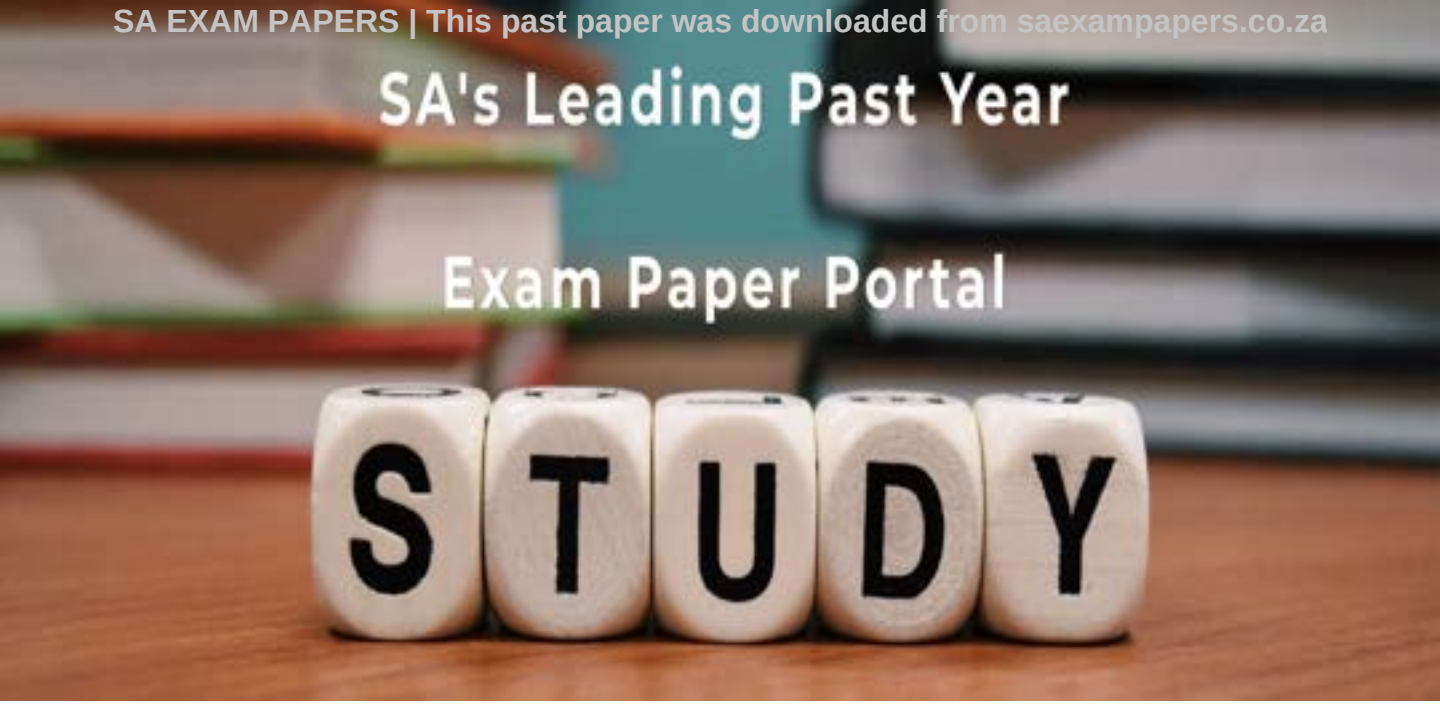

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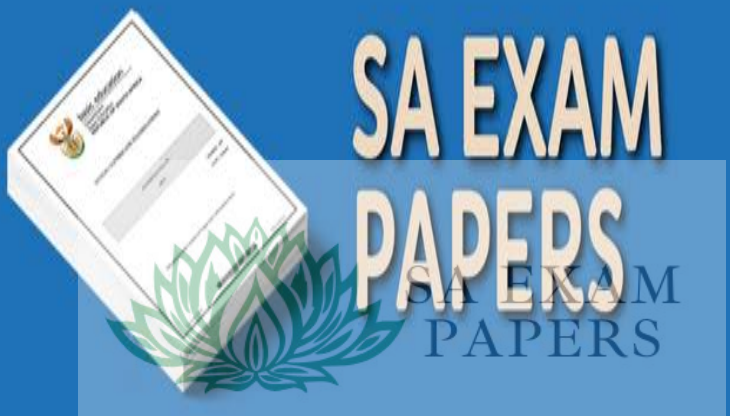


basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE
NASIONALE SENIOR SERTIFIKAAT

GRADE/*GRAAD* 12

TECHNICAL SCIENCES P1
TEGNIESE WETENSKAPPE V1

NOVEMBER 2023

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 14 pages.
Hierdie nasienriglyne bestaan uit 14 bladsye.

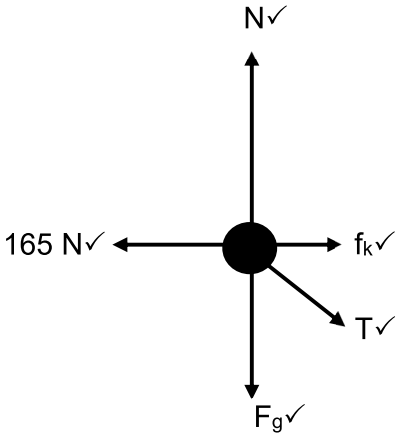
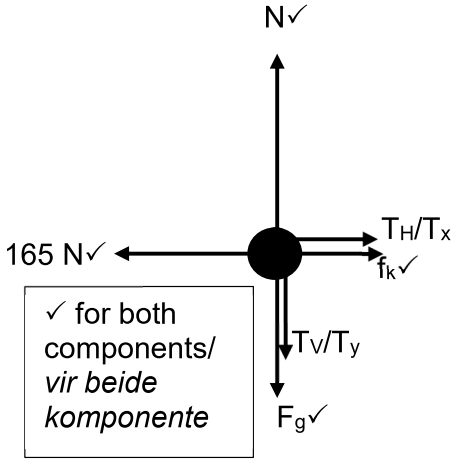
QUESTION 1/*VRAAG 1*

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

[20]

QUESTION 2/*VRAAG 2*

2.1

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

ACCEPTABLE LABELS/ *AANVAARBARE ETIKETTE*:	NOTES/ *AANTEKENINGE*:
N/F_N: Normal/*Normaal* F_g/w: Force due to gravity/weight/ *Krag weens swaartekrag/ gewig* F_A/165 N: Applied force/*Toegepaste krag* T/tension/*spanning*/F_T: Force in string/ *Krag in tou* f_k,f,F_f,f_w : kinetic friction/frictional force/ *kinetiese wrywing/ wrywingskrag*	ONE mark for each force represented by an arrow with a correct label. Penalise ONCE for each of the following:/*EEN punt vir elke krag wat deur 'n pyltjie met 'n korrekte byskrif aangedui word.* *Penaliseer EEN KEER vir elk van die volgende:* • No arrows/*Geen pyltjies* • There is no dot./*Daar is nie 'n kol nie.* • Gap between the line and the dot/*Gaping tussen die lyn en die kol* • Dotted lines are used./*Stippellyne word gebruik.* • A force diagram is given./ *'n Kragtediagram word gegee.*

(5)

2.2 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 netto/resulterende krag op 'n voorwerp met massa, m, toegepas word, versnel dit die voorwerp in die rigting van die netto krag. Die versnelling is direk eweredig aan die netto/resulterende krag en omgekeerd eweredig aan die massa van die voorwerp. (2)

2.3 For 220 kg block/*Vir 'n 220 kg-blok:*

$F_{net/netto}$ = ma ✓

$165 - T\cos 30° - 35$ ✓ = 220 × 0,4 ✓

T = 48,498 or 48,50 N ✓ **Accept/*Aanvaar:*** 48,28 N (4)

2.4 **POSITIVE MARKING FROM 2.3/*POSITIEWE NASIEN VANAF 2.3***

For a 75 kg block/*Vir 'n 75 kg-blok:*

$F_{net/netto}$ = ma

$T_H - f_k$ = ma ✓any one/*enige een*

$48,50 \cos 30° - f_k$ ✓ = (75)(0,4) ✓

f_k = 12 N

$f_k = \mu_k N$

$f_k = \mu_k (F_g - T\sin 30°)$ ✓ any one/*enige een*

12 ✓ $= \mu_k (735 - 24,25)$ ✓

μ_k = 0,02/0,017 ✓ (7)

2.5 Increases/*Toeneem*✓ (1)

NEGATIVE MARKING FROM 2.5/NEGATIEWE NASIEN VANAF 2.5

2.6 If the string joining the blocks is horizontal/*Indien die tou wat die twee blokke verbind, horisontaal is:*

- Magnitude of the normal force increases.✓/*Grootte van die normaalkrag neem toe.*
- Frictional force is directly proportional to the normal force.✓/*Wrywingskrag is direk eweredig aan die normaalkrag.* (2)

[21]

QUESTION 3/*VRAAG 3*

3.1.1 Total linear momentum of an isolated system✓ remains constant ✓ in magnitude and direction.
Totale lineêre momentum van 'n geïsoleerde/geslote stelsel bly konstant in grootte en rigting. (2)

3.1.2

$v_p = \frac{\Delta x}{\Delta t}$ ✓
$= \frac{0,05}{0,5}$ ✓
$= 0,1 \text{ m·s}^{-1}$ ✓

$v_Q = \frac{\Delta x}{\Delta t}$
$= \frac{0,1}{0,5}$ ✓
$= 0,2 \text{ m·s}^{-1}$ ✓ (5)

POSITIVE MARKING FROM 3.1.2/POSITIEWE NASIEN VANAF 3.1.2

3.1.3

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\Sigma p_{after/na} = mv_{fP} + mv_{fQ}$ ✓ $= 2m(-0,1) + m(0,2)$ ✓ $= 0 \text{ (kg·m·s}^{-1})$✓	$\Sigma p_{before/voor} = \Sigma p_{after/na}$ ✓ $0 = \underline{2m(-0,1) + m(0,2)}$ ✓ $= 0 \text{ (kg·m·s}^{-1})$✓

(3)

3.1.4 Conserved✓/*Behoue*
$\Sigma p_{before/voor} = \Sigma p_{after/na}$✓/The system is isolated/the surface is frictionless./ Total momentum (before) collision is equal to total momentum (after) collision.
Die stelsel is geïsoleerd/die oppervlak is wrywingloos. Totale momentum (voor) botsing is gelyk aand die totale momentum (na) botsing. (2)

3.2.1 Product of the net force and the time the net force acts on an object. ✓✓/ *Produk van die netto krag en die tyd wat die netto krag op die voorwerp inwerk.*

OR/*OF*

Impulse is equal to the change in momentum./*Impuls is gelyk aan die verandering in momentum*.

3.2.2

OPTION 1/*OPSIE 1* **DOWN AS - / *AFWAARTS AS -***	**OPTION 2/*OPSIE 2*** **DOWN AS + / *AFWAARTS AS +***
$F_{net/netto}\Delta t = \Delta p$✓ $F_{net/netto}(0,05)$✓ = 0,6✓ (10 –15)✓ $F_{net/netto}$ = 300 N, upwards✓	$F_{net/netto}\Delta t = \Delta p$✓ $F_{net/netto}(0,05)$✓= 0,6✓ (-10–15)✓ $F_{net/netto}$ = -300 N, $F_{net/netto}$ = 300 N, upwards✓/ *afwaarts* **Accept/Aanvaar:** $F_{net/netto} = ma$

OPTION 3/*OPSIE 3* DOWN AS - / *AFWAARTS AS -*	OPTION 4/OPSIE 4 DOWN AS + / *AFWAARTS AS +*
$a = \frac{\Delta v}{\Delta t}$ $= \frac{10-(-15)}{0,05}$ ✓✓ $= 500 m \cdot s^{-2}$ $F_{net} = ma$ ✓ $= 0,6$ ✓(500) = 300 N upwards ✓/*afwaarts*	$a = \frac{\Delta v}{\Delta t}$ $= \frac{-10-15}{0,05}$ ✓✓ $= -500 m \cdot s^{-2}$ $F_{net} = ma$ ✓ $= 0,6$ ✓ (-500) = -300 N = 300 N upwards ✓/*opwaarts*

(5)

3.3 Safety/seat belts✓/*Veiligheidsgordels*
Airbags✓/*Lugsakke*
Crumple zones✓/*Frommelsone* (Any correct answer/*Enige korrekte antwoord*) (3)
[22]

QUESTION 4/*VRAAG 4*

4.1 The product of the force applied on an object and the displacement in the direction of the force. ✓✓/
Die produk van die krag toegepas op 'n voorwerp en die verplasing in die rigting van die krag. (2)

4.2 $W = F\Delta x\cos\theta$
$= mg\Delta y\cos 0°$ } ✓ (Any one/*Enige een*)
$= (250)(9,8)(50)(1)$ ✓
$= 122\,500$ J ✓ (3)

POSITIVE MARKING FROM 4.2/*POSITIEWE NASIEN VANAF 4.2*

4.3

OPTION 1/*OPSIE 1*	OPTION 2/*OPSIE 2*
$P_{ave/gemid} = Fv_{ave/gemid}$ ✓ $= (250)(9.8)(25)$ ✓ $= 61\,250$ W ↓ $P_{ave/gemid} = \frac{61\,250}{746}$ ✓ = 82,1 hp ✓	$v = \frac{\Delta x}{\Delta t}$ $25 = \frac{50}{\Delta t}$ $\Delta t = 2s$ $P = \frac{W}{\Delta t}$ ✓ $P = \frac{122500}{2}$ ✓ $P = 61250$ W $P_{ave/gemid} = \frac{61\,250}{746}$ ✓ = 82,1 hp ✓

(4

4.4.1 The total mechanical energy of an isolated system✓ remains constant.✓/
Die totale meganiese energie van 'n geïsoleerde stelsel bly konstant.

OR/*OF*

The sum of the gravitational potential energy and kinetic energy in an isolated system remains constant./*Die som van die gravitasie-potensiële energie en kinetiese energie in 'n geïsoleerde stelsel bly konstant.* (2)

4.4.2 Greater than ✓✓ / *Groter as* (2)

NEGATIVE MARKING FROM 4.4.2/*NEGATIEWE NASIEN VANAF 4.4.2*

4. 4.3 Mechanical energy on the ground is zero. ✓✓/ *Meganiese energie op die grond is nul.* (2)

4.4.4 $M_{E\ top/bo} = M_{E\ bottom/onder}$

$(\frac{1}{2}mv_i^2 + mgh)_{top/bo} = (\frac{1}{2}mv_f^2 + mgh)_{bottom/onder}$ ✓any one/*enige een*

$\frac{1}{2}(250)(0)^2 + (250)(9,8)(50)$ ✓$= \frac{1}{2}(250)v_f^2 + (250)(9,8)(0)$ ✓

$v_f = 31,30\ m{\cdot}s^{-1}$ (downwards/*afwaarts*) ✓ (4)

[19]

QUESTION 5/*VRAAG 5*

5.1.1

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\frac{F_1}{A_1} = \frac{F_2}{A_2}$ ✓ $\frac{1000}{1,96\times10^{-3}}$ ✓ $= \frac{F_2}{4,91\times10^{-2}}$ ✓ $F_2 = 25\,051,02$ N✓	$P = \frac{F}{A}$ ✓ $= \frac{1000}{1,96\times10^{-3}}$ ✓ $= 510204,08$ Pa $P = \frac{F}{A}$ $510204,08 = \frac{F}{4,91\times10^{-2}}$ ✓ $F = 25\,051,02$ N✓

(4)

POSITIVE MARKING FROM 5.1.1/POSITIEWE NASIEN VANAF 5.1.1

5.1.2 Yes✓/*Ja*
The magnitude of the output force **F_2** (25 051,02 N) is greater/more than that of the required force of (20 kN). ✓/*Die grootte van die uitsetkrag* **F_2** (25 051,02 N) *is groter as dié van die vereiste krag van (*20 kN*).*

OR/*OF*
20 kN < 25051,02 N (2)

5.2.1 Stress is the internal restoring force per unit area of a body.✓✓/
Druk (Spanning) is die interne herstelkrag per eenheidsarea van 'n liggaam. (2)

5.2.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\text{Area} = \frac{\pi d^2}{4}$ $= \frac{\pi(0,03)^2}{4}$ ✓ $= 706,85 \times 10^{-6}\ m^2$ $\sigma = \frac{F}{A}$ ✓ $\sigma = \frac{4 \times 10^3}{706,85 \times 10^{-6}}$ ✓ $\sigma = 5,66 \times 10^6$ Pa ✓	$\sigma = \frac{F}{A}$ ✓ $= \frac{F}{\frac{\pi d^2}{4}}$ $\sigma = \frac{4 \times 10^3}{\frac{\pi(0,03)^2}{4}}$ ✓ ✓ $\sigma = 5,66 \times 10^6$ Pa✓

OPTION 3/*OPSIE 3*	**OPTION 4/*OPSIE 4***
$\text{Area} = \pi r^2$ $\text{Area} = \pi(0,015)^2$✓ $= 706,86 \times 10^{-6}\ m^2$ $\sigma = \frac{F}{A}$ ✓ $= \frac{4 \times 10^3}{706,86 \times 10^{-6}}$ ✓ $\sigma = 5,66 \times 10^6$ Pa✓	$\sigma = \frac{F}{A}$ ✓ $\sigma = \frac{4 \times 10^3}{\pi(0,015)^2}$✓ ✓ $\sigma = 5,66 \times 10^6$ Pa✓ Range/*Reeks:* (5657708,63 – 5658842,421)

(4)

5.2.3

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\varepsilon = \frac{\Delta l}{L}$ ✓ $= \frac{0188-0,2}{0,2}$ ✓ $=-0,06$✓	$\varepsilon = \frac{\Delta l}{L}$ ✓ $= \frac{188-200}{0,2}$ ✓ $=-0,06$✓

(3)

5.2.4 **POSITIVE MARKING FROM 5.2.2 to 5.2.3/*POSITIEWE NASIEN VANAF 5.2.2 tot 5.2.3***

$K = \frac{\sigma}{\varepsilon}$ ✓

$= \frac{5,66 \times 10^6}{0,06}$ ✓

$= 9,43 \times 10^7$ Pa ✓ (3)

5.3 Monograde oil is only suitable for use within a very narrow temperature range. ✓✓/ Monograde oil has one viscosity at all temperatures /*Monograad-olie is slegs geskik vir gebruik in 'n baie beperkte temperatuuromvang. Monograad-olie het een viskositeit by alle temperature.* (2)

[20]

QUESTION 6/*VRAAG 6*

6.1.1 Reflection✓/*Weerkaatsing* (1)

6.1.2 θ_1 is equal to θ_2 ✓/θ_1 *is gelyk aan* θ_2 (1)

6.1.3
- The image is of the same size as the object.✓/*Die beeld is dieselfde grootte as die voorwerp.*
- It is formed at the same distance from the mirror as the object.✓/*Dit word gevorm op dieselfde afstand vanaf die voorwerp.*
- It is laterally inverted./*Dit is lateraal (sydelings) omgekeerd.*
- Virtual/*Virtueel*
- The image is upright./*Die beeld is regop.*

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

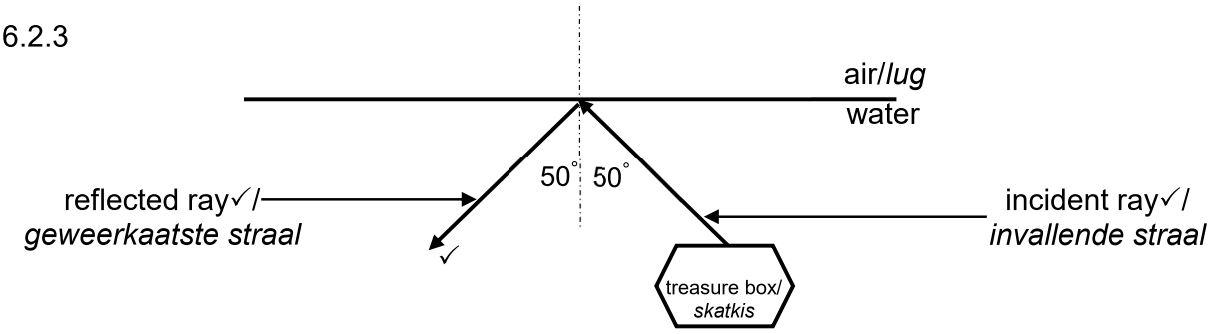
6.2.1
- The wavelength increases/the speed of light increases.✓/*Die golflengte neem toe/die spoed van lig neem toe.*
- The light ray bends away from the normal/*Angle of refraction is greater than the angle of incidence.*✓/*Die ligstaal buig weg vanaf die normaal/ Brekingshoek is groter as die invalshoek.* (2)

6.2.2 The light ray would be reflected back into the water.✓/*Die ligstraal sal terug in die water weerkaats (gereflekteer) word.* (1)

OR/*OF*

Total internal reflection/Totale interne weerkaatsing

6.2.3



MARKING CRITERIA/*NASIENKRITERIA*	
Correct label of reflected ray/Korrekte byskrif van *geweerkaatste straal*	✓
Correct direction of the reflected ray/*Korrekte rigting van die geweerkaatste straal*	✓
Incident ray correctly labeled/Korrekte byskrif van invallende straal	✓

(3)

[10]

QUESTION 7/*VRAAG 7*

7.1.1 Gamma ray✓/*Gammastraal* (1)

7.1.2
- Highest frequency/shortest wavelength✓/*Hoogste frekwensie/kortste golflengte*
- Highest energy of the photons/*Hoogste energie van die fotone*
- Highest penetrating ability/*Hoogste deurdringvermoë* (Any one/*Enige een*) (1)

7.1.3

OPTION 1/*OPSIE 1*	OPTION 2/*OPSIE 2*
$E_{photon/foton} = \frac{hc}{\lambda}$ ✓ $= \frac{(6,63\times10^{-34})(3\times10^{8})}{5\times10^{-12}}$ ✓ $=3,978 \times 10^{-14}$ J ✓	$c=f\lambda$ $3 \times 10^{8} = f(5 \times 10^{-12})$ $f = 6 \times 10^{19}$ $E = hf$ ✓ $= 6,63 \times 10^{-34} .6 \times 10^{19}$ ✓ $=3,978 \times 10^{-14}$ J ✓

(3)

7.2.1 Convex/Converging (lens)✓/*Konvekse/Konvergerende (lens)* (1)

7.2.2 Virtual✓/*Virtueel* (1)

7.2.3 **NEGATIVE MARKING FROM 7.2.2/*NEGATIEWE NASIEN VANAF 7.2.2***
The image is formed at a point where the refracted rays appear to converge✓ when extended✓./*Die beeld word gevorm by 'n punt waar die gebreekte strale lyk asof dit konvergeer wanneer dit verleng word.* (2)

7.3 Cameras✓/*Kameras*
Telescopes/*Teleskope*
Binoculars/*Verkykers*
Corrective lenses for Hypermetropia Long sighted/Farsightedness/*Regstellende lense vir Hipermetropie/versiendheid* (1)
Magnifying glass/*Vergrootglas*
Projector/*Projektor*
Periscope/*Periskoop*
(Any ONE correct answer/*Enige EEN korrekte antwoord*)

[10]

QUESTION 8/*VRAAG 8*

8.1

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

$$= \frac{(8{,}85\times10^{-12})(1\times10^{-2})}{3\times10^{-3}} \checkmark$$

$$= 2{,}95\times10^{-11}\ \text{F}$$

$$C = \frac{Q}{V} \checkmark$$

$$2{,}95\times10^{-11} = \frac{7{,}08\times10^{-9}}{V} \checkmark$$

$$V = 240\ \text{V} \checkmark$$

(5)

8.2
- Filter circuits in power supplies/Tunning circuits✓/*Filtreerstroombane in kragtoevoere*
- Smoothing circuits✓/Afvlakkingstroombane
- Separation of frequencies between the woofer and tweeter✓/*Verdeling van frekwensies tussen die basluidspreker en diskantluidspreker*
- Power factor correction/improvement in electrical transmission systems✓/*Arbeidsfaktorregstelling/verbetering in elektriese transmissiestelsels*
- Energy storage/*Energieberging*
- Remote sensing/*Afstandswaarneming*
- Signal coupling and decoupling/Seinkoppeling en ontkoppeling
- Electronic noise filtering/Elektronies geraasfiltrering
- Emergency shutdown for computers/Noodafskakeling van rekenaars
- Starting capacitors in motors/Aanskakeling van kapasitors in motors

(Any correct THREE/*Enige korrekte DRIE*) (3)

[8]

QUESTION 9/*VRAAG 9*

9.1 When 220 V is applied to the machine, 5,3 kJ of energy is consumed every second (to convert electrical energy into light and heat energy).✓✓/*Wanneer* 220 V *op die masjien toegepas word, word* 5,3 kJ *energie elke sekonde verbruik (om elektriese energie in lig- en hitte-energie om te skakel).*

OR/*OF*

The electric welding machine has a resistance that allows a current of 24,3 A to give a power consumption of 5,3 kW./*Die elektriese sweismasjien het 'n weerstand wat 'n stroom van* 24,3 A *toelaat om 'n kragverbruik van* 5,3 kW *te gee.* (2)

9.2.1

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$P = I^2R$✓ $5{,}3\times10^3 = 24{,}3^2(R)$ ✓ $R = 8{,}98\ \Omega$✓	$P = \frac{V^2}{R}$ ✓ $5{,}3\times10^3 = \frac{(218{,}11)^2}{R}$ ✓ $R = 8{,}98\ \Omega$✓
OPTION 3/*OPSIE 3*	
$R = \frac{V}{I}$ ✓ $= \frac{218{,}11}{24{,}3}$ ✓ $= 8{,}98\ \Omega$✓	

(3)

9.2.2 **POSITIVE MARKING FROM 9.2.1/*POSITIEWE NASIEN VANAF* 9.2.1**

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$P = \frac{W}{\Delta t}$ ✓ $5{,}3\times10^3 = \frac{W}{30\times60}$ ✓ $W = 9\ 540\ 000$ J ✓	$W = \frac{V^2}{R}\Delta t$ ✓ $= \frac{(218{,}11)^2}{8{,}98}(30\times60)$ ✓ $= 9{,}54\times10^6$ J✓
OPTION 3/*OPSIE 3*	**OPTION 4/*OPSIE 4***
$W = I^2R\Delta t$ ✓ $= (24{,}3^2)(8{,}98)(30\times60)$ ✓ $= 9{,}54\times10^6$ J✓	$W = VI\Delta t$ ✓ $= (218{,}11)(24{,}3)(30\times60)$✓ $= 9{,}54\times10^6$ J✓

(3)

9.2.3

OPTION 1/*OPSIE 1*	OPTION 2/*OPSIE 2*
Cost/*Koste* = P×Δt×tariff/*tarief* = (5,3) ✓ (0,5)(0,75)✓ = R1,99✓	Cost/Koste= E.Tarifs/*Tarief* $= \frac{9540000}{3600000} \times R0,75$ ✓ ✓ =R 1,99 ✓

(3)
[11]

QUESTION 10/*VRAAG 10*

10.1 A device that converts mechanical energy into electrical energy✓✓/*'n Toestel wat meganiese energie in elektriese energie omskakel* (2)

10.2 AC/*WS* (generator) ✓ (1)

10.3 AC generators have slip rings.✓/*WS-generators het sleepringe.* (1)

10.4.1 The number of turns in the secondary coil is greater than the number of turns in the primary coil.✓✓ /*Die aantal windings in die sekondêre spoel is groter as die aantal windings in die primêre spoel.*

OR/*OF*

The number of turns in the primary coil is less than the number of turns in the secondary coil./ *Die aantal windings in die primêre spoel is minder as die aantal windings in die sekondêre spoel.* (2)

10.4.2 $\frac{V_S}{V_P} = \frac{N_S}{N_P}$ ✓

$\frac{V_S}{120} = \frac{80}{40}$ ✓

$V_S = 240\,V$ ✓

(3)
[9]

TOTAL/*TOTAAL*: 150