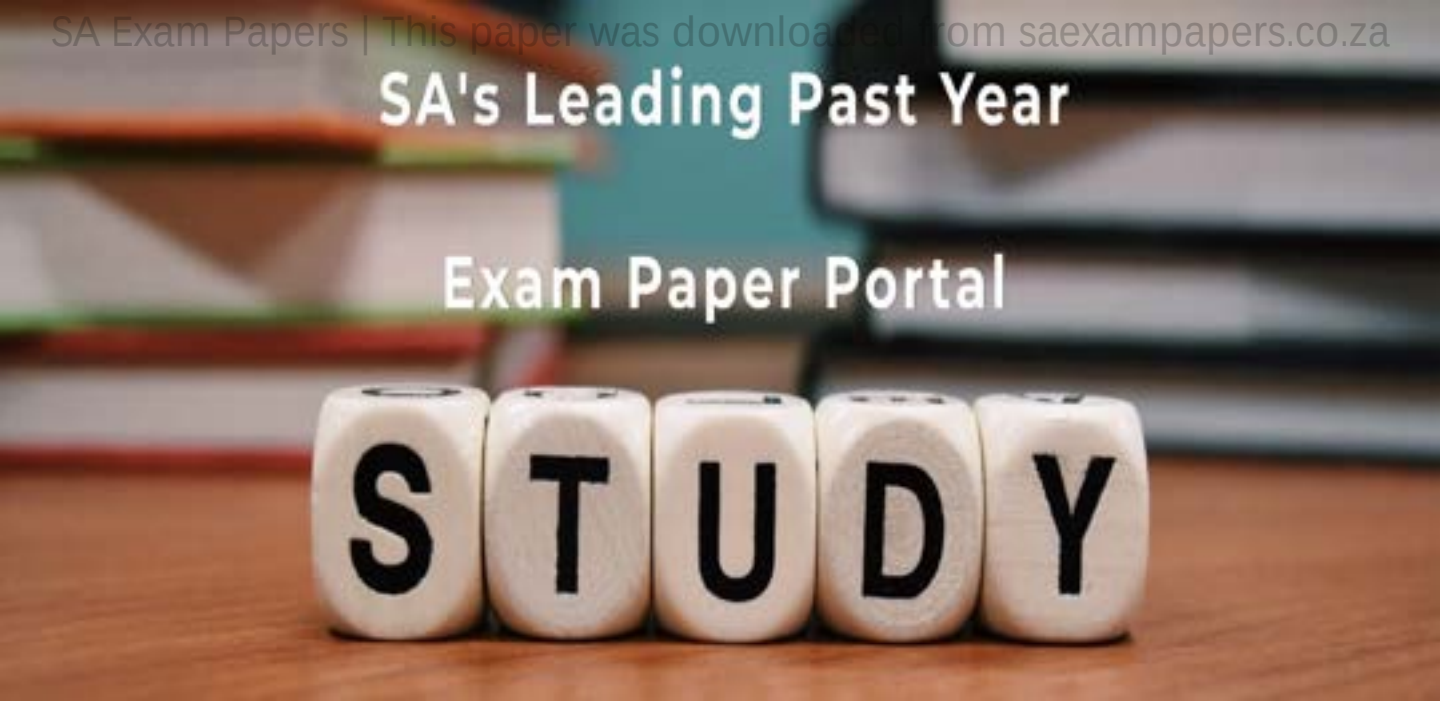

Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIORSERTIFIKAAT*

GRADE/*GRAAD* 12

SEPTEMBER 2023

TECHNICAL SCIENCES P1/ *TEGNIESE WETENSKAPPE V1* MARKING GUIDELINE/*NASIENRIGLYN*

MARKS/*PUNTE*: **150**

This marking guideline consists of 11 pages./
Hierdie nasienriglyn bestaan uit 11 bladsye.

QUESTION/*VRAAG* 1

1.1	C ✓✓	(2)
1.2	B ✓✓	(2)
1.3	B ✓✓	(2)
1.4	A ✓✓	(2)
1.5	D ✓✓	(2)
1.6	C ✓✓	(2)
1.7	D ✓✓	(2)
1.8	B ✓✓	(2)
1.9	A ✓✓	(2)
1.10	B ✓✓	(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 krag. Die versnelling is direk eweredig aan die resulterende/netto krag en omgekeerd eweredig aan die massa van die voorwerp. (2)

2.2

Marking criteria	Labels	Marks
Correct direction and label of normal force *Regte rigting en benoeming van normale krag*	N/F_N	1
Correct direction and label of the weight *Regte rigting en benoeming van gewig*	Fg/w	1
Correct direction and label of horizontal and vertical component of the applied force OR Correct direction and label of applied force *Korrekte rigting en benoeming van horisontale en vertikale component van die toegepaste krag OF* *Korrekte rigting en benoeming van toegepaste krag*	F/F_a	1
Correct direction and label of frictional force *Korrekte rigting en benoeming van wrywingskrag*	*f*/f_k/F_f	1
Correct direction and label of the tension *Korrekte rigting en benoeming van die spanning*	T	1

(5)

2.3 $F_{net_\perp} = 0$ } Any one/
$F_{net_\perp} = F_g - N - F_{A\perp}$ } *Enige een* ✓
0 ✓$= 3(9{,}8) - N - 25sin30°$ ✓
$N = 16{,}9\ N$ upwards/*opwaarts* ✓ (4)

2.4 Kinetic frictional force/*Kinetiese wrywingskrag* ✓ (1)

2.5 **Apply positive marking from QUESTION 2.3**
Positiewe nasien vanaf VRAAG 2.3

$F_{net} = ma$
$F_{A\parallel} - T - f = ma$ ✓Enige een
$25cos30° - T - 3{,}38 = 3a$ ✓
$T = 18{,}27 - 3a$ .....(1)

Any one

$F_{net} = ma$
$T - f = ma$
$T - 0{,}8 = (1)a$ ✓
$T = 0{,}8 + a$ .....(2)

Any one
Enige een ✓

(1) into (2)
$18{,}27 - 3a = 0{,}8 + a$
$4a = 17{,}47$
$a = 4{,}37\ m.s^{-2}$ to the right/*na regs* ✓ (5)

2.6 Tension/spanning (1)

2.7 INCREASE ✓
Decreasing the y/perpendicular component increases the normal force **OR** the normal force is directly proportional to the frictional force. ✓✓

VERHOOG
Vermindering van die y/loodregte komponent verhoog die normaalkrag ***OF*** die normaalkrag is direk eweredig aan die wrywingskrag. (3)
[21]

QUESTION/*VRAAG* 3

3.1 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)

3.2 **OPTION 1 Right + / OPSIE 1 Regs +**

$\sum p_{before} = \sum p_{after}$
$m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$

Any one/
Enige een ✓

$(12\,000)(20) + (2\,000)(0)$ ✓$= (12\,000 + 2\,000)v_f$ ✓
$v_f = 17{,}14\ m \cdot s^{-1}$ ✓
$v = 17{,}14\ m \cdot s^{-1}; east/oos$ ✓

OPTION 2 Left + / OPSIE 1 Links +

$\sum p_{before} = \sum p_{after}$
$m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$

Any one
Enige een ✓

$(12\,000)(-20) + (2000)(0)$ ✓$= (12\,000 + 2000)v_f$ ✓
$v_f = -17{,}14\ m \cdot s^{-1}$ ✓
$v = 17{,}14\ m \cdot s^{-1}; east/oos$ ✓ (5)

3.3 $E_{Ki} = ½ mv^2_{Ai} + ½ mv^2_{Bi}$ ✓
$= ½ (12\,000)(20)^2 + ½ (2\,000)(0)^2$ ✓
$= 2\,400\,000\,J$

$E_{Kf} = ½ mv^2_{Ai} + ½ mv^2_{Bi}$
$= ½v^2(m_{Ai} + m_{Bi})$
$= ½ (17{,}14)^2(12\,000 + 2\,000)$ ✓
$= 2\,056\,457{,}2\,J$
$E_{Ki} \neq E_{Kf}$ ✓

INELASTIC/*ONELASTIES* ✓ (5)

3.4 Crumple zones increase contact time during a collision ✓which reduces the net force ✓on the vehicle and its occupants, for the same change in momentum. ✓

Frommelsones vermeerder die kontaktyd wat die netto krag op die motor en die passassiers, vir dieselfde verandering in momentum. (3)

3.5 3.5.1 $F_{net}\Delta t = \Delta p$
$F_{net} = \frac{mv_f - mv_i}{\Delta t}$ ✓
$F_{net} = \frac{(0{,}45)(-4{,}5-6)}{0{,}16}$ ✓✓
$F_{net} = -29{,}53$ N
$F_{net} = 29{,}53$ N ✓(away from the wall/*weg van die muur*) (4)

3.5.2 SMALLER THAN, ✓ greater contact time means smaller force or contact time is inversely proportional to the force. ✓

KLEINER AS, groter kontaktyd beteken kleiner krag of kontaktyd is omgekeerd eweredig aan die krag. (2)
[21]

QUESTION/*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 toegepaste krag op 'n voorwerp en die verplasing in die rigting van die krag. (2)

4.2 4.2.1 $W_{net} = W_{Fa} + W_f$
$W_{net} = F_a \Delta x cos\emptyset + f \Delta x cos\emptyset$ } Any one/*Enige een* ✓
$W_{net} = (45)(5)\, cos\, 25°$ ✓$+(1.6)(5)\, cos\, 180°$ ✓
$W_{net} = 195{,}92\, J$ ✓

OR/OF

$F_{net} = F_{A\|} - f$
$F_{net} = F_A cos\emptyset - f$ } Any one
Enige een ✓
$F_{net} = 45cos25 - 1{,}6$ ✓
$F_{net} = 39{,}18\, N$

$W_{net} = F_{net} \Delta x cos\emptyset$
$W_{net} = (39{,}18)(5)\cos 0°$ ✓
$W_{net} = 195{,}92\, J$ ✓ (4)

4.2.2 **Apply positive marking from QUESTION 4.2.1/*Positiewe nasien vanaf VRAAG 4.2.1***

$P = \frac{W}{\Delta t}$ ✓
$P = \frac{203{,}92}{7}$ ✓
$P = 29{,}14\, W$ ✓ (3)

4.3 INCREASE. ✓
The displacement (distance covered) of the crate is directly proportional to the work done on the crate. ✓✓

VERMEERDER: Die verplasing (afstand gedek) van die krat is direk eweredig aan die werk gedoen op die krat. (3)

4.4 4.4.1 The <u>total mechanical energy</u> (sum of gravitational potential energy and kinetic energy) in an <u>isolated system remains constant</u>. ✓✓

Die <u>totale meganiese energie</u> (som van gravitasie-potensiële energie en kinetiese energie) in <u>'n geïsoleerde stelsel bly konstant</u>. (2)

Any one
Enige een ✓

4.4.2

$$\sum E_M = \sum E_M$$
$$E_{Ki} + E_{Pi} = E_{Kf} + E_{Pf}$$
$$½mv^2{}_i + mgh_i = ½mv^2{}_f + mgh_f$$
$$(0) + (15)(9{,}8)(2x) \checkmark = ½(15)(14)^2 + (15)(9{,}8)(x) \checkmark$$
$$x = 10\ m$$
$$height\ at\ A/hoogte\ by\ A = 2x = 2(10) = 20\ m \checkmark$$

OR/OF

$$\sum E_M = \sum E_M$$
$$E_{Ki} + E_{Pi} = E_{Kf} + E_{Pf}$$
$$½mv^2{}_i + mgh_i = ½mv^2{}_f + mgh_f$$

Any one
Enige een ✓

$$(0) + (15)(9{,}8)(x) \checkmark = ½(15)(14)^2 + (15)(9{,}8)(\tfrac{1}{2}x) \checkmark$$
$$x = 10\ m$$
$$height\ at\ A/hoogte\ by\ A = 2x = 2(10) = 20\ m \checkmark$$ (4)

[18]

QUESTION/*VRAAG* 5

5.1 The ratio of change in dimension to the original dimension. ✓✓

Die verhouding van verandering in dimensie tot die oorspronklike dimensie. (2)

5.2 5.2.1

$$\delta = \frac{F}{A} \checkmark$$
$$\delta = \frac{12}{\pi(0{,}9)^2} \checkmark$$
$$\delta = 4{,}72 \times 10^6\ Pa \checkmark$$ (4)

5.2.2

$$\varepsilon = \frac{\Delta L}{L} \checkmark$$
$$\varepsilon = \frac{2{,}006 - 2}{2} \checkmark$$
$$\varepsilon = 3 \times 10^{-3} \checkmark$$

NOTE/*LET WEL*: Penalise if units are included (final answer).
P*enaliseer indien eenhede ingesluit is (finale antwoord).* (3)

5.2.3 **Apply positive marking from QUESTION 5.2.1 and QUESTION 5.2.2**
Positiewe nasien vanaf VRAAG 5.2.1 en VRAAG 5.2.2

$K = \frac{\delta}{\varepsilon}$ ✓

$K = \frac{4{,}72 \times 10^{6}}{3 \times 10^{-3}}$ ✓

$K = 1{,}57 \times 10^{9}\ N \bullet m^{-2}/Pa$ ✓ (3)

5.3 5.3.1 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 in ewewig, die druk by 'n punt toegepas word eweredig na al die ander dele van die vloeistof versprei word. (2)

5.3.2 $P = \frac{F}{A}$ ✓

$P = \frac{3\,500 \times 9{,}8}{7{,}49}$ ✓

$P = 4\,579{,}44\ Pa$ ✓ (3)

5.3.3 **Apply positive marking from QUESTION 5.3.2/*Positiewe nasien vanaf VRAAG 5.3.2***

$\frac{F_1}{A_1} = \frac{F_2}{A_2}$ ✓

$4\,579{,}44 = \frac{F_2}{0{,}54}$ ✓

$F = 2\,472{,}90\ N$ downwards/*afwaarts* ✓ (3)
[20]

QUESTION/*VRAAG* 6

6.1 6.1.1 Upon reflection from a smooth surface, the angle of the reflected ray is equal to the angle of the incident ray (with respect to the normal). ✓
The reflected ray is always in the plane defined by (the same plane as) the incident ray and the normal. ✓

Wanneer lig op 'n platvlak val, weerkaats dit sodat die weerkaatsingshoek gelyk is aan die invalshoek (met respek vir die normale)
Die invalstraal, weerkaatste straal en normaalstraal lê almal op dieselfde vlak. (2)

6.1.2 B – Normal/*Normaal* ✓
C – Reflected ray/*Weerkaatste straal* ✓ .(2)

6.2 6.2.1 The bending of light when it passes from one medium to another. ✓✓

Die buiging van lig wanneer dit van een medium na 'n ander beweeg. (2)

6.2.2 MEDIUM 2. ✓

When light moves from an optical medium with higher density to an optical medium of lower density it bends away from the normal. ✓✓
Wanneer lig van 'n meer digte optiese medium na 'n minder digte optiese medium beweeg buig dit weg van die normaal af.

OR/*OF*

When light moves from an optical medium with lower density to an optical medium of higher density it bends towards the normal.
Wanneer lig van 'n minder digte optiese medium na 'n meer digte optiese medium beweeg buig dit na die normaal toe. (2)

6.2.3 Light has to move from optical medium with higher density to optical medium of lower density. ✓
The angle of incidence must be greater than the critical angle. ✓

Lig moet van 'n hoër optiese medium na 'n laer optiese medium beweeg.
Die invalshoek moet grootter wees as die grenshoek van die betrokke mediums. (2)
[10]

QUESTION/*VRAAG 7*

7.1 A changing magnetic and electric field mutually perpendicular to each other and the direction of propagation of the wave. ✓✓

'n Verandering van magnetiese en elektriese velde onderling loodreg op mekaar en die rigting van die voortplanting van die golf. (2)

7.2
- When ultraviolet light shines on certain objects, it can excite the molecules in the object to produce fluorescence. ✓
  Wanneer 'n ultravioletlig op 'n sekere voorwerp skyn, kan dit die voorwerp prikkel om fluoressensie te produseer
- A visible photon is released when the molecule loses the absorbed energy, making the substance appear to glow in the dark. ✓
  'n Sigbare foton word vrygestel wanneer die molekule geabsobeerde energie verloor, wat die stof in die donker laat gloei.
- This is used by the police when investigating crime scenes as some bodily fluids, such as sweat, saliva, semen and blood appear to glow in the dark under ultraviolet light. ✓
  Dit word deur die polisie gebruik wanneer misdaadtonele ondersoek word soos sommige liggaamsvloeistowwe, soos sweet, spoeg, semen en bloed blyk te gloei in die donker onder ultraviolet lig. (3)

7.3 $E = h\frac{c}{\lambda}$ ✓

$2{,}49 \times 10^{-19}$ ✓ $= (6{,}63 \times 10^{-34})$ ✓$\frac{(3 \times 10^{8})}{\lambda}$ ✓

$\lambda = 7{,}99 \times 10^{-7}\ m$ ✓ accept/*aanvaar* 8×10^{-7} m

OR/*OF*

$E = h$ ✓

$2{,}49 \times 10^{-19} = (6{,}63 \times 10^{-34})f$ ✓

$f = 3{,}76 \times 10^{14}\ Hz$

$c = f\lambda$ ✓

$(3 \times 10^{8}) = (3{,}76 \times 10^{14})\lambda$ ✓

$\lambda = 7{,}99 \times 10^{-7} m$ ✓ accept/*aanvaar* 8×10^{-7} m (5)

[10]

QUESTION/*VRAAG* 8

8.1 The amount of charge a capacitor can store per volt. ✓✓

Die hoeveelheid lading wat 'n kapasitor per volt kan stoor. (2)

8.2 $C = \frac{\varepsilon_o A}{d}$ ✓

$C = \frac{(8{,}85 \times 10^{-12})(3{,}5)}{(4 \times 10^{-3})}$ ✓ ✓

$C = 7{,}74 \times 10^{-9}\ F$ ✓ (4)

8.3 **Apply positive marking from QUESTION 8.2 / *Positiewe nasien vanaf VRAAG 8.2***

$C = \frac{Q}{V}$ ✓

$(7{,}74 \times 10^{-9}) = \frac{Q}{(240)}$ ✓

$Q = 1{,}86 \times 10^{-6}\ C$ ✓ (3)

[9]

QUESTION/*VRAAG* 9

9.1 The potential difference across a conductor is directly proportional to the current in the conductor at constant temperature. ✓✓

Die potensiaalverskil oor 'n geleier is direk eweredig aan die stroom in die geleier by konstante temperatuur. (2)

9.2 9.2.1 $\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓

$\frac{1}{R_P} = \frac{1}{7} + \frac{1}{4}$ ✓

R = 2,55 Ω

$R_T = R_p + R_s$

$R_T = 2{,}55 + 6$ ✓

$R_T = 8{,}55\ \Omega$ ✓ (4)

9.2.2 **Apply positive marking from QUESTION 9.2.1 / *Positiewe nasien vanaf VRAAG 9.2.1***

$I_T = \frac{V}{R}$ ✓

$I_T = \frac{12}{8{,}55}$ ✓

$I_T = 1{,}4\ A$ ✓ (3)

9.2.3 **APPLY POSITIVE MARKING FROM QUESTION 9.2.1 AND QUESTION 9.2.2**
POSITIEWE NASIEN VANAF VRAAG 9.2.1 EN VRAAG 9.2.2

OPTION 1/*OPSIE* 1	**OPTION 2/*OPSIE* 2**	**OPTION 3/*OPSIE* 3**
$R = \frac{V}{I}$ $2{,}55 = \frac{V}{1{,}4}$ $V = 3{,}58\ \Omega$ $P = VI$ ✓ $P = (8{,}42)(1{,}4)$ ✓ $P = 11{,}79\ W$ ✓	$P = I^2R$ ✓ P $= (1{,}4)^2(6)$ ✓ P $= 11{,}76\ W$ ✓	$P = \frac{V^2}{R}$ ✓ $P = \frac{(8{,}42)^2}{6}$ ✓ $P = 11{,}82\ W$ ✓

(3)
[12]

QUESTION/*VRAAG* 10

10.1 10.1.1 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 of the magnetic flux. ✓

Wanneer die magnetiese vloed wat met die spoel verbind is, verander, 'n emk in die spoel geïnduseer word. Die grootte van die geïnduseerde emk is direk eweredig aan die tempo van verandering van die magnetiese vloed. (2)

10.1.2 Moving the conductor / magnet faster relative to each other.
Using a stronger magnetic field.
Moving the conductor perpendicular to the magnetic field.

Any two
OF/OR *Enige twee* ✓✓

Beweeg geleier / magneet vinniger relatief tot mekaar.
Gebruik van 'n sterker magneetveld.
Beweeg die geleier loodreg teenoor die magneetveld. (2)

10.2 10.2.1 A transformer that decreases the voltage. ✓✓
'n Transformator wat die spanning verlaag. (2)

10.2.2 $\frac{V_s}{V_p} = \frac{N_s}{N_p}$ ✓

$\frac{V_s}{200} = \frac{70}{700}$ ✓

$V_s = 20\ V$ ✓ (3)
[9]

TOTAL/*TOTAAL*: 150