basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

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

TECHNICAL SCIENCES P1
TEGNIESE WETENSKAPPE V1

2022

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

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

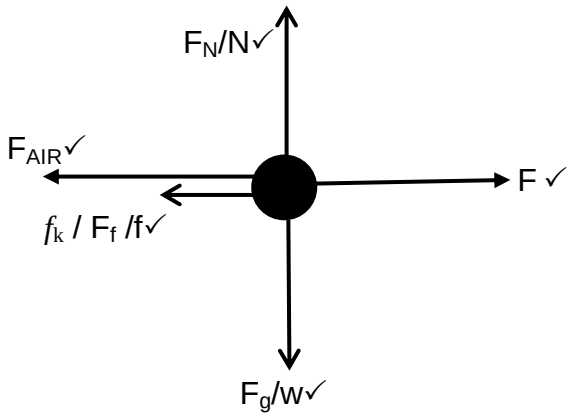
QUESTION 1/*VRAAG* 1

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

[20]

QUESTION 2/*VRAAG* 2

2.1



ACCEPTABLE LABELS/ *AANVAARBARE BYSKRIFTE*:	**NOTES/*NOTAS*:**
N/F_N: Normal/ Normaal/10 000N F_g/w: Force due to gravity/Weight *Gravitasiekrag/Gewig/10 000N* $F_{air\ resistance}$/ F_{air} / 2 500N *$F_{lugweerstand}$/ F_{lug}/ 2 500N* f_k / f/ friction/ *wrywing*/500N F/F_{engine}/$F_{applied}$ F_{enjin}/$F_{toegepas}$	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* • Penalise when extra forces are added/ *Penaliseer indien ekstra kragte bygevoeg was*.

(5)

2.2 **NEGATIVE MARKING WITHIN 2.2/*NEGATIEWE NASIEN BINNE***

Inertia. ✓
The property of a body to resist any change ✓in its state of motion or rest. ✓

Traagheid
Die eienskap van 'n voorwerp om enige verandering, in sy toestand van beweging of rus, teen te staan. (3)

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

2.3.2 $F_{net} = ma$
$F_A + F_B + f = ma$ ✓ (any one/*enige een)*
50 + 55 + (-18) ✓= 145·a ✓
a = 0,6 m·s^{-2} to the left/west/forward✓*/na links /wes/voorentoe* (4)

2.3.3

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$F_{net} = \frac{\Delta p}{\Delta t}$ ✓(any one/ *enige een)* $F_{net} = ma$ $F_{net} = 80$ ✓$(\frac{5-3}{6})$ ✓ $F_{net} = 26,67$ N ✓	$a = \frac{v_f - v_i}{\Delta t}$ $a = \frac{5-3}{6}$ ✓ $a = 0,33$ m·s^{-2} $F_{net} = ma$ ✓ $F_{net} = 80$ ✓ x 0,33 $F_{net} = 26,4$ N ✓

(4)

2.4.1 An object will remain at rest or continue moving at a constant velocity (or at constant speed in a straight line) ✓ unless acted upon by a non-zero external resultant/net force. ✓

'n Voorwerp sal in sy toestand van rus of uniforme beweging volhard tensy 'n nie-nul resulterende/netto krag daarop inwerk. (2)

2.4.2 Refer to page 10 for the diagram/ *Verwys na bladsy 10 vir die diagram*.

CRITERIA/ KRITERIA	**MARK/PUNT**
w = 170 mm / 8500 N	1
F = 95 mm / 4750 N	1
T = 194,7 mm / 9737,17 N	1
Angle/*Hoek*: 29,2º	1
Right angle triangle drawn with arrows *Reghoekige driehoek met pyltjies ingesluit.*	1

(5)

2.4.3 w = mg
8 500 = m x 9,8 ✓
m = 867,35 kg ✓ (2)

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QUESTION 3/*VRAAG* 3

3.1.1 When object **A** exerts a force on object **B**, object **B** simultaneously exerts an oppositely directed force of equal magnitude on object **A**. ✓✓

*Wanneer voorwerp **A** 'n krag op voorwerp **B** uitoefen, sal voorwerp **B** tegelykertyd 'n teenoorgesteld gerigte krag met 'n gelyke grootte uitoefen op voorwerp **A**.* (2)

3.1.2 **NEGATIVE MARKING IF A PISTOL IS USED.**
NEGATIEWE NASIEN AS 'N PISTOOL GEBRUIK IS.
From a rifle. ✓ In the gun with the shorter barrel, ✓ the force from the expanding gases acts for a shorter period of time than for a gun with a longer barrel(rifle). ✓ So the change in momentum is more in the rifle.

OR

From a rifle. In the gun with the longer barrel, the force from the expanding gases acts for a longer period of time than for a gun with a shorter barrel(pistol). So the change in momentum is less in the pistol.

*Van die geweer. In die pistool met 'n korter loop sal die krag van die uitsittende gasse, vir 'n korter tydperk inwerk as vir 'n geweer met n langer loop. Dus is die verandering in momentum meer in die gewe*er.

OF

Van die geweer. In die geweer met 'n langer loop sal die krag van die uitsittende gasse langer tydperk inwerk as 'n pistool met 'n korter loop. Dus sal die verandering in momentum minder wees in die geweer. (3)

3.2.1 The total linear momentum of an isolated system ✓remains constant✓ /is conserved in magnitude and direction.

Die totale lineêre momentum in 'n geïsoleerde sisteem bly constant/bly behoue in grootte en rigting. (2)

3.2.2 $\sum p$ before = $\sum$ p after
$(m_r + m_b)v_b = m_r v_r + m_b v_b$ ✓ (any one/*enige een)*
$(1,2 + 0,03)$ ✓ x 0 = $1,2.v_r + 0,03 \times 330$ ✓
$v_r = 8,25\ m.s^{-1}$ ✓ in opposite direction of the bullet. ✓
teenoorgestelde rigting as die koeël. (5)

3.2.3 During elastic collision, the total kinetic energy is conserved ✓ and total momentum is conserved ✓, during inelastic collision, total kinetic energy is not conserved ✓ but total momentum is conserved. ✓

Tydens elastiese botsing, bly die totale kinetiese energie behoue en die die totale lineêre momentum bly behoue en tydens onelastiese botsing bly die totale kinetiese energie nie behoue nie en die totale lineêre momentum bly behoue. (4)

3.3

OPTION 1/ *OPSIE 1*	**OPTION 2/ *OPSIE 2***
$F_{net}\Delta t = \Delta p = m(v_f - v_i)$ ✓ F_{net} (0,03) ✓ = 70(0 – 12,5) ✓ F_{net} = -29 166,67 N F_{net} = 29 166,67 N upwards/✓ *opwaarts*	$a = \frac{v_f - v_i}{\Delta t}$ $a = \frac{0 - 12,5}{0,03}$ ✓ $a = -416,67 m \cdot s^{-2}$ $F_{net} = ma$ ✓ $F_{net} = 70(-416,67)$ ✓ F_{net} = 29 166,67 N upwards ✓ *opwaarts*

(4)
[20]

QUESTION 4/*VRAAG* 4

4.1 It is the energy an object posesses due to its position from the surface of the earth. ✓✓

Dit is die energie wat 'n voorwerp besit as gevolg van sy posisie vanaf die aardoppervakte. (2)

4.2 $E_p = mgh$ ✓
$E_p = 6 \times 10^4 \times 9,8 \times 948$ ✓
$E_p = 5,57 \times 10^8$ J ✓ (3)

4.3.1 $M_E = E_P + E_K$ ✓ (any one/*enige een*)
$M_E = mgh + 1/2mv^2$
$M_E = 0,22 \times 9,8 \times 0,25$ ✓$+ 0,5(0,22)(0)^2$ ✓
$M_E = 5,39 \times 10^{-1}$ J ✓ (4)

4.3.2 **POSITIVE MARKING FROM 4.3.1/ *POSITIEWE NASIEN VANAF 4.3.1***
5,39 x 10^{-1} J✓✓
(M_E is conserved. Thus the value of mechanical energy at the lowest point is 5,39 x 10^{-1} J).

M_E bly behoue. Dus is die waarde van die meganiese energie by die laagste punt is 5,39 x 10^{-1} J.) (2)

4.3.3 **POSITIVE MARKING FROM 4.3.1/ *POSITIEWE NASIEN VANAF 4.3.1***

$(Ek + Ep)_{top} = (Ek + Ep)_{bottom}$
$M_{E\,(top)} = M_{E\,(bottom)}$ ✓ (any one)

$(Ek + Ep)_{bo} = (Ek + Ep)_{onder}$
$M_{E\,(bo)} = M_{E\,(onder)}$ (*enige een*)

$5,39 \times 10^{-1}$ ✓ $= (0,22 \times 9,8 \times 0,05) + \frac{1}{2}(0,22)v^2$ ✓

$v = 1,98$ m.s^{-1} ✓ (4)
[15]

QUESTION 5/*VRAAG* 5

5.1.1

$$\sigma = \frac{F}{A} \checkmark$$

$$16x10^{6} = \frac{40x10^{3}}{A} \checkmark$$

$$A = 2,5 \times 10^{-3}\ m^2 \checkmark$$

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$A = x \times x$ $x = \sqrt{2,5 \times 10^{-3}}$ $x =$ 0,05 m x = 50 mm ✓	$A = 2,5 \times 10^{-3}$ $x =$ 0,05 m x = 50 mm ✓

(5)

5.1.2

$$K = \frac{\sigma}{\varepsilon} \checkmark$$

$$90x10^{9} = \frac{16x10^{6}}{\varepsilon} \checkmark$$

$$\varepsilon = 1,78 \times 10^{-4} \checkmark$$

(3)

5.1.3 **POSITIVE MARKING FROM 5.1.2/ *POSITIEWE NASIEN VANAF 5.1.2***

$$\varepsilon = \frac{\Delta\ell}{L} \checkmark$$

$$1,78 \times 10^{-4} = \frac{\Delta\ell}{300} \checkmark$$

$$\Delta\ell = 0,053 \text{ mm} \checkmark$$

(3)

5.2.1

OPTION 1/*OPSIE 1*	
$A = \pi r^2$ $A = \pi \times (0,1)^2$ ✓ $A = 3,142 \times 10^{-2}\ m^2$	$A = \frac{\pi d^2}{4}$ $A = \frac{\pi(0,2)^2}{4}$ ✓ $A = 3,142 \times 10^{-2}\ m^2$
$P = \frac{F}{A}$ ✓ $P = \frac{20 \times 10^3}{3,142 \times 10^{-2}}$ ✓ $P = 636,54 \times 10^3$ Pa ✓ **Range/*Gebied*: 636,54 x 10^3 to/*tot* 645161,30**	
OPTION 2/*OPSIE 2*	**OPTION 3/*OPSIE 3***
$P = \frac{F}{A}$ ✓ ✓ $P = \frac{20 \times 10^3}{\pi(0.1)^2}$ ✓ $P = 636,54 \times 10^3$ Pa ✓ **Range/*Gebied*:** **636,54 x 10^3 to/*tot* 645161,30**	$P = \frac{F}{A}$ ✓ ✓ $P = \frac{20 \times 10^3}{\frac{\pi(0,2)^2}{4}}$ ✓ $P = 636,54 \times 10^3$ Pa ✓ **Range/*Gebied*:** **636,54 x 10^3 to/*tot* 645161,30**

(4)

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

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\frac{F_1}{A_1} = \frac{F_2}{A_2}$ ✓ $\frac{F_1}{1,96 \times 10^{-3}}$ ✓ $= \frac{20 \times 10^3}{3,142 \times 10^{-2}}$ ✓ $F_1 = 1247,61$ N ✓	$P = \frac{F}{A}$ ✓ ✓ $636,54 \times 10^3 = \frac{F}{1,96 \times 10^{-3}}$ ✓ $F = 1247,61$ N ✓

(4)
[19]

QUESTION 6/*VRAAG* 6

6.1 The bending of light✓ when it passes from one medium to another (of different optical densities).✓

Die breking van lig wanneer dit vanaf een meduim na 'n ander beweeg (van verskillende optiese digthede). (2)

6.2 Angle of incidence ✓ / *Invalshoek* (1)

6.3 25°✓ (1)

6.4 Emergent angle ✓/ *Uitvalshoek* (1)

6.5 Increases ✓/ *Verhoog* (1)

6.6.1 Incident (ray) ✓/ *Invallende straal* (1)

6.6.2 Refraction (ray) ✓/ *Brekingstraal (gebreekte straal)* (1)

6.6.3 Emergent (ray) ✓/*Uitvallende straal (uittredende straal)* (1)

6.7 **NEGATIVE MARKING WITHIN 6.7./ *NEGATIEWE NASIEN IN 6.7.***

Glass. ✓
As the light move from air to glass it bends towards the normal✓, which indicates a decrease in speed. ✓

Glas
Indien n ligstraal beweeg vanaf lug na glas, buig dit na die normal wat 'n indikasie is van 'n afname in spoed.

OR/*OF*

As light moves from glass to air it bends away from the normal, which indicates an increase in speed.

Indien lig beweeg vanaf glas na lug buig dit weg van die normal en dit is 'n indikasie van 'n toename in spoed. (3)

6.8 Telescopes ✓
Binoculars ✓
Periscopes ✓
Optic fibre
Endoscope (any three)

Teleskoop
Verkyker
Periskoop
Optiese vesel
Endoskoop (enige drie) (3)
[15]

QUESTION 7/*VRAAG* 7

7.1
- Visible ✓
- Radio waves ✓
- Microwaves ✓
- X-rays ✓
- Infra-red
- Ultraviolet
- Gamma rays (any four)

- *Sigbare lig*
- *Radiogolwe*
- *Mikrogolwe*
- *X-strale*
- *Infrarooi*
- *Ultravioletstrale*
- *Gammastrale* *(enige vier*) (4)

7.2.1 Ultraviolet ✓/ *Ultraviolet* (1)

7.2.2 Infrared ✓/*Infrarooi* (1)

7.2.3 X-ray ✓/*X-straal* (1)

7.2.4 Radio waves ✓/*Radiogolwe* (1)
[8]

QUESTION 8/*VRAAG* 8

8.1.1 Charge ✓/*Laai* (1)

8.1.2 **NEGATIVE MARKING FROM 8.1.1/ *NEGATIEWE NASIEN VANAF 8.1.1***
The capacitor is connected to a battery/power source✓/*Die kapasitor is aan 'n battery/ kragbron gekoppel.* (1)

8.2.1
$$C = \frac{\varepsilon_o A}{d} \checkmark$$
$$C = \frac{(8{,}85\times10^{-12})(10{,}2\times10^{-4})}{2.38\times10^{-3}} \checkmark$$
$$C = 3{,}79 \times 10^{-12}\ F \checkmark$$ (3)

8.2.2 **POSITIVE MARKING FROM 8.2.1/ *POSITIEWE NASIEN VANAF 8.2.1***
$$C = \frac{Q}{V} \quad \checkmark$$
$$3{,}79\times10^{-12} = \frac{0{,}345\times10^{-9}}{V} \checkmark$$
$$V = 91{,}03\ V \checkmark$$ (3)
[8]

QUESTION 9/*VRAAG* 9

9.1.1 Light ✓
Heat ✓
Sound
Mechanical (energy) (any two)

Lig
Warmte
Klank
Meganiese (energie) *(enige twee)* (2)

9.1.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***	**OPTION 3/*OPSIE 3***
P = VI ✓ P = 220 x 6 ✓ P = 1320 W = 1,32 kW ✓(any one/ *enige een*)	$R = \frac{V}{I}$ $R = \frac{220}{6}$ R = 36,67 Ω $P = I^2R$ ✓ $P = (6)^2(36,67)$ ✓ P =1320,12 W P = 1,32 kW ✓ (any one/*enige een*)	$R = \frac{V}{I}$ $R = \frac{220}{6}$ R = 36,67 Ω $P = \frac{V^2}{R}$ ✓ $P = \frac{220^2}{36,37}$ ✓ P =1319,88 W P = 1,32 kW ✓ (any one/*enige een*)

(3)

9.2

OPTION 1/*OPSIE 1*	**OPTION 2/ *OPSIE 2***
$R = \frac{V}{I}$ $R = \frac{1,5}{0,5}$ ✓ R = 3 Ω $R_s = R_1 + R_2$ ✓ 3 = 2 + R_2 ✓ R_2 = 1 Ω ✓	$R_1 = \frac{V_1}{I_1}$ $2 = \frac{V_1}{0,5}$ ✓ V_1 = 1 V V = 1,5 -1 = 0,5 V $R_2 = \frac{V_2}{I_2}$ ✓ $R_2 = \frac{0,5}{0,5}$ ✓ R_2 = 1 Ω ✓

(4)
[9]

QUESTION 10/*VRAAG* 10

10.1.1 An electric motor is a device that converts electrical energy to mechanical energy. ✓✓
NOTE: If devise is omitted credit 1 mark only.

'n Elektriese motor is 'n toestel wat elektriese energie na meganiese energie omskakel.
***LET WEL**: Gee slegs 1 punt indien toestel weggelaat is.* (2)

10.1.2 Split ring/Commutator ✓
Spleetring/kommutator (1)

10.1.3 Anticlockwise ✓/*Antikloksgewys* (1)

10.2 Mechanical energy into electrical energy. ✓✓/M*eganiese energie na elektriese energie* (2)

10.3 $\frac{V_S}{V_P} = \frac{N_S}{N_P}$ ✓

$\frac{240}{V_P} = \frac{1500}{250}$ ✓

$V_P = 40\ V$ ✓ (3)

[9]

TOTAL/*TOTAAL*: 150

QUESTION/*VRAAG 2.4.2*