basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE
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GRADE/*GRAAD* 12

TECHNICAL SCIENCES: P1
TEGNIESE WETENSKAPPE: V1

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MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

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

QUESTION 1/*VRAAG* 1

1.1 D ✓✓ (2)

1.2 C ✓✓ (2)

1.3 B ✓✓ (2)

1.4 A ✓✓ (2)

1.5 B ✓✓ (2)

1.6 C ✓✓ (2)

1.7 D ✓✓ (2)

1.8 A ✓✓ (2)

1.9 C ✓✓ (2)

1.10 D ✓✓ (2)

[20]

QUESTION 2/*VRAAG* 2

2.1 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 force. ✓*I'n Voorwerp sal in sy toestand van rus of uniforme beweging volhard tensy 'n nie-nul resulterende krag daarop inwerk.* (2)

2.2.1

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
F_y= 60.Sin30^o✓ = 30 N✓	F_y= 60.Cos60^o✓ = 30 N✓

(2)

2.2.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
Apply positive marking from 2.2.1 ***Positiewe nasien vanaf 2.2.1*** $f_k = \mu_k N$ ✓ $= \underset{\checkmark}{0,13}\ [(6x9,8) - 60.Sin30^o]$ ✓ = 3,74 N (to the right) ✓*/na regs* NOTE: Credit if $60.Sin30^o$ is expressed as 30 *LET WEL: Gee die punt indien $60.Sin30^o$ aangedui word as 30*	**Apply positive marking from 2.2.1** ***Positiewe nasien vanaf 2.2.1*** $N = mg - F_y$ $N = (6x9,8) - 60.Sin30^o$ ✓ = 58,8 - 30 = 28,8 N $f_k = \mu_k N$ ✓ $= \underset{\checkmark}{0,13} \times 28,8$ = 3,74 N (to the right) ✓*/na regs* NOTE: Credit if 28,8N is expressed as 58,8 - 30 *LET WEL: Gee die punt indien 28,8N aangedui is as 58,8 - 30.*

(4)

2.2.3

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$F_x = 60.Cos30^o$ ✓ = 51,96 N✓	$F_x = 60.Sin60^o$ ✓ = 51,96 N✓

(2)

Positive marking from 2.2.2 and 2.2.3/*Positiewe nasien vanaf 2.2.2 en 2.2.3*

2.3 $F_{net} = ma$
$F_x + fk = ma$] ✓ any one */enige een*
$60Cos30° + (-3,74)$✓ = $6.a$ ✓

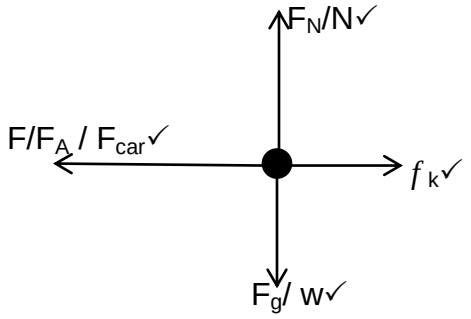
a = $8,04\ m.s^{-2}$ to the left ✓*/na links* (4)

2.4 Decrease✓
The vertical component (F_y) will increase and thus the normal force will decrease. ✓✓
OR
The force will tend to lift the object from the surface and thus decrease the friction.
Afneem
Die vertikale komponent (F_y) sal toeneem en dus sal die normaalkrag afneem.
OF
Die krag sal neig om die voorwerp van die oppervlak te lig en dus die wrywing laat afneem. (3)

2.5.1 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**.*
NOTE:Credit one mark if any of the key words is ommitted (1/2)
LET WEL: Gee een punt indien enige van die sleutelwoorde weggelaat is (1/2). (2)

2.5.2



ACCEPTABLE LABELS:/ *AANVAARBARE BYSKRIFTE:*	**NOTES:/*NOTAS:***
N/F_N: Normal/*Normaal* F_g/w: Force due to gravity/Weight/ *Gravitasiekrag/Gewig* F/F_A/F_{car}: Applied force/ *Toegepaste krag* f_k/F_f/ f: frictional force/ *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 nie* • 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/*Kragtediagram gegee* • Extra force is given/ *Ekstra kragte gegee word*

(4)
[23]

QUESTION 3/*VRAAG* 3

3.1.1 Product of the mass of an object and its velocity. ✓✓/*Produk van die massa van 'n voorwerp en die snelheid daarvan.* (2)

3.1.2 $p_L = mv$✓
$= 5800 \times 1,5$✓
$= 8700$ kg.m.s^{-1} west✓/*wes* (3)

3.1.3 **Apply positive marking from 3.1.2**
Positiewe nasien vanaf 3.1.2

$\sum p_{before} = \sum p_{after}$
$m_Lv_L + m_Wv_W = m_C v_C$
$m_Lv_L + m_Wv_W = (m_L + m_w) v_C$
✓ any one/*enige een*

$5800 \times 1,5 + 2500 \times 0$ ✓ = $8300 \times v_C$✓
$\therefore v_C = 1,05$ m.s^{-1}✓ west✓/*wes* (5)

3.1.4 During elastic collision, the <u>total kinetic energy is conserved</u> and the total linear momentum is conserved ✓✓and during inelastic collision, <u>total kinetic energy is not conserved</u> and the total linear momentum is conserved. ✓✓

Accept/*Aanvaar* : $\sum p_{before/voor} = \sum p_{after/na}$ and $\sum Ek_{before/voor} = \sum Ek_{after/na}$
$\sum p_{before/voor} = \sum p_{after/na}$ and $\sum Ek_{before/voor} \neq \sum Ek_{after/na}$

NOTE: Do not penalise if total linear momentum is ommitted
: Penalise one mark if the word 'total' is ommitted for elastic and inelastic collision

Tydens elastiese botsing, bly die <u>totale kinetiese energie behoue</u> en die die totale lineêre momentum bly behoue en tydens onelastiese botsing <u>bly die totale kinetiese energie nie behoue nie</u> en die totale lineêre momentum bly behoue.
LET WEL: Moenie penaliseer as die totale lineêre momentum weggelaat is nie.
Penaliseer met een punt indien die woord "totale" weggelaat is vir elastiese en onelastiese botsings (4)

3.2.1
- If the vehicle collides or come to a standstill, the driver and passengers would contiue moving at the initial velocity. ✓
- Safety belts will then <u>prevent them from moving forward</u>✓and hurting themselves and others or even going through the windscreen.

- *As die voertuig bots of tot stilstand kom, sal die bestuurder en passasiers aanhou om teen die aanvanklike snelheid te beweeg.*
- *Veiligheidsgordels sal dan <u>voorkom dat hulle vorentoe beweeg</u> en hulleself en ander beseer of selfs om deur die windskerm te gaan.* (2)

3.2.2

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
Let the direction towards the wall be positive/*Laat die rigting na die muur positief wees* $F_{net}\Delta t$ = Impulse] ✓any one/ *enige een* Impulse = Δp] Impulse = 0 – 24300 ✓ Impulse = - 24300 Impulse = 24300 kg.ms^{-1}✓(away from the wall/*weg van die muur.)*	Let the direction towards the wall be negative/*Laat die rigting na die muur negatief wees* $F_{net}\Delta t$ = Impulse] ✓any one/ *enige een* Impulse = Δp] Impulse = 0 – (- 24300) ✓ Impulse = 24300 kg.ms^{-1} ✓ (away from the wall/*weg van die muur.)*

(3)

Positive marking from 3.2.2/*Positiewe nasien vanaf 3.2.2*

3.2.3 $F_{net}\Delta t$ = Impulse✓
F_{net} x 1,2 = 24300✓
F_{net} = 20 250 N
Force exerted by impulse/*Krag deur impuls uitgeoefen* = 20 250 N✓
The wall can withstand 80 000 N, so it will withstand the impact of the test. ✓/
Die muur kan 80 000 N *weerstaan, so dit sal die impak van die toets weerstaan.*

NOTE**:** If F_{net} is more than 80 000N then it will NOT withstand the impact of the test (resulting from positive marking).
LET WEL:Indien F_{net} meer as 80 000 N is, sal dit nie die impak van die toets weerstaan nie (resultaat van positiewe nasien). (4)
[23]

QUESTION 4/*VRAAG* 4

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

4.1.2 $W = F_A \Delta x \cos\theta$✓
$W = 60 \times 8 \times \cos 25°$✓
$W = 435{,}03$ J✓ (3)

4.2.1 The total mechanical energy ✓of an isolated system is constant. ✓
OR
The sum of the gravitational potential energy and kinetic energy✓ in an isolated system remains constant. ✓

Die totale meganiese energie van 'n geïsoleerde stelsel is konstant.
OF
Die som van die gravistasie- potensiële energie en kinetiese energie in 'n geïsoleerde stelsel bly konstant. (2)

4.2.2 $E_p = mgh$ ✓
$E_p = 75 \times 9.8 \times 12$✓
$E_p = 8\,820$ J ✓
(**Accept/*Aanvaar*** : 8,820 kJ/8,82 x 10^3 J) (3)

4.2.3 $E_K = \frac{1}{2}mv^2$ ✓
$= 0.5 \times 75 \times 3^2$✓
= 337,5 J✓ (3)

Positive marking from 4.2.3/*Positiewe nasien vanaf 4.2.3.*

4.3

$M_{E\,top} = E_{k\,top} + E_{p\,top}$ ✓

$11500 = 337,5 + E_{p\,top}$ ✓

$E_{p\,top} = 11\,162,5$ J

$E_{p\,before} = E_{p\,top} - E_{p\,ground}$

$= 11\,162,5 - 8820$ ✓

$= 2342,5$ J ✓

(4)
[17]

QUESTION 5/*VRAAG* 5

5.1.1

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\text{Area / Oppervlakte} = \frac{\pi D^2}{4}$ $= \frac{\pi(2,5 \times 10^{-3})^2}{4}$ ✓ $= 4,908 \times 10^{-6}\ m^2$ $\sigma = \frac{F}{A}$ ✓ $= \frac{16}{4,908 \times 10^{-6}}$ ✓ $= 3,26 \times 10^6$ Pa✓	Area/*Oppervlakte* = πr^2 Area/*Oppervlakte* = $\pi(1,25 \times 10^{-3})^2$ ✓ $= 4,908 \times 10^{-6}\ m^2$ $\sigma = \frac{F}{A}$ ✓ $= \frac{16}{4,908 \times 10^{-6}}$ ✓ $= 3,26 \times 10^6$ Pa✓
OPTION 3/*OPSIE 3*	**OPTION 4/*OPSIE 4***
$\sigma = \frac{F}{A}$ ✓ $\sigma = \left[\frac{16}{\pi\left(\frac{2,5 \times 10^{-3}}{2}\right)^2}\right]$ ✓ $= 3,26 \times 10^6$ Pa✓	$\sigma = \frac{F}{A}$ ✓ $\sigma = \left[\frac{16}{\pi(1,25 \times 10^{-3})^2}\right]$ ✓ $= 3,26 \times 10^6$ Pa ✓

(4)

5.1.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\varepsilon = \frac{\Delta \ell}{L}$ ✓ $\varepsilon = \frac{0,5}{3 \times 10^{3}}$ ✓ ε = 1,666 x 10^{-4} ✓ NOTE: Penalise if the unit is given. *LET WEL: Penaliseer indien die eenheid gegee is.*	$\varepsilon = \frac{\Delta \ell}{L}$ ✓ $\varepsilon = \frac{5 \times 10^{-4}}{3}$ ✓ ε = 1,666 x 10^{-4} ✓ NOTE: Penalise if the unit is given. *LET WEL: Penaliseer indien die eenheid gegee is.*

(3)

Positive marking from 5.1.1 and 5.1.2./*Positiewe nasien vanaf 5.1.1 en 5.1.2.*

5.1.3

$K = \frac{\sigma}{\varepsilon}$ ✓

$K = \frac{3,26 \times 10^{6}}{1,666 \times 10^{-4}}$ ✓

K = 1,956 x 10^{10} Pa✓

(3)

5.2.1 Pressure at a particular point is the thrust acting on the unit area around that point. ✓✓
NOTE: Do not penalise if force is used instead of thrust
Druk by 'n spesifieke punt is die stukrag wat op die eenheid-oppervlakte rondom daardie punt inwerk
LET WEL: Moenie penaliseer as krag gebruik is in plaas van stukrag nie (2)

5.2.2

$P = \frac{F}{A}$ ✓

$P = \frac{26}{7,855 \times 10^{-5}}$ ✓

P= 3,3099 x 10^{5} Pa ✓

(3)

5.2.3

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\frac{F_1}{A_1} = \frac{F_2}{A_2}$ ✓ $\frac{26}{7,855 \times 10^{-5}} = \frac{1278}{A_2}$ ✓ A_2 = 3,861 x 10^{-3} m^2 ✓	**Positive marking from 5.2.2/ *Positiewe nasien vanaf 5.2.2.*** $P = \frac{F_2}{A_2}$ ✓ 3,3099 x10^{5} = $\frac{1278}{A_2}$ ✓ A_2 = 3,861 x 10^{-3} m^2 ✓

(3)
[18]

QUESTION 6/*VRAAG* 6

6.1 The bending of light when it passes from one medium to another (of different optical densities).✓✓
Die buiging/breking van lig wanneer dit van een medium na die volgende deurgaan. (2)

6.2 Critical angle✓/*Kritieke hoek/Grenshoek* (1)

6.3 90º✓ (1)

6.4 
Medium 1✓/*Medium1*
Light ray **QS** bends away from the normal.✓/*Ligstraal **QS** buig weg vanaf die normaal.* (2)

6.5 **QR**✓ (1)

6.6 The light must travel from a more optically dense to a less optically dense medium.✓
The incident angle should be greater than the critical angle. ✓

Die lig moet van 'n meer opties digte na 'n minder opties digte medium beweeg
Die invalshoek moet groter as die kritieke hoek/grenshoek wees. (2)
[9]

QUESTION 7/*VRAAG* 7

7.1.1 The phenomenon whereby white light break up (spread out) into its component colours.✓✓
Die verskynsel waar wit lig opbreek (uitsprei) in sy komponentkleure. (2)

7.1.2 3. yellow✓/*geel*
6. Indigo✓ (2)

7.1.3 Refraction ✓/*Refraksie/Breking* (1)

7.1.4 When the wavelength increases the speed of the waves will also increase. ✓✓
Accept: Wavelength is directly proportional to the speed of the wave.

Wanneer die golflengte toeneem, sal die spoed van die golwe ook toeneem.
***Aanvaar**: Golflengte is direk eweredig aan die spoed van die golf.* (2)

7.2.1 A succession/repetition of pulses✓✓/*Opeenvolging/herhaling van pulse*
OR/*OF*
A disturbance that transfers energy through matter or space./*'n Versteuring wat energie deur materie of ruimte oordra.* (2)

7.2.2
- can propogate in a vacuum✓/*kan in 'n vakuum voortplant*
- move at the speed of light (3×10^8 m.s^{-1}) ✓/*beweeg teen die spoed van lig* (3×10^8 m.s^{-1})
- transfer energy/*dra energie oor*
- have a dual nature (particle and wave) nature/*het 'n tweeledige aard (deeltjie en golf)*
- can be polarized / kan gepolariseer word. (any two/*enige twee*) (2)

7.2.3

Radio-wave/ *Radio-golwe*	Micro-wave/ Mikro-golwe	Infrared/ *Infrarooi*	Visible light/ *Sigbare-lig*	Ultraviolet / *Ultraviolet*	X-rays/ *X-strale*	Gamma rays/ *Gamma-strale*

✓✓

NOTE/*LET WEL*: 2 or zero/*2 of nul*. (2)
[13]

QUESTION 8/*VRAAG* 8

8.1 Capacitance is the amount of charge a capacitor can store✓ per volt. ✓
Kapasitansie is die hoeveelheid lading wat 'n kapasitor per volt kan stoor. (2)

8.2.1 $C = \frac{\varepsilon_o A}{d}$ ✓

$= \frac{(8{,}85 \times 10^{-12})(2)}{6 \times 10^{-3}}$ ✓

$= 2{,}95 \times 10^{-9}$ F ✓ (3)

Positive marking from 8.2.1/*Positiewe nasien vanaf 8.2.1.*

8.2.2 $C = \frac{Q}{V}$ ✓

$2{,}95 \times 10^{-9} = \frac{Q}{120}$ ✓

$Q = 3{,}54 \times 10^{-7}$ C ✓

(3)
[8]

QUESTION 9/*VRAAG* 9

9.1 It is the rate at which electrical energy is converted in an electric circuit. ✓✓
Dit is die tempo waarteen elektriese energie omgeskakel word in 'n elektriese stroombaan. (2)

9.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***	**OPTION 3/OPSIE 3**
$P = \frac{V^2}{R}$ ✓ $60 = \frac{(220^2)}{R}$ ✓ R = 806,67 Ω ✓ **Range/*Gebied*:** 806,67- 806,83	P = VI 60 =220 x I I = 0,2727 A $R = \frac{V}{I}$ ✓ $R = \frac{220}{0,2727}$ ✓ R= 806,75 Ω ✓ **Range/*Gebied*:** 806,67- 806,83	P = VI 60 =220 x I I = 0,2727 A $P = I^2 R$ ✓ $60 = (0,2727)^2 R$ ✓ R = 806,83 Ω ✓ **Range/*Gebied*:** 806,67- 806,83

(3)

9.3

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$R_T = R_1 + R_2$ $R_T = 3 + 5$ ✓ $R_T = 8\ \Omega$ $R = \frac{V}{I}$ ✓ $8 = \frac{3}{I}$ ✓ I = 0,375 A V = IR = 0,375 x 5 ✓ = 1,875 V ✓	$R_T = R_1 + R_2$ = 3 + 5 ✓ = 8 Ω V = 5/8 ✓× 3✓ = 1,875 V✓ NOTE: Maximum mark is 4/5 *LET WEL:Maksimum punte is 4/5*

(5)
[10]

QUESTION 10/*VRAAG* 10

10.1.1 Electromagnetic induction✓/*Elektromagnetiese induksie* (1)

10.1.2 When the speed at which the magnet is moved in and out of the coil is increased the rate of change in the magnetic flux increases/ The rate of change of magnetic flux is directly proportional to the induced emf.✓
The induced emf/ the extent of deflection of the needle increase with the increase in change of the magnetic flux. ✓

Wanneer die spoed waarteen die magneet in en uit die spoel beweeg vermeerder word, sal die tempo van verandering in die magnetiese vloed vermeerder. Die geïnduseerde emk/die mate van defleksie van die naald vermeerder met die toename in die verandering van die magnetiese vloed. (2)

10.1.3 Alternating current✓/*Wisselendestroom* (1)

10.2.1
- The primary voltage is higher (220 V) than the secondary voltage (24 V) ✓
- More windings on primary than on secondary coil✓

OR

- The secondary voltage is lower (24 V) than the primary voltage (220 V)
- The windings on the secondary coil are fewer than that of the primary coil.

- *Die primêre spanning is hoër* (220 V) *as die sekondêre spanning* (24 V)
- *Meer windings op primêr as op sekondêre spoel*

OF

- *Die sekondêre spanning is laer* (24 V) *as die primêre spanning* (220 V)
- *Die windings op die sekondêre spoel is minder as dié op die primêre spoel.* (2)

10.2.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\frac{V_S}{V_P} = \frac{N_S}{N_P}$ ✓ $\frac{24}{220} = \frac{480}{N_p}$ ✓ N_p = 4400 windings✓	Ratio: Vs : Vp 24 : 220✓ ∴ Ns : Np 480 : 4400 windings✓ **NOTE**: Maximum mark is 2/3 (for OPTION 2) *LET WEL:Maksimum punte is 2/3 (vir OPSIE2)*

(3)
[9]

TOTAL/*TOTAAL*: 150