelastic ✓/*Onelasties* (5)

3.4 **POSITIVE MARKING FROM QUESTION 3.2.2/*POSITIEWE NASIEN VANAF VRAAG 3.2.2***
105 012 N ✓ (1)

3.5 Newton's third law of motion ✓ /*Newton se derde bewegingswet* (1)

3.6
- airbags ✓ /*lugsakke*
- crumple zones/*vrommelsones*
- padded dashboards/*opgestopte paneelborde*
- safety belts/*veiligheidsgordels*
- head rests/*kopstutte*

(Any one/*Enige een*) (1)
[18]

QUESTION/*VRAAG* 4

4.1 A system in which the net external force acting on the system is zero. ✓✓
/*'n Sisteem waarop die netto eksterne krag wat op die sisteem inwerk, nul is*. (2)

4.2.1 $W = F\Delta x\cos\theta$ ✓
$= (460)(\cos 40°)(100)(\cos 0°)$ ✓
$= 35\,238{,}04$ J ✓ (3)

4.2.2 $W = F\Delta x\cos\theta$
$= (325)(100)\cos 180°$ ✓
$= -\,32\,500{,}00$ J ✓ (2)

4.2.3 **POSITIVE MARKING FROM QUESTION 4.2.1 AND QUESTION 4.2.2/** ***POSITIEWE NASIEN VANAF VRAAG 4.2.1 EN VRAAG 4.2.2***

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
$W_{net/netto} = W_{Fapplied/toegepas} - W_f$ $= 35\,238{,}04 - 32\,500{,}00$ ✓ $= 2738{,}04$ J ✓	$F_{net/netto} = F_x + (-f)$ $= F\cos\theta + (-f)$ $= (460)(\cos 40°) + (-325)$ $= 27{,}38044$ N $W_{net/netto} = F_{net/netto}\Delta x\cos\theta$ $= (27{,}38044)(100)(\cos 0°)$ ✓ $= 2738{,}04$ J ✓

(2)

4.3.1 Yes ✓ /*Ja*

NEGATIVE MARKING / *NEGATIEWE NASIEN*
There are no net external forces acting on the system. ✓✓ /*Daar is geen netto eksterne kragte wat op die stelsel inwerk nie.*
OR/*OF*
The system is isolated./*Die stelsel is geïsoleerd.*
OR/*OF*
No friction/*Geen wrywing.*/No air resistance/*Geen lugweerstand*
OR/*OF*
The track is frictionless./*Die baan is wrywingloos.* (3)

4.3.2 $M_{E(A)} = M_{E(B)}$
$E_{P(A)} + E_{K(A)} = E_{P(B)} + E_{K(B)}$
$mgh_{(A)} + \frac{1}{2}mv^2_{(A)} = mgh_{(B)} + E_{K(B)}$ } ✓ (Any one/*Enige een*)
$(5)(9{,}8)(8)$ ✓ $+ \frac{1}{2}(5)(0)^2$ ✓ $= (5)(9{,}8)(0)$ ✓ $+ E_{K(B)}$
$E_{K(B)} = 392$ J ✓ (5)

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

$M_{E(C)} = M_{E(B)}$
$(mgh + \frac{1}{2}mv^2)_C = (mgh + \frac{1}{2}mv^2)_B$ } ✓ (Any one/*Enige een*)

$\underline{(5)(9{,}8)(2) + \frac{1}{2}(5)(v^2)}$ ✓ $= 392$ ✓
$v = 10{,}84\ m\cdot s^{-1}$ ✓ (4)

[21]

QUESTION/*VRAAG* 5

5.1 A measure of the ability of a material to withstand changes in length ✓ when subjected to lengthwise tension or compression. ✓ /*'n Meting van die vermoë van 'n materiaal om veranderinge in lengte te weerstaan wanneer dit aan trekking of drukking in die lengte onderwerp word.* (2)

5.2.1 Similar to ✓ /*Soortgelyk* (1)

5.2.2 **NEGATIVE MARKING FROM QUESTION 5.2.1/*NEGATIEWE NASIEN VANAF VRAAG 5.2.1***
Similar material will have the same modulus (of elasticity) ✓ that will allow uniform transfer of load across the repaired section. ✓ / *Soortgelyke material sal diesefde modulus (van elastisiteit) hê wat eenvormige lasoordrag oor die herstelde gedeelte toelaat.* (2)

5.3 $K = \frac{\sigma}{\varepsilon}$ ✓

$K = \frac{1,6 \times 10^{8}}{1,78 \times 10^{-2}}$ ✓

$K = 8,99 \times 10^{9}$ Pa ✓ (3)
[8]

QUESTION/*VRAAG* 6

6.1 In a continuous liquid at equilibrium, the pressure applied at a point is transmitted equally to the other parts of the liquid. ✓✓ /*In 'n kontinue vloeistof by ewewig, sal die druk by 'n punt eweredig oorgedra word na al die ander dele van die vloeistof.* (2)

6.2

OPTION 1	**OPTION 2**
$P = \frac{F}{A}$ ✓ $2,67 \times 10^{6}$ ✓ $= \frac{F}{\pi(0,046)^2}$ ✓ $= 17\,749,12$ N ✓	$A = \pi r^2$ $= \pi(0,046)^2$ $= 6,6476 \times 10^{-3}$ m² $P = \frac{F}{A}$ ✓ $2,67 \times 10^{6}$ ✓ $= \frac{F}{6,6476 \times 10^{-3}}$ ✓ F = 17 749,09 N ✓
Range/*Reeks*: 17 749,09 N - 17 749,12 N	

(4)

6.3 Greater than ✓/*Groter as* (1)

6.4.1 Oil with lower viscosity. ✓ /*Olie met laer viskositeit.* (1)

6.4.2 **NEGATIVE MARKING FROM QUESTION 6.4.1/*NEGATIEWE NASIEN VANAF VRAAG 6.4.1***
The oil with a lower viscosity would flow easily ✓ in a colder environment and will require a force of a lower magnitude ✓ to operate the machine./*Die olie met 'n laer viskositeit sal makliker vloei in 'n kouer omgewing en sal 'n krag van kleiner grootte benodig om die masjien te laat werk.* (2)

6.5 Decreases ✓/*Neem af*

NEGATIVE MARKING/*NEGATIEWE NASIEN*
The temperature of the hydraulic oil increases ✓✓ (as the machine is in operation), therefore the viscosity decreases. /*Tydens die werking van die masjien, Die temperatuur van die hidrouliese olie neem toe (tydens die werking van die masjien), dus neem die viskositeit af.* (3)
[13]

QUESTION/*VRAAG 7*

7.1.1 The change in direction of a wave upon striking the interface between two materials. ✓✓ /*Die verandering in rigting van 'n golf wanneer dit die vlak tussen twee materiale tref.* (2)

7.1.2  ✓✓ (2)

7.1.3
- Image formed is virtual ✓ /*'n Skynbeeld beeld vorm*
- Laterally inverted ✓ /*Sydelings omgekeer*
- Same size as the object/*Dieselfde grootte as die voorwerp*
- Upright/*Regop*
- Image is the same distance from the mirror to the object/*Beeld is dieselfde afstand vanaf die spieel tot die voorwerp*

(Any two/*Enige twee*) (2)

7.2.1 The angle of incidence in a denser medium such that the refracted ray just passes through the surface of separation of the two media. ✓✓ /*Die invalshoek in die digter medium sodat die gebreekte straal net deur die oppervlak wat die twee media skei, gaan.*

OR/*OF*

The angle of incidence in the optically denser medium for which the angle of refraction is 90°./*Die invalshoek in die opties digter medium waar die brekingshoek 90° is.* (2)

7.2.2 Angle of incidence should be between 47° and 90°. ✓✓ /*Die invalshoek moet tussen 47° en 90° wees.*

OR/*OF*

$47° < \theta < 90°$ (2)

7.3 By accelerating electric charges ✓✓

OR/*OF*

By changing magnetic field and electric field ✓✓ (mutually perpendicular to each other and in the direction of propagation of the wave)./*Deur 'n verandering van magnetiese en elektriese velde, (onderling loodreg op mekaar en in die rigting van die voortplanting van die golf).* (2)

7.4.1 Quantum/Packet of energy. ✓✓ /*Kwantum/Pakkie van energie.* (2)

7.4.2 $3 \times 10^8\ m \cdot s^{-1}$ ✓ (1)

7.4.3 $E = hf$ ✓

$3{,}32 \times 10^{-19} = (6{,}63 \times 10^{-34})f$ ✓

$f = 5{,}01 \times 10^{14}$ Hz ✓ (3)

7.5.1 Microwaves ✓/*Mikrogolwe* (1)

7.5.2 Gamma rays ✓/*Gammastrale* (1)

7.6 As wavelength increases, frequency decreases.✓✓ /*Soos golflengte toeneem, neem frekwensie af.*

OR/*OF*

As wavelength decreases, frequency increases./*Soos golflengte afneem, neem golflengte toe.*

OR/*OF*

$\lambda \alpha \frac{1}{f}$ (2)

[22]

QUESTION/*VRAAG* 8

8.1 The amount of charge that a capacitor can store per volt. ✓✓ /*Die hoeveelheid lading wat 'n kapasitor kan stoor per volt.* (2)

8.2
- (Two) metal plates ✓ /*(Twee) metaalplate*
- Dielectric (insulating) material/*Diëlektriese (isolator) materiaal*

(Any one/*Enige een*) (1)

8.3.1 $C = \frac{Q}{V}$ ✓

$0{,}0003 = \frac{0{,}033}{V}$ ✓

$V = 110$ V ✓

No ✓ /*Nee*, (the new capacitor will not be operational/*die nuwe kapasitor sal nie in werking wees nie).* (4)

8.3.2
- Decrease the area of the metal plates. ✓ /*Verklein die area van die metaalplate.*
- Increase the separation distance between the metal plates./*Vergroot die skeidingsafstand tussen die metaalplate.*
- Use a dielectric with a lower dielectric constant./*Gebruik 'n diëlektries met 'n laer diëlektriese konstante.*

(Any one/*Enige een*) (1)

[8]

QUESTION/*VRAAG* 9

9.1
- Length (of the conductor) ✓ /*Lengte (van die geleier)*
- Thickness/cross sectional area (of the conductor)/*Dikte/deursnit (van die geleier)*
- Temperature (of the conductor)/*Temperatuur (van die geleier)*
- Type of material (of the conductor)/*Tipe materiaal (van die geleier)*

(Any one/*Enige een*) (1)

9.2.1

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
$P = I^2R$ ✓ $= (3)^2(4)$ ✓ $= 36$ W ✓	$V = IR$ $= (3)(4)$ $= 12$ V $P = VI$ ✓ $= (12)(3)$ ✓ $= 36$ W ✓

OPTION/*OPSIE* 3
$V = IR$ $= (3)(4)$ $= 12$ V $P = \frac{V^2}{R}$ ✓ $= \frac{(12)^2}{4}$ ✓ $= 36$ W ✓

(3)

9.2.2

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓ $= \frac{1}{3} + \frac{1}{6}$ ✓ $R_P = 2\ \Omega$ $V = IR_P$ ✓ $= (3)(2)$ ✓ $= 6$ V ✓	$R_P = \frac{R_1 \times R_2}{R_1 + R_2}$ ✓ $R_P = \frac{3 \times 6}{3 + 6}$ ✓ $R_P = 2\ \Omega$ $V = IR_P$ ✓ $= (3)(2)$ ✓ $= 6$ V ✓

(5)
[9]

QUESTION/VRAAG 10

10.1 The direction of the induced emf in the coil opposes the effect that produces it. ✓✓ /*Die rigting van die geïnduseerde emk in die spoel sodanig is dat dit die aksie wat dit veroorsaak, teenstaan*. (2)

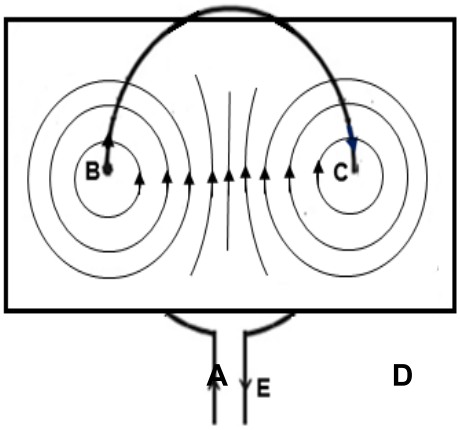
10.2.
- Electromagnetic braking (in trains, machinery or roller coasters). ✓ / *Elektromagnetiese remming (in treine, masjinerie en tuimeltreine).*
- Induction cooking pots ✓ /*Induksie kookpotte*
- Electric motors/*Elektriese motors*
- Electric generators/*Elektriese generators*
- Transformers/*Transformators*
- Metal detectors/*Metaalopspoorder*

(Any correct one/*Enige korrekte een*) (2)

10.3.1 Clockwise ✓ /*Kloksgewys* (1)

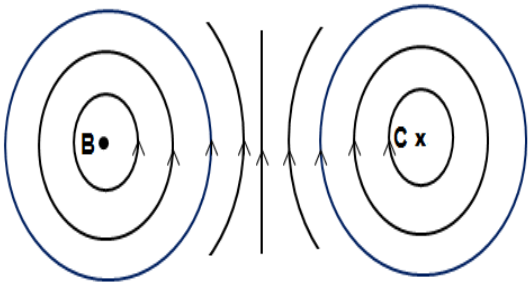
10.3.2

OPTION/*OPSIE* 1



Marking criteria/*Nasienkriteria*:
- Magnetic field pattern drawn around both point **B** and **C** ✓ / *Magnetiese veldpatroon geteken rondom beide punte **B** en **C***
- Direction of the induced magnetic field ✓/*Rigting van die geïnduseerde magneetveld*
- Shape of the induced magnetic field between **B** and **C** ✓ /*Vorm van die geïnduseerde magneetveld tussen **B** en **C***

OPTION/*OPSIE* 2



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- Direction of the induced magnetic field ✓/*Rigting van die geïnduseerde magneetveld*
- Shape of the induced magnetic field between **B** and **C** ✓ /*Vorm van die geïnduseerde magneetveld tussen **B** en **C***

(3)

10.4

$$\frac{V_S}{V_P} = \frac{N_S}{N_P} \checkmark$$

$$\frac{276}{V_P} \checkmark = \frac{150}{100} \checkmark$$

$$V_P = 184 \text{ V} \checkmark$$

(4)
[12]

TOTAL/*TOTAAL*: 150