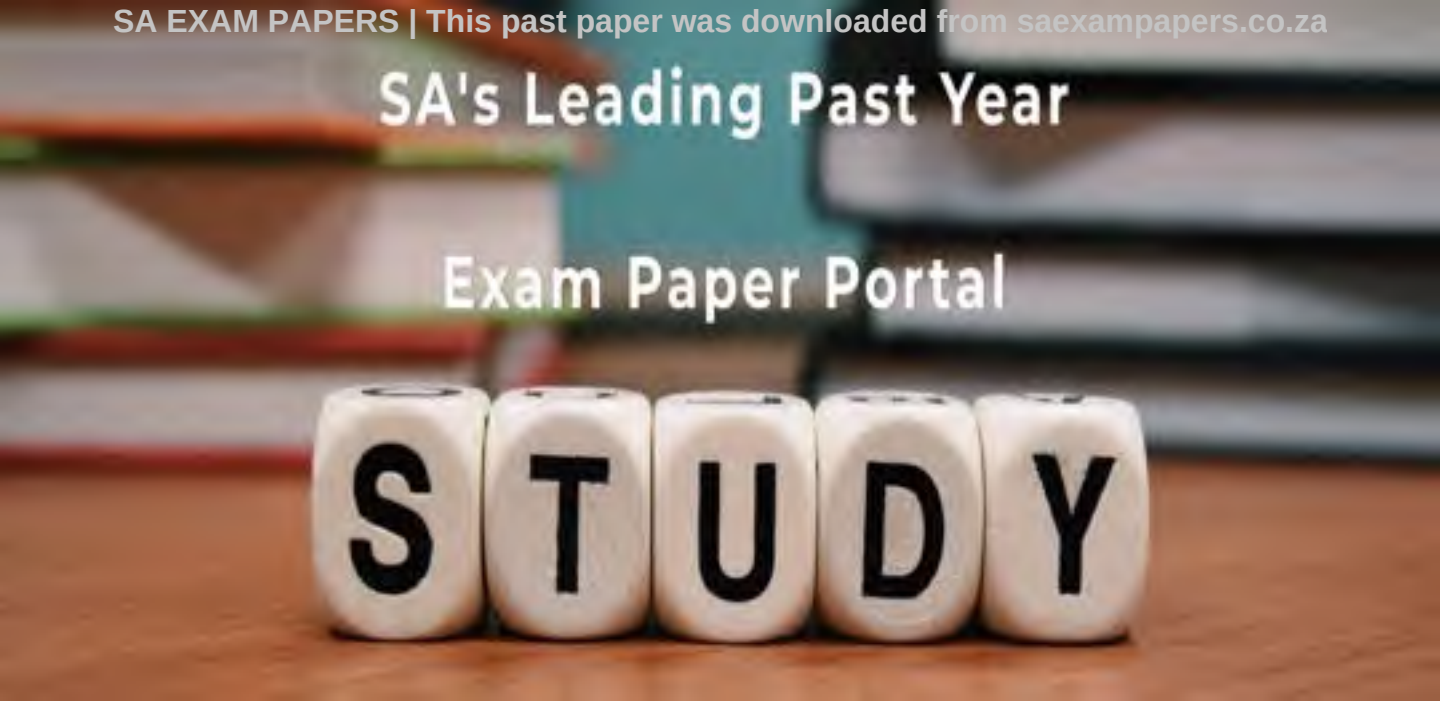


basic education

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* 2024

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

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

DBE: IM	DBE: IM	UMALUSI: EM	UMALUSI: EM
19/05/2024	19/05/2024	19/05/2024	19/05/2024

Please turn over/*Blaai om asseblief*

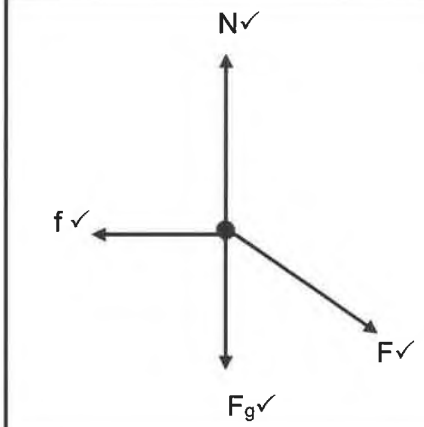
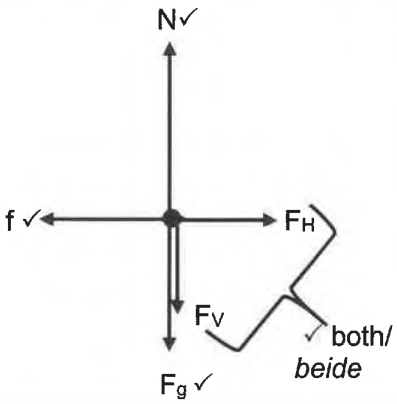
QUESTION 1/*VRAAG 1*

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

[20]

QUESTION 2/*VRAAG 2*

2.1

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

(4)

ACCEPTABLE LABELS/ *AANVAARBARE BYSKRIFTE*:	**NOTES/*NOTAS*:**
N/F_N: Normal/*Normaal* F_g: w / Force due to gravity/weight/ *Gravitasiekrag/Gewig* F_A: Applied force/*193,19 N / Toegepaste krag* *f*: fk/f_f/kinetic friction/frictional force/ *kinetiese wrywing/wrywingskrag*	One mark for each force represented by an arrow with a correct label./*Een punt vir elke krag voorgestel deur 'n pyl met korrekte byskrif.* Penalise ONCE for each of the following/*Penaliseer EEN KEER vir elk van die volgende:* • No arrows/*Geen pyltjies* • There is no dot/*Geen kol nie* • Gap between the line and the dot/*Spasie tussen lyn en kol* • Dotted lines are used/*Stippellyne gebruik* • A force diagram is given/ *'n Kragtediagram word gegee* • Any additional force/*Enige addisionele krag*

2.2 An object continues in a state of rest or uniform (moving with a constant) velocity✓ unless it is acted upon by a net/resultant/unbalanced force. ✓/*'n Voorwerp gaan voort in 'n toestand van rus of eenvormige (beweeg teen 'n konstante) snelheid tensy 'n netto/resulterende/ongebalanseerde krag daarop inwerk*

Accept: An object continues in a state of rest or uniform linear motion (moving with a constant velocity) ✓ unless it is acted upon by an external net/resultant/unbalanced force. ✓
Aanvaar: *'n Voorwerp gaan voort in 'n toestand van rus of eenvormige lineêre (beweeg teen 'n konstante snelheid) tensy 'n eksterne netto/resulterende/ ongebalanseerde krag daarop inwerk.* (2)

2.3 0/Zero/*Nul* ✓
$F_{net} = ma$ ✓
$= m(0)$ ✓
$= 0(N)$ (3)

2.4.1 $F_y = F\sin\Theta$
$= 193{,}19 \sin 20°$ ✓
$= 66{,}07$ N ✓ (2)

2.4.2 **POSITIVE MARKING FROM QUESTION 2.4.1**
POSITIEWE NASIEN VANAF VRAAG 2.4.1

OPTION 1 UP AS POSITIVE *OPSIE 1 OP AS POSITIEF*	**OPTION 2 DOWN AS POSITIVE** *OPSIE 2 AF AS POSITIEF*
$N + F_g + F_v = 0$ / $N + mg + F\sin\Theta = 0$ ✓ Any one *Enige een*	$N + F_g + F_v = 0$ / $N + mg + F\sin\Theta = 0$ ✓ Any one/ *Enige een*
$N - (55 \times 9{,}8) - 66{,}07$ N = 0 ✓	$N + (55 \times 9{,}8) + 66{,}07$ N = 0 ✓
N = + 605,07 N	N = - 605,07 N
N = 605,07 N ✓	N = 605,07 N ✓

(3)

2.4.3 **POSITIVE MARKING FROM QUESTION 2.4.2**
POSITIEWE NASIEN VANAF VRAAG 2.4.2
$f_k = \mu_k N$ ✓
$= 0{,}3 \times 605{,}07$ ✓
$= 181{,}521$ N ✓ (3)

2.5 There are only two forces acting on the vertical plane. ✓/ The vertical component is now equal to zero.
The normal force will be equal to the weight. ✓
Daar is slegs twee kragte wat op die vertikale vlak inwerk./Die vertikale komponent is nou gelyk aan nul.
Die normaalkrag sal gelyk aan die gewig wees.

Accept/*Aanvaar:*
$F_y = 0$ ✓
$\therefore F_g = N$ ✓ (2)
[19]

QUESTION 3/*VRAAG 3*

3.1 The product of the object's mass and its velocity. ✓✓
Die produk van die voorwerp se massa en die snelheid daarvan. (2)

3.2 (Average) net/resultant force ✓/*(Gemiddelde) netto krag* (1)

3.3.1 $F_{net}\Delta t = \Delta p$
Impulse = Δp
$F_{net}\Delta t = mv_f - mv_i$ ✓ Any one/ *Enige een*
$= 120 - (-40)$ ✓
$= 160$ N·s ✓ left/*links* ✓ (4)

3.3.2 **POSITIVE MARKING FROM QUESTION 3.3.1**
POSITIEWE NASIEN VANAF VRAAG 3.3.1

$F_{net}\Delta t = \Delta p$ ✓
$F_{net}(20)$ ✓ $= 160$✓
F_{net} = 8 N left ✓/*links* (4)

3.4.1

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\sum p_i = \sum p_f$ ✓ $p_{i(X)} + p_{i(Y)} = p_{f(X)} + p_{fY)}$ $(+120)$ ✓ + (-50) ✓ = (-40) ✓+ $p_{f(Y)}$ $p_{f(Y)}$ = 110 kg·m·s^{-1} $p_{f(Y)}$ = 110 kg·m·s^{-1} left/*links* ✓	$\Delta p_X = mv_f - mv_i$ ✓ $= (-40) - (+120)$ ✓ $= -160$ kg·m·s^{-1} $\Delta p_{(Y)} = -\Delta p_{(X)}$ $p_f - (-50)$ ✓$= 160$ ✓ $p_{f(X)}$ = 110 kg·m·s^{-1} left/*links* ✓

(5)

3.4.2 Total linear momentum of an isolated system ✓ remains constant/ conserved✓(in magnitude and direction).
Totale lineêre momentum van 'n geïsoleerde sisteem bly konstant/bly behoue (in grootte en rigting). (2)
[18]

QUESTION 4/*VRAAG 4*

4.1.1

ACCEPTABLE LABELS/ *AANVAARBARE BYSKRIFTE*:	**NOTES/*NOTAS*:**
F_g/w: Force due to gravity/weight/ *Gravitasiekrag/Gewig* F_{pump}/F_A: Applied force/ *Toegepaste krag*	One mark for each force represented by an arrow with a correct label./*Een punt vir elke krag voorgestel deur 'n pyl met korrekte byskrif.* Penalise ONCE for each of the following/ *Penaliseer EEN KEER vir elk van die volgende*: • No arrows/*Geen pyltjies* • There is no dot/*Geen kol nie* • Gap between the line and the dot/*Spasie tussen lyn en kol* • Dotted lines are used/*Stippellyne gebruik* • A force diagram is given/ • *'n Kragtediagram word gegee* • Additional force/*Addisionele krag*

(2)

4.1.2 $F_{pump/\,pomp} = F_g$ ✓
$= mg$ ✓ Any one / *Enige een*
$= 850 \times 9{,}8$ ✓
$= 8\,330$ N upwards/*opwaarts* ✓

(3)

4.1.3 **POSITIVE MARKING FROM QUESTION 4.1.2**
POSITIEWE NASIEN VANAF VRAAG 4.1.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$P_{ave} = Fv_{ave}$ ✓ $7200 = 8330\ v_{ave}$ ✓ v_{ave} = 0,86 m·s^{-1} upwards/ *opwaarts*✓	$P=\frac{w}{\Delta t}$ $=\frac{F\Delta x\cos\theta}{\Delta t}$ $7\ 200 = \frac{8330 \times 12{,}5\cos 0\ °}{\Delta t}$ Δt = 14,55 s ✓ $v = \frac{\Delta x}{\Delta t}$ $v = \frac{12{,}53}{14{,}55}$ ✓ v = 0,86 m·s^{-1} upwards/*opwaarts*✓

(3)

4.2.1 The total mechanical energy of an isolated system ✓remains constant/conserved. ✓
Die totale meganiese energie van 'n geïsoleerde sisteem bly konstant.
OR/*OF*
The sum of gravitational and kinetic energy of an isolated system remains constant
Die som van die gravitasie- potensiële energie en die kinetiese energie van 'n geïsoleerde sisteem bly konstant. (2)

4.2.2 0 (J)/ Zero/*Nul* ✓ (1)

4.2.3 The direction of displacement is perpendicular to the direction of the gravitational force. ✓
Die rigting van verplasing is loodreg op die rigting van die gravitasiekrag.

$W_{F_g} = F_g \Delta x \cos 90°$ ✓ (2)

4.3.1 $E_P = mgh$ ✓
$= 274 \times 9{,}8 \times 12{,}58$ ✓
$= 33779{,}82$ J ✓ (3)

4.3.2 **POSITIVE MARKING FROM QUESTION 4.1.3 and 4.3.1**
POSITIEWE NASIEN VANAF VRAAG 4.1.3 and 4.3.1
$M_E = E_p + E_k$✓
$= 33779{,}822$ ✓ $+ \frac{1}{2}(274)\ (0{,}86)^2$ ✓
$= 33881{,}15$ J✓
Range/*Reeks*: 33 881,14 J – 33 881,15 J (4)
[20]

QUESTION 5/*VRAAG 5*

5.1 Within the limit of elasticity, stress is directly proportional to the strain✓✓
Binne die limiet van elastisiteit is druk (spanning) direk eweredig aan die rekking (vervorming) (2)

5.2
$$K = \frac{\sigma}{\varepsilon} \checkmark$$
$$= \frac{5{,}5 \times 10^{6}}{2{,}75 \times 10^{-4}} \checkmark$$
$$= 2 \times 10^{10} \text{Pa} \checkmark$$

The most appropriate material would be wood. ✓
Die geskikste materiaal is hout. (4)

5.3
$$\varepsilon = \frac{\Delta \ell}{L} \checkmark$$
$$2{,}75 \times 10^{-4} \checkmark = \frac{\Delta \ell}{1{,}15} \checkmark$$
$$\Delta \ell = 3{,}16 \times 10^{-4} \text{ m} \checkmark$$ (4)

5.4.1 A normal force exerted by a liquid at rest on a surface that is in contact with it. ✓✓
'n Normaalkrag wat deur 'n vloeistof wat in rus is, uitgeoefen word op 'n oppervlak wat daarmee in kontak is. (2)

5.4.2 In a continuous liquid at rest, the pressure applied at any point is transmitted equally to other parts of the liquid. ✓✓
In 'n kontinue vloeistof in rus word die druk wat op enige punt toegepas word, gelyk oorgedra aan ander dele van die vloeistof. (2)

5.4.3

OPTION 1/*OPSIE 1*	OPTION 2/*OPSIE 2*
$A_2 = \pi \frac{D^2}{4}$ ✓ $= 3{,}14 \frac{(24 \times 10^{-2})^2}{4}$ ✓ $= 0{,}0452 \text{ m}^2$ ✓	$A_2 = \pi r^2$ ✓ $= 3{,}14 (12 \times 10^{-2})^2$ ✓ $= 0{,}0452 \text{ m}^2$ ✓

(3)

 Please turn over/*Blaai om asseblief*

5.4.4 **POSITIVE MARKING FROM QUESTION 5.4.3**
POSITIEWE NASIEN VANAF VRAAG 5.4.3

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\frac{F_1}{A_1} = \frac{F_2}{A_2}$ ✓ $\frac{5}{\pi(6\times10^{-2})^2} = \frac{F_2}{0,0452}$ ✓ $F_2 = 19,99\,N$ ✓	$P_1 = F_1A_1$ $P_1 = \frac{5}{\pi(6\times10^{-2})}$ $P_1 = P_2$ $P_2 = \frac{F_2}{A_2}$ Any one ✓ *Enige een* $442,097 = \frac{F_2}{0,0452}$ $F_2 = 19,98\,N$ ✓ **Range/Reeks**: 19,89 N -20,45 N

(3)
[20]

QUESTION 6/*VRAAG 6*

6.1 Plane/flat mirror ✓/*Vlakspieël/plat spieël*
The incident ray and the reflected ray are on the same plane. ✓✓
Die invallende straal en die weerkaatste straal is op dieselfde vlak.
OR/*OF*
The angle of incidence is equal to the angle of reflection.
Die invalshoek is gelyk aan die weerkaatsingshoek. (3)

6.2.1 The angle between the normal and the incident ray. ✓✓
Die hoek tussen die normaal en die invallende straal. (2)

6.2.2 Equal to ✓/*Gelyk aan* (1)

6.3.1 Refraction ✓ and dispersion. ✓/*Refraksie/Ligbreking en dispersie* (2)

6.3.2 The components of white light have <u>different wavelengths/frequencies</u>✓ and are therefore <u>refracted differently.</u>✓
Die komponente van wit lig het <u>verskillende golflengtes/frekwensies</u> en word dus <u>verskillend gebreek</u>. (2)

6.4.1 The angle of incidence in the more optically dense medium ✓ for which angle of refraction in the less optically dense medium is 90°. ✓
Die invalshoek in die meer optiese digte medium waarvoor die invalshoek in die minder optiese digte medium 90° is.

OR/*OF*

The angle of incidence in the denser medium such that the refracted ray just passes through the surface of separation of the two media.
Die invalshoek in die digter medium is sodanig dat die weerkaatste straal beweeg op die skeidingsvlak tussen die twee mediums. (2)

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

6.4.3 Used in endoscope ✓/*Gebruik in endoskoop*
Used in telescope/*Gebruik in teleskoop*
Binoculars/*Verkyker*
Periscope/*periskoop*
Fibre Optic/optiese vesel(kabel)
Any other correct answer
Enige korrekte antwoord (1)
[14]

QUESTION 7/*VRAAG 7*

7.1.1 Ultraviolet waves ✓/*Ultraviolet golwe* (1)

7.1.2 Security checks at the airports ✓/*Sekuriteitbeheer op lughawens*
Food warmers/*Voedselverwarmers*
Use in remote controls/*Gebruik in afstandbeheerapparate*
Used in night vision cameras/*Gebruik in nagvisiekameras*
Heaters/*Verwarmers*
Any other correct answer
Enige korrekte antwoord (1)

7.2 It has higher frequency/higher penetrating abilities. ✓
Over exposure to this radiation would cause damage to the human body. ✓
Dit het 'n hoër frekwensie en hoër deurdringingsvermoë.
Te veel blootstelling aan hierdie straling skadelik vir die menslike liggaam wees. (2)

7.3 $E = hf$ ✓
$= (6{,}63 \times 10^{-34})(2{,}3 \times 10^{14})$ ✓
$= 1{,}52 \times 10^{-19}$ J✓ (3)
[7]

QUESTION 8/*VRAAG 8*

8.1 Capacitance is the amount of charge it can store per volt. ✓✓
Kapasitansie is die hoeveelheid lading wat dit per volt kan stoor. (2)

8.2
- Distance between the plates ✓/*Afstand tussen die plate*
- Type of dielectric material ✓/*Tipe diëlektriese materiaal*
- Area of the plates ✓/*Oppervlak van die plate* (3)

8.3

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

$$= \frac{(8{,}85 \times 10^{-12})(2 \times 10^{-4})}{2 \times 10^{-3}} \checkmark$$

$$= 8{,}85 \times 10^{-13}\,F$$

Any one/ *Enige een* ✓

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

✓

$$8{,}85 \times 10^{-13} = \frac{4{,}5 \times 10^{-11}}{V} \checkmark$$

$$V = 50{,}85\ V \checkmark$$

(5)
[10]

QUESTION 9/*VRAAG 9*

9.1 The loss of electrical energy as heat through the transmission lines is reduced ✓✓
Die verlies aan elektriese energie as hitte deur die transmissielyne verminder word. (2)

9.2 Step-down transformer ✓/*Verlagingstransformator*
Voltage must be decreased before it is transmitted into the homes for consumption ✓
Spanning moet verlaag voordat dit vir verbruik na huise oorgedra word. (2)

9.3

$$\frac{V_s}{V_p} = \frac{N_s}{N_p} \checkmark$$

$$\frac{V_s}{6\,200} = \frac{4\,900}{9\,000} \checkmark$$

$$V_s = 3\,375{,}56\ V \checkmark$$

(3)

9.4

$$P = \frac{V^2}{R} \checkmark$$

$$= \frac{6200^2}{560} \checkmark$$

$$= 68642{,}86\ W \checkmark$$

(3)
[10]

QUESTION 10/*VRAAG 10*

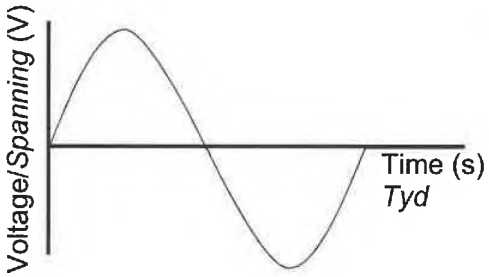
10.1 Electric machine that converts electrical energy into mechanical energy. ✓✓
Elektriese masjien wat elektriese energie na meganiese energie omskakel. (2)

10.2 Armature/coil. ✓/*Anker/Spoel* (1)

10.3.1 A current carrying component **1** in the presence of the magnetic field experiences a force. ✓
*'n Stroom wat komponent **1** in die teenwoordigheid van die magnetiese veld dra, ondervind 'n krag.* (1)

10.3.2 Anticlockwise ✓/*Antikloksgewys* (1)

10.4



Marking Criteria/*Nasienkriteria*	
Correct shape/*Korrekte vorm*	✓
One full cycle/*Een volle siklus*	✓

(2)

10.5.1 When the magnetic flux linked with the coil changes, an emf is induced in the coil.✓ The magnitude of the induced emf is directly proportional to the rate of change in magnetic flux ✓
Wanneer die magnetiese vloed wat met die spoel verbind is verander, word 'n emk in die spoel geïnduseer. Die grootte van die geïnduseerde emk is direk eweredig aan die tempo van verandering in magnetiese vloed. (2)

10.5.2 $$\varepsilon = -N\frac{\Delta\varphi}{\Delta t} \checkmark$$
$$= -300\frac{(3{,}21\times10^{4})-(5\times10^{4})}{0{,}3}\checkmark$$
$$= 17900000\ \text{V} \quad \checkmark$$

(3)
[12]

TOTAL/*TOTAAL*: 150