basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE
NASIONALE SENIOR SERTIFIKAAT

GRADE/*GRAAD* 12

TECHNICAL SCIENCES: P1
TEGNIESE WETENSKAPPE: V1

EXEMPLAR/*MODEL* 2018

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

This memorandum consists of 12 pages.
Hierdie memorandum bestaan uit 12 bladsye.

QUESTION 1/*VRAAG* 1

1.1 B ✓✓ (2)

1.2 A ✓✓ (2)

1.3 C ✓✓ (2)

1.4 C ✓✓ (2)

1.5 B ✓✓ (2)

1.6 A ✓✓ (2)

1.7 B ✓✓ (2)

1.8 C ✓✓ (2)

1.9 A ✓✓ (2)

1.10 A ✓✓ (2)

[20]

QUESTION 2/*VRAAG* 2

2.1

2.1.1 Newton's first law. ✓/*Newton se eerste bewegingswet.*

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. ✓/*'n Voorwerp sal in sy toestand van rus of uniforme beweging volhard tensy 'n nie-nul resulterende krag daarop inwerk.* (3)

2.1.2 The passenger's body. ✓/*Die passasier se liggaam.*

- Inertia is determined by the object's mass; the greater an object's mass, the greater is its inertia. ✓/*Traagheid word deur die voorwerp se massa bepaal; hoe groter die massa hoe groter die traagheid.*

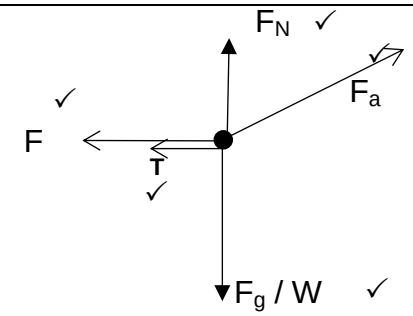
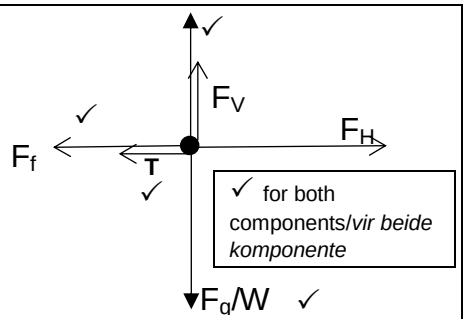
OR/*OF*

- The passenger's body has a bigger mass as compared to the toolbox./*Die passasier se liggaam het 'n groter massa as die gereedskapkis.* (2)

2.2

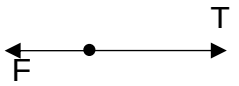
2.2.1 When a net force F_{net} is applied to an object of mass (m) it accelerates in the direction of the net force. This acceleration is directly proportional to the net force ✓ and inversely proportional to the mass of the object. ✓/*Wanneer 'n netto krag* F_{net} *op 'n voorwerp met 'n massa (m) inwerk,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

2.2.2

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

(5)

2.2.3 4 kg block/*4 kg-blok*



$F_{net} = ma$

$T - F_f = ma$

$T - 45 = 4a$ ✓

$T = 4a + 45$

✓ any one of the equations/*enige een van die vergelykings*

4 kg block/7 *kg-blok*

$F_{net} = ma$

$F_aCos30^0 - (T + F_f) = ma$

250x0,866✓ – (4a + 45 ✓ + 45) = 7a✓

216,5 – 90 = 7a + 4a

126,5 = 11a a = 11,5 m.s^{-2} ✓

(6)

2.2.4

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
T = 4a + 45 = 4(11,5) + 45 ✓ = 91 N ✓	$F_aCos30^0 - (T + F_f) = ma$ 250 x 0,866 – (T+ 45) = 7a 216,5 – 45 – T = 7(11,5) ✓ T = 171,5 – 80,5 T = 91 N ✓

(2)

[20]

QUESTION 3/*VRAAG* 3

3.1 When the airbag inflates during the collision the contact time of the passenger or driver with an airbag is longer ✓ than without airbag while the change in momentum remains the same. ✓ Thus the net force on the passenger or driver is reduced ✓ according to the equation $F_{net}=\frac{\Delta p}{\Delta t}$

Indien die lugsak gedurende die botsing opblaas, word die kontaktyd tussen die bestuurder of passasier met die lugsak langer as wat dit sonder die lugsak was, terwyl die verandering in momentum dieselfde bly. Die netto krag op die passasier of bestuurder word dus verminder volgens die vergelyking $F_{net}=\frac{\Delta p}{\Delta t}$ (3)

3.2

3.2.1 Impulse = Δp
Impulse = $p_f - p_i$ ✓

$= (1.5\times10^3\times0)-(1.5\times10^3\times12)$ ✓

$= -1{,}8\times10^4$ N.s

$= 1{,}8\times10^4$ N.s to the right/*regs* ✓

OR/*OF*

$= 1{,}8\times10^4$N.s to the right/*regs* (3)

3.2.2 $F_{net}=\frac{\Delta p}{\Delta t}$ ✓

$= \frac{1{,}8\times10^4}{0{,}15}$ ✓

$=1{,}2\times10^5$ N ✓/120 kN (3)

3.3

3.3.1 The total linear momentum of an isolated system remains constant. ✓✓
OR
The total linear momentum of an isolated system before the collision/ explosion is equal to total momentum after the collision/explosion.
Die totale liniêre momentum in 'n geslote stelsel bly konstant.
OF
Die totale liniêre momentum van 'n geslote stelsel is voor die botsing/ ontploffing gelyk aan die totale liniêre momentum na die botsing/ ontploffing. (2)

3.3.2

$\Delta\vec{p}_{net} = \vec{0}$
$\vec{p}_{T(before)} = \vec{p}_{T(after)}$
$\vec{p}_{il} + \vec{p}_{iw} = \vec{p}_{fl} + \vec{p}_{fw}$
$m_l\vec{v}_{il}+m_w\vec{v}_{iw} = m_l\vec{v}_{fl}+m_w\vec{v}_{fw}$
$(6\,000)(1{,}25)$ ✓ $+(4\,500)(0)$ ✓ $= 6\,000\vec{v}_{fl}+(4\,500)(2{,}5)$ ✓
$7\,500+0 = 6\,000\vec{v}_{fl}+11\,250$
$\vec{v}_{fl} = \frac{-3\,750}{6\,000}$
$\vec{v}_{fl} = -0{,}625$ m·s^{-1}
$\vec{v}_{fl} = 0{,}625$ m·s^{-1} west/*wes* ✓ (5)

✓ For any of the equations/*vir enige een van die vergelykings*

3.3.3 $E_{kTi} = E_{kil} + E_{kiw}$ ✓

$$= \frac{m_l v_{il}^2}{2} + \frac{m_w v_{iw}^2}{2}$$

$$= \frac{(6000)(1,25)^2}{2} + \frac{(4500)(0)^2}{2}$$ ✓

$= 4\,687.5$ J or $= 4{,}687$ k J ✓

$E_{KTf} = E_{Kfl} + E_{Kfw}$

$$= \frac{m_l v_{fl}^2}{2} + \frac{m_w v_{fw}^2}{2}$$

$$= \frac{(6000)(-0,625)^2}{2} + \frac{(4500)(2,5)^2}{2}$$ ✓

$= 15\,234.375$ J **OR/*OF*** $= 15{,}234$ kJ ✓

The collision is inelastic ✓ because kinetic energy is not conserved✓./*Die botsing is onelasties, want die kinetiese energie bly nie behoue nie.* (7)

[23]

QUESTION 4/*VRAAG* 4

4.1

4.1.1 A system in which there are no external forces acting on it. ✓✓/*Geen eksterne kragte werk in op die stelsel nie.*
OR/*OF*
It is a system in which only conservative forces are acting on it./*Dit is 'n stelsel waar slegs konserwatiewe kragte daarop inwerk.* (2)

4.1.2 $E_p = mgh$ ✓

$E_p = 40 \times 9.8 \times 6$✓

$E_p = 2\ 352$ J (Accept/*Aanvaar* 2,352 kJ/2,35 x 10^3 J✓ (3)

4.1.3 $W_{net} = F_{net}\ \Delta x.\cos\Theta$✓

$W_{net} = 250 \times 3$ ✓$\times\cos 0°$✓

$W_{net} = 750$ N✓

4.1.4 Decrease/*Verminder* ✓

- When F is applied at an angle, the net horizontal force acting on an object decreases✓✓; that means the net work done decreases.✓/ *Wanneer F teen 'n hoek toegepas word, verminder die netto horisontale krag wat op 'n voorwerp inwerk, ✓✓; dit beteken die netto werk gedoen, verminder.* (4)

4.2

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

4.2.2

OPTION 1/*OPSIE 1*

$M_{E \text{ at } A} = M_{E \text{ at } B}$
$(K_E + K_P)_{at\ A} = (K_E + K_P)_{at\ B}$
$(\frac{1}{2}mv^2 + mgh)_{at\ A} = (\frac{1}{2}mv^2 mgh)_{at\ B}$
Any one of equations ✓/*Enige een van die vergelykings*

$\left(\frac{1}{2}\right)(65)(0)^2 + (65)(9{,}8)(4{,}5)$✓$= K_{E \text{ at } B} + (65)(9{,}8)(0.35)$ ✓
$2866{,}50 = K_{E \text{ at } B} + 222{,}95$
$K_{E \text{ at } B}$=2 643,55 J✓ accept/*aanvaar* 2,64kJ= $2{,}643 \times 10^3$ J

OPTION 2/*OPSIE 2*

$\Delta E_K = \Delta E_P$
$E_{K(B)} - 0 = mgh(B) - mgh(A)$
✓

E_{K_B} =(65)(9,8)(0,35) ✓ – (65)(9,8)(4,5) ✓

$E_{K(B)}$=222,95-2866,50

$E_{K(B)}$=-2643,55 J
$E_{P \text{ lost}} = E_{P \text{ gained}}$
✓

$E_{K \text{ gained}}$ =2643,55 J= 2.643 kJ= 2.643×10^3 J (4)

4.2.3 $K_{E \text{ at } \mathbf{B}} = \frac{1}{2}mv^2_{\text{at } \mathbf{B}}$ ✓

$2643{,}55 = (\frac{1}{2})(65)(v)^2$✓

$v^2 = 81{,}34$

$V = 9{,}02\ m.s^{-1}$ ✓ (3)
[22]

QUESTION 5/*VRAAG* 5

5.1

5.1.1

$$\text{Stress} = \frac{\text{Force}}{\text{Area}}$$

$$\text{Area} = \frac{\text{force}}{\text{stress}} \quad \checkmark$$

$$= \frac{50\times10^{3}}{6\times10^{6}} \quad \checkmark$$

$$= 8{,}3\times10^{-3}\text{m}^2 \quad \checkmark$$

$$\text{Area} = \frac{\pi d^2}{4}$$

$$d = \sqrt{\frac{\text{Area}\times4}{\pi}} \quad \checkmark$$

$$d = \sqrt{\frac{8{,}3\times10^{-3}\times4}{\pi}} \quad \checkmark$$

$$=0{,}10279 \text{ m}$$

$$=102{,}79 \text{ mm} \quad \checkmark$$

(6)

5.1.2

$$\text{Young's modulus} = \frac{\text{stress}}{\text{strain}}$$

$$\text{strain} = \frac{\text{stress}}{\text{Young's modulus}} \quad \checkmark$$

$$\text{strain} = \frac{6\times10^{6}}{70\times10^{9}} \quad \checkmark$$

$$=8{,}57\times10^{-5} \quad \checkmark$$

(3)

5.1.3 $$\text{Strain} = \frac{\text{change in length}}{\text{original length}}$$

change in length= strain ×original length ✓

change in length= $8{,}57\times10^{-5}$ ×200 ✓

=0,01714 mm
=1,714×10^{-2} mm
=1,714 ×10^{-5}m

✓ any one/*enige een*

(3)

5.2 Viscosity is the property of the fluid to oppose relative motion between the two adjacent layers. ✓✓/*Viskositeit is die eienskap van die vloeistof om die relatiewe beweging tussen die twee aangrensende lae teen te staan.* (2)

5.3 $\frac{F_1}{A_1} = \frac{F_2}{A_2}$

$F_1 = \frac{F_2 x\ A_1}{A_2}$ ✓

$F_1 = \frac{450 \times 5{,}13 \times 10^{-4}}{6{,}5 \times 10^{-3}}$ ✓

$= 35{,}52\ N$ ✓ (3)

5.4

OPTION 1/*OPSIE 1*	OPTION 2/*OPSIE 2*
$Area = \pi r^2$ ✓ $= \pi\ (0{,}015)^2$ ✓ $= 7{,}06\ \times 10^{-4}\ m^2$ ✓	$Area = \frac{\pi d^2}{4}$ ✓ $= \frac{\pi(0.03)^2}{4}$ ✓ $= 7{,}06\ \times 10^{-4}\ m^2$ ✓

(3)
[20]

QUESTION 6/*VRAAG* 6

6.1 Doping is the process of adding impurities to intrinsic semiconductors. ✓✓/ *Doepatoevoeging/Dotering ('Doping') is die proses om onsuiwerhede by intrinsieke halfgeleiers toe te voeg.* (2)

6.2 Silicon is a pure semiconductor as impurity atoms must be added to improve conductivity or a pure semiconductor which is undoped.✓✓/*Silikon is 'n suiwer halfgeleier aangesien onsuiwerheidsatome bygevoeg moet word om geleidingsvermoë of 'n suiwer halfgeleier te verbeter wat ongedoop/ ongedoteer is.* (2)

6.3

6.3.1 P-type semiconductor ✓/P-halfgeleier (1)

6.3.2 A diode allows current flow in one direction only./*'n Diode laat stroomvloei slegs in een rigting toe.* ✓ (1)

6.4

6.4.1 $C = \varepsilon_0 \frac{A}{d}$. ✓

$C = 8.85 \times 10^{-12} \frac{0.25}{1.00 \times 10^{-3}}$ ✓

$C = 2\ 212{,}5 \times 10^{-12} F$ ✓
$= 2{,}213\ 10^{-9}\ F$
$= 2{,}213\ nF$ (3)

6.4.2

$C = \frac{Q}{V}$
$Q = CV$
✓ any one/*enige een*

$Q = 2.213 \times 10^{-9} \times 3 \times 10^{3}$ ✓
$Q = 6.638 \times 10^{-6}$ C ✓
$= 6.63\ \mu C$ (3)

6.4.3 (Any two/*Enige twee*)
- Plate area/*Plate-area* ✓
- Plate spacing/*Plate-spasiëring* ✓
- Dielectric material/*Diëlektriese materiaal* (2)

6.5

6.5.1 Series.✓ The current decreased as more light bulbs where added./*Die stroom het afgeneem omdat meer gloeilampe bygevoeg is.* ✓ (2)

6.5.2 Power is directly proportional to the current drawn./*Krag is direk eweredig aan die stroomsterkte* ✓ **OR/OF** $P \propto I$ (1)

6.5.3

$P = V \times I$ ✓	$P = V \times I$	**OR/OF**	$P = V \times I$
$= 2{,}70 \times 0{,}18$ ✓	$= 2{,}7 \times 0{,}22$ ✓		$= 2{,}7 \times 0{,}3$ ✓
$= 0{,}486$ W ✓	$= 0{,}594$ W ✓		$= 0{,}81$ W ✓

(5)

6.5.4

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$R = \frac{V}{I}$ ✓ $R = \frac{2{,}70}{0{,}18}$ $R = 15\ \Omega$ ✓ $W = I^2 R \Delta t$ $= (0.18)^2 \times 15(120)$ ✓ $= 58{,}32\ J$ ✓	$P = \frac{W}{t}$ ✓ W = P x t $W = 0{,}486$ ✓$\times\ 120$ ✓ $W = 58{,}32\ J$ ✓
OPTION 3/*OPSIE 3*	**OPTION 4/*OPSIE 4***
$W = VIt$ ✓ $W = 2{,}70 \times 0{,}18$ ✓$\times 120$ ✓ $W = 58{,}32\ J$ ✓	$R = \frac{V}{I}$ $R = \frac{2{,}70}{0{,}18}$ $R = 15\ \Omega$ ✓ $W = \frac{V^2 t}{R}$ ✓ $= \frac{(2{,}70)^2 \times 120}{15}$ ✓ = 58,32 J ✓

(4)
[26]

QUESTION 7/*VRAAG* 7

7.1

7.1.1 From H to G✓/*Van H na G* (1)

7.1.2 Magnetic flux density is the number of field lines perpendicular through the unit area./*Magnetiesevloed-digtheid is die aantal veldlyne loodreg deur die eenheidsarea.*
OF/*OR*
Magnetic flux is the number of magnetic field lines per unit area./*Magnetiese vloed is die aantal magneetveldlyne per eenheidsarea.* ✓✓ (2)

7.1.3 Area=πr²
$=3,142\times(0,0225)^2$✓
$= 1,59\times10^{-3}\ m^2$✓

$B = \frac{\phi}{A}$ ✓
$= \frac{90\times10^{-3}}{1,59\times10^{-3}}$✓
$= 56,57\ T$ ✓ (5)

7.2

7.2.1 Whenever there is a change in the magnetic field linked with the conductor, the emf is induced in the conductor. The magnitude of this emf is proportional to the rate of change in the magnetic flux linkage with the conductor./*Wanneer daar 'n verandering in die magnetiese veld is wat aan die geleier gekoppel word, word die emk in die geleier geïnduseer. Die grootte van hierdie emk is eweredig aan die tempo van verandering in die magnetiese vloedkoppeling met die geleier.* ✓✓ (2)

7.2.2 $\varepsilon = -N\frac{\Delta\phi}{\Delta t}$✓

$= -11\frac{14}{12}$✓
$=-12,8\ V$✓ (3)

7.2.3 (Any two/*Enige twee*)
- The strength of the magnetic field. ✓/*Die sterkte van die magnetiese veld.*
- The number of turns on the coil. ✓/*Die aantal draaie op die spoel.*
- The speed at which the magnet or solenoid are moved relative to each other./*Die spoed waarteen die magneet of solenoïed relatief tot mekaar beweeg word.* (2)

[15]

QUESTION 8/*VRAAG* 8

8.1

8.1.1 Split-ring or commutator/
Gesplete ringkommutator (Splitringkommutator) of kommutator ✓ (1)

8.1.2 Coil or armature/*Spoel of anker* ✓ (1)

8.2 Can be transmitted over long distances without major energy loss. ✓
The voltage can be increased/stepped up or decreased/stepped down./*Kan oor lang afstande oorgedra word sonder groot energieverlies. Die spanning kan verhoog of verlaag word.* ✓ (2)
[4]

TOTAL/*TOTAAL*: 150