basic education

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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 16 pages.
Hierdie nasienriglyne bestaan uit 16 bladsye.

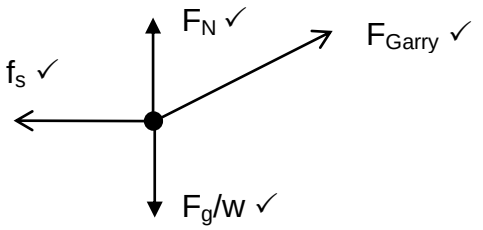
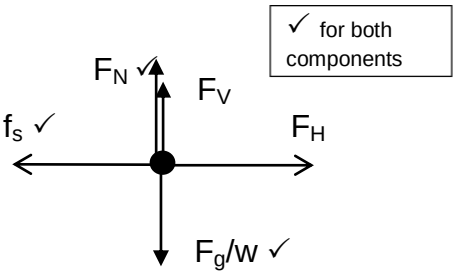
QUESTION 1/*VRAAG 1*

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

[20]

QUESTION 2/*VRAAG 2*

2.1

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
	
NOTES: Allocate mark for arrow and label. Ken punte toe vir pyl en byskrif. <u>Penalise once if:/Penaliseer een keer:</u> • No arrows/Geen pylpunte • Gaps between the line and the arrow/ Spasie tussen die lyn en pylpunt. • Dotted lines are used./Stippellyne gebruik. • Additional force is included/ Addisionele kragte ingesluit.	**Acceptable labels:** • Normal force: N/F_N/F_{normal} • Applied force: F/ F_A /F_{Gary}/F_G/T_{Gary} • Gravitational force: W/$F_{gravity}$/weight/F_g • Vertical component of F_{Gary}: F_{GV}/F_V/F_y • Horizontal component of F_{Gary}: F_{GH}/F_H/F_x • Frictional force: *f*/f_s/F_f

(4)

2.2 An object <u>will remain at rest or continue moving at a constant velocity</u> ✓ <u>unless a non-zero resultant / net force/ (unbalanced force) acts on it.</u> ✓
´n Liggaam sal in sy toestand van rus of uniforme snelheid (beweeg teen konstante snelheid) volhard tensy ´n ongebalanseerde krag/(netto of resulterende krag) daarop inwerk. (2)

2.3 It will remain at rest because the <u>net/ unbalanced force acting on it is zero</u>. ✓✓
OR
It will remain at rest as long as the horizontal component (F_H) of the pulling force (F_{Gary}) is equal to the static friction (f_s).
ACCEPT
It will remain at rest because the <u>acceleration is zero (a = 0 m.s^{-2})</u>
Dit sal in rus bly want <u>die netto krag wat daarop inwerk is nul.</u>
OF
Dit sal in rus verkeer solank die horisontale komponent (F_H) van die trekkrag (F_{Gary}) gelyk is aan die statiese wrywingskrag (f_s)
AANVAAR
Dit sal in rus bly want die <u>versnelling is nul (a</u> = 0 m.s^{-2}<u>)</u> (2)
[8]

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 uitoefen op voorwerp **B**, sal voorwerp **B** gelyktydig ´n gelyke maar teenoorgestelde krag op voorwerp **A** uitoefen.* (2)

3.1.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
For crate B/*Vir krat B* (Let right be positive) *(Laat na regs positief wees.)* $F_{net} = ma$ $F_{net} = F_{A\ on\ B} + f_k$ $F_{A\ on\ B} + f_k = ma$ $F_{A\ on\ B} - f_k = ma$ } Any one ✓ $F_{A\ on\ B} – 25,3$ ✓ $= 30 \times 2,3$ ✓ $F_{A\ on\ B} = 30 \times 2,3 + 25,3$ $F_{A\ on\ B} = 94,3$ N $F_{B\ on\ A} = - F_{A\ on\ B}$ $F_{B\ on\ A} = - 94,3$ N } Any one ✓ $= 94,3$ N ✓ to the left ✓	Assume that both crates are made of the same material. *(If the statement is omitted:* $\frac{5}{6}$*)* Veronderstel dat beide kratte van dieselfde material gemaak is. (Indien die stelling weggelaat is: $\frac{5}{6}$) For 30 kg $F_k = \mu_k \times N$ $25,3 = \mu_k (30)(9,8)$ ✓ $\mu_k = 0,086$ For 12 kg $F_k = \mu_k \times N$ $= (0,086)(12)(9,8)$ ✓ $= 10,11$ N $F_{net} = F_a + F_{fB} + F_{fA}$ $(30+12) \times 2,3 = F_a + (-25,3) – (10,11)$ ✓ $F_a = 132,01$ N Forces on 12 kg $F_{net} = F_a + F_f + F_{B\ on\ A}$ $(12 \times 2,3) = 132,01 – 10,11 - F_{B\ on\ A}$ ✓ $F_{B\ on\ A} = 94,3$ N ✓ to the left ✓

(6)

3.2.1 When a net force, F_{net}, acts on an object {of mass (m)}, it accelerates the object in the direction of the net force. ✓✓ (This acceleration is directly proportional to the net force and inversely proportional to the mass of the object.)
Wanneer ´n resulterende krag F_{net} op 'n voorwerp inwerk {met massa (m)}, versnel die voorwerp in die rigting van die resulterende krag. (Hierdie versnelling is direk eweredig aan die resulterende krag en omgekeerd eweredig aan die massa van die voorwerp.) (2)

3.2.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
Trolley **M**	Trolley **N**
$F_{net} = ma$ / $T + F_H + f_k = ma$ — Any one ✓	$F_{net} = ma$ / $F_{Paul} + T + f_k = ma$ — Any one ✓
$T + \underline{60Cos28^0 - 6,40}$ ✓ $= \underline{70 \times 1,09}$ ✓	$\underline{180 - T - 8,58}$ ✓ $= 130 \times 1,09$ ✓
$T + 52,98 - 6,40 = 76,3$	$171,42 - T = 141,7$
$T = 29,72$ N ✓	$T = 29,72$ N ✓

(4)

3.2.3 Decreases ✓
Verlaag (1)

3.2.4 **Apply negative marking from QUESTION 3.2.3**
Merk negatief vanaf VRAAG 3.2.3
There will be a vertical component of the applied force. ✓ OR This vertical upward force will tend to lift the trolley from the floor. The normal force will therefore decrease ✓ and thus the frictional force will decrease. ✓
Daar sal ´n vertikale komponent van die toegepaste krag wees. OF Hierdie vertikale komponent sal neig om die trollie van die vloer af op te lig. Die normaalkrag sal gevolglik veminder en dus ook die wrywingskrag. (3)

[18]

QUESTION 4/*VRAAG 4*

4.1 An isolated system is one in which the net external force acting on it (on the system) is zero. ✓✓
OR
Isolated system is a system which is not influenced by external forces/ surroundings.
´n Geisoleerde sisteem is waar ´n netto eksterne krag wat daarop inwerk gelyk is aan nul.
OF
´n Geisoleerde sisteem word nie beinvloed deur eksterne kragte nie. (2)

4.2 Let east be positive/*Laat oos positief wees.*

$p_C = mv_{iC}$ ✓
$= 1\ 116 \times 30$ ✓
$= 33\ 480\ kgm.s^{-1}$, east✓ (3)

4.3 Let east be positive/*Laat oos positief wees.*
$\sum p_i = \sum p_f$
$m_Cv_{iC} + m_Bv_{iB} = m_Cv_{fC} + m_Bv_{fB}$ } ✓ for any

$1\ 116(30) + 1\ 497(0)$ ✓ $= 1\ 116(v_{fC}) + 1\ 497(8)$ ✓
$v_{fC} = 19{,}27\ m.s^{-1}$✓ (to the east).

NOTE: Accept other relevant labels for subscripts of the car and the bakkie.
LET WEL: Aanvaar ander onderskrifte vir motor en bakkie. (4)

4.4 Principle of conservation of linear momentum. ✓
Die beginsel van behoud van liniere momentum.

The total linear momentum of an isolated system✓ remains constant/ is conserved (in magnitude and direction) ✓.
Die totale liniere momentum in ´n geisoleerde sisteem is konstant/bly behoue (in grootte en in rigting).

OR/*OF*
In an isolated system ✓, the total linear momentum before collision/explosion is equal to the total linear momentum after collision/explosion✓.
In ´n geisoleerde sisteem, is die totale liniere momentum voor die botsing gelyk aan die totale liniere momentum na die botsing. (3)

4.5 Smaller than. ✓
Kleiner as (1)

4.6 Velocity of the car decreased ✓ after collision from 30 $m.s^{-1}$ to 19 $m.s^{-1}$. Momentum is directly proportional to velocity. ✓
Snelheid van die motor neem af na die botsing vanaf 30 $m.s^{-1}$ tot 19 $m.s^{-1}$.
Momentum is direk eweredig aan snelheid. (2)
[15]

QUESTION 5/*VRAAG 5*

5.1 Inelastic collision is a collision in which <u>total (linear) momentum is conserved</u>✓ but <u>total kinetic energy is not conserved</u>. ✓
´n Onelastiese botsing is waar die <u>totale liniêere momentum behoue bly</u> maar die <u>totale kinetiese energie bly nie behoue nie</u>. (2)

5.2 The (net) force is equal to the rate of change in momentum. ✓✓
Die netto krag is gelyk aan die tempo van verandering in momentum. (2)

5.3 $F_{net}\Delta t = \Delta p$
$F_{net}\Delta t = m(v_f - v_i)$ } ✓ for any one

$4,5 \times 10^3 \times 3 \times 10^{-2}$✓ $= 80(v_f - 0)$ ✓

$v_f = 1,69\ m.s^{-1}$, in the direction of motion ✓ (4)
[8]

QUESTION 6/*VRAAG 6*

6.1.1 The sum of the gravitational potential energy and the kinetic energy (of an object, at a particular point). ✓✓
Die som van die gravitasie potensiele energie en die kinetiese energie van ´n voorwerp by ´n bepaalde punt.
NOTE:
If "Gravitational" is omitted, subtract one mark.
Indien Gravitasionele weggelaat was, minus een punt. (2)

6.1.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$E_m = E_p + E_k$ $= mgh + \frac{1}{2}mv^2$ } Any one ✓ $(0,15)(9,8)(17)$ ✓ + $\frac{1}{2}(0,15)(3^2)$ ✓ = 25,67 J✓	$E_p = mgh$ $= (0,15)(9,8)(17)$ ✓ = 24,99 J $E_k = \frac{1}{2}mv^2$ $= \frac{1}{2}(0,15)(3^2)$ ✓ = 0,675 J $E_m = E_p + E_k$ ✓ = 24,99 + 0,675 = 25,67 J ✓

(4)

6.1.3 **Apply positive marking from QUESTION 6.1.2.**
Merk positief vanaf VRAAG 6.1.2

At this point E_m is still 25.67 J

$E_m = E_p + E_k$
$E_m = mgh + \frac{1}{2}mv^2$ } Any one ✓

$(0,15)(9,8)(6)$ ✓ + $\frac{1}{2}(0,15)v^2$ ✓ = 25,67J✓
$v^2 = 224,67$
$v = 14,99\ m.s^{-1}$ ✓ (5)

6.1.4 **Apply positive marking from QUESTION 6.1.2.**
Merk positief vanaf VRAAG 6.1.2

E_m is still 25,67 J and $E_p = 0$ at the bottom.
$E_m = E_p + E_k = 25,67$
$E_m = mgh + \frac{1}{2}mv^2$
$(0,15)(9,8)(0)$ ✓ + $(0,5)(0,15)v^2$ ✓ = 25,67✓
$v^2 = 342,27$
$v = 18,50\ m.s^{-1}$✓ (4)

6.2.1 $P_{Ave} = Fv$ ✓ (1)

6.2.2 $P = \frac{W}{\Delta t}$

$= \frac{F \Delta x \cos\theta}{\Delta t}$ ✓

$= \frac{60 \times 0,5 \times 1}{1,2}$ ✓

$= 25$ W ✓

In hp: $P = \frac{25}{746}$

$= 0,034$ hp ✓ (4)

[20]

QUESTION 7/*VRAAG 7*

7.1.1 Elasticity of a body is the property/ability of the body to/(by virtue of which the body) regain its original size and shape ✓when the deforming force is removed. ✓
Elastisiteit van ´n liggaam is die eienskap van die liggaam om na sy oorspronklike vorm en grootte te herstel wanneer die vervormingskrag verwyder word. (2)

7.1.2 $\text{Stress} = \frac{\text{Force}}{\text{Area}}$
$\sigma = \frac{F}{A}$ ✓Any one

$\sigma = \frac{2{,}3 \times 10^{3}}{8{,}09 \times 10^{-3}}$ ✓

σ = 284301,61 Pa
σ = 0,284 x 10^6 Pa
σ = 0,284 MPa/ 284 kPa ✓ Any one

(3)

7.1.3 $\text{Strain} = \frac{\text{Changeinlength}}{\text{Originallength}}$
$\varepsilon = \frac{\Delta \ell}{L}$ ✓ Any one

$\varepsilon = \frac{21 \text{x} 10^{-3}}{2{,}02}$ ✓

ε = 0,0104 ✓
OR
ε = 1,04 x 10^{-2} Penalise if the unit is included.
Penaliseer indien die eenheid aangedui is. (3)

7.2 Hooke's law states that within the limit of elasticity,✓ stress is directly proportional to strain. ✓
Hooke se wet bepaal dat druk, binne die grens van elastisiteit, direk eweredig is aan die rekking. (2)

7.3
- Elastic band✓
- Quartz fire in guitar strings✓
- Phosphorus bronze in springs (and cables), (Any two)
  Any other correct answer.
- *Elastiese bande*
- *Kitaarsnare*
- *Fosforbrons in vere (kabels)* (2)

7.4 Viscosity is the property of a fluid to oppose relative motion between two adjacent layers.✓✓
OR
Viscosity is the measure of a fluid's resistance to flow.
Viskositeit is die eienskap van ´n vloeistof om die relatiewe beweging tussen twee aangrensende vlakke teen te werk.
OF
Viskositeit is die mate van weerstand wat n vloeistof bied teen vloei. (2)

7.5

- (Hydraulic) power brakes ✓
- Dentist chairs ✓
- (Hydraulic) lifts
- (Hydraulic) Press
- Car suspension
- (Hydraulic) Pump
- Car jacks
- Steering wheel systems
- Bulldozer's working systems,

Any two

Any other correct answer.

- *(Hidrouliese) remme*
- *Tandarts stoele*
- *(Hidrouliese) hysers*
- *Motor domkrag*
- *(Hidrouliese) stuurwiel stelsels*
- *Voorligters*
- *Motor suspensies*
- *(Hidrouliese) pomp*
- *Stuurwiel stelsels*

(2)

7.6.1

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\text{Area} = \frac{\pi d^2}{4}$ $Area = \frac{\pi(0,04)^2}{4}$ $= 1,257 \times 10^{-3} m^2$ $P_1 = \frac{F_1}{A_1}$ ✓ $P_1 = \frac{260N}{1,257 \times 10^{-3}}$ ✓ = 206841,69 Pa = 2,07 x 10^5 Pa ✓	Area = πr^2 Area = $\pi(0.02)^2$ = 1,257 X 10^{-3} m^2 $P_1 = \frac{F_1}{A_1}$ ✓ $P_1 = \frac{260N}{1,257 \times 10^{-3}}$ ✓ = 206841,69 Pa = 2,07 x 10^5 Pa ✓

OPTION 3/*OPSIE 3*
$P_1 = \frac{F_1}{A_1}$ ✓ $P_1 = \frac{260N}{\pi(0,02)^2}$ ✓ = 206901,43 Pa = 2,07 x 10^5 Pa ✓

(4)

7.6.2 **For Option 2: Positive marking from QUESTION 7.6.1**
Vir Opsie 2: Merk positief vanaf VRAAG 7.6.1

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\text{Area} = \frac{\pi d^2}{4}$ $\text{Area} = \frac{\pi(0{,}16)^2}{4}$ $= 0{,}020\ m^2$ **OR** $\text{Area} = \pi r^2$ $\text{Area} = \pi(0{,}08)^2$ $= 0{,}02\ m^2$ $P_2 = \frac{F_2}{A_2}$ ✓ $206841{,}69$ ✓$= \frac{F_2}{0{,}020}$ ✓ $F_2 = 4136{,}83$ N $= 4{,}14 \times 10^3$ N $= 4{,}14$ kN } ✓ Any one	$\frac{F_1}{A_1} = \frac{F_2}{A_2}$ ✓ $\frac{260}{1{,}257 x 10^{-3}}$ ✓ $= \frac{F_2}{0{,}02}$ ✓ $F_2 = 4136{,}83$ N $F_2 = 4{,}14X10^3$ N $= 4{,}14$ kN } ✓Any ACCEPT: 4136,83 N - 4160,00 N ANVAAR: 4136,83 N - 4160,00 N

(4)
[24]

QUESTION 8/*VRAAG 8*

8.1 A semiconductor is a material which has (electrical) conductivity between that of a conductor and an insulator.✓✓
´n Halfgeleier is ´n stof wat ´n geleidingsvermoë het tussen ´n geleier en ´n nie geleier/isolator. (2)

8.2 Intrinsic (semiconductor)✓/undoped semiconductor
Intrinsieke (halfgeleier)/ongedoteerde halfgeleier. (1)

8.3.1 Doping (process).✓
Dotering (proses) (1)

8.3.2 n-type semiconductor. ✓

During doping there is an excess of a negative charge because of the donated unpaired electron.✓
OR
Pentavalent element/ impurity was added which contributed to an excess of negative charges.
n-*tipe halfgeleier*
Gedurende dotering is daar ´n oormaat van negatiewe lading as gevolg van die ongepaarde elektron wat geskenk was.
OF
Pentavalente element/onsuiwerheid bygevoeg wat bygedra het tot die oormaat negatiewe ladings. (2)

8.4.1 $C = \frac{\varepsilon_o A}{d}$ ✓

$= \frac{(8,85\times10^{-12}\times12,2\times10^{-4})}{3,28\times10^{-3}}$ ✓✓

$= 3,29 \times10^{-12}$ F ✓ (3,29 pF) (4)

8.4.2 Decrease ✓
Verlaag (1)

8.4.3 **Apply negative marking from QUESTION 8.4.2**
Merk neagtief vanaf VRAAG 8.4.2
Capacitance is inversely proportional to the distance between the plates ✓ OR
$(C\ \alpha \frac{1}{d})$
Therefore, if the distance is doubled, capacitance will be halved. ✓
Kapasitansie is omgekeerd eweredig aan die afstand tussen die twee plate. OF
$(C\ \alpha \frac{1}{d})$
Dus, indien die afstand verdubbel, sal die kapasitansie halveer word. (2)

8.5.1 $V = IR$

$I = \frac{V}{R}$ ✓ Any one

$I = \frac{220}{44}$ ✓

$I = 5\ A$ ✓ (3)

8.5.2 Heat produced is directly proportional to (the square of) the current ✓✓
OR
When the current increases, heat produced also increases.
Die warmte wat opgewek is, is direk eweredig aan (die kwadraat van) die stroomsterkte.
OF
Indien die stroomsterkte verhoog sal die warmte wat gevorm word ook meer word. (2)

8.5.3
- (Electric) Heaters ✓
- (Electric) Kettles ✓
- (Electric) irons
- Toasters
- Geysers, **etc**.

Any two

- *(Elektriese) verwarmers*
- *(Elektriese) Ketels*
- *(Elektriese) strykysters*
- *Broodroosters*
- *Warmwatertoestelle,* ***ens*** (2)

[20]

QUESTION 9/*VRAAG 9*

9.1.1 Faraday's Law states that 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 magneetvloed wat met die spoel verbind is verander, word´n emk in die spoel geinduseer. Die grootte van die geinduseerde emk is direk eweredig aan die tempo van verandering van die magnetiese vloed. (2)

9.1.2
- Increase the strength of the magnetic field. ✓
  OR: Use a stronger magnet.
- Increase the number of turns on the coil. ✓
- Increase the speed at which the magnet and coil are moved relative to each other.

Any two

- *Verhoog die magneet sterkte.*
  OF: Gebruik ´n sterker magneet.
- *Verhoog die aantal windings op die spoel.*
- *Verhoog die spoed waarmee die magneet of spoel relatief tot mekaar beweeg.* (2)

9.2 $\Phi = BA$✓
$\Phi = 0,4 \times 0,6$✓
$\Phi = 0,24$ Wb
$\Phi = 240$ mWb
✓ Any one (3)
[7]

QUESTION 10/*VRAAG 10*

10.1.1 A transformer that decreases the voltage. ✓✓
OR
The transformer in which the induced secondary voltage is less than the primary voltage.
OR
Step-down transformer is a transformer with more windings on the primary coil than on the secondary coil
´n Transformator wat die potensiaalverskil verlaag.
OF
´n Verlagingstransformator het meer windings op die primêre as die sekondêre spoel.
OF
Die transformator waarin die geïnduseerde sekondêre potensiaal laer is as die primêre potensiaal. (2)

10.1.2 $\frac{V_s}{V_p} = \frac{N_s}{N_p}$ ✓
$\frac{20}{220} = \frac{48}{N_P}$ ✓
N_p = 528 (turns/ windings) ✓ (3)

ACCEPT: $\frac{V_p}{V_s} = \frac{N_p}{N_s}$

10.2.1 P – Brushes/ Borsels✓
Q – Commutator (segment) ✓ {ACCEPT: Split ring}
Kommutator {Aanvaar: Spleetring} (2)

10.2.2 Q ✓ (1)

10.2.3 In an AC generator, the electrical energy is transferred to the load by means of brushes and <u>slip rings</u> ✓
OR
AC generator produces current that changes direction (every half a cycle).
In ´n WS generator, word die elektriese energie oorgedra na die lading deur die borsels van die sleepringe.
OF
´n WS generator wek ´n stroom op wat (elke halfsiklus) van rigting verander

In an DC generator, the electrical energy is transferred to the load by means of brushes and <u>commutator</u> (split rings) ✓
OR
DC generator produces current that flows in one direction only.
In 'n GS generator, word die elektriese energie oorgedra na die lading deur die borsels van die <u>kommutator</u> (splitring)*.*
OF
´n GS generator wek ´n stroom op wat in een rigting vloei. (2)
[10]

TOTAL/*TOTAAL*: 150