



**NATIONAL
SENIOR CERTIFICATE/
NASIONALE
SENIOR SERTIFIKAAT**

GRADE/GRAAD 12

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

MARKS/PUNTE: 150

This marking guideline consists of 13 pages./
Hierdie nasienriglyn bestaan uit 13 bladsye

QUESTION / VRAAG 1

- | | | |
|------|------|-------------|
| 1.1 | D ✓✓ | (2) |
| 1.2 | B ✓✓ | (2) |
| 1.3 | A ✓✓ | (2) |
| 1.4 | D ✓✓ | (2) |
| 1.5 | C ✓✓ | (2) |
| 1.6 | A ✓✓ | (2) |
| 1.7 | B ✓✓ | (2) |
| 1.8 | A ✓✓ | (2) |
| 1.9 | A ✓✓ | (2) |
| 1.10 | C ✓✓ | (2) |
| | | [20] |

QUESTION / 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. ✓ /
'n Voorwerp sal in rus bly of aanhou beweeg teen 'n konstante snelheid (of teen 'n konstante spoed in 'n reguit lyn) ✓ *tensy dit deur 'n nie-nul eksterne resulterende krag inwerk.* ✓ (2)

2.2.1 **OPTION / OPSIE 1**

$$F_y = 120 \sin 30^\circ \checkmark$$

$$= 60 \text{ N} \checkmark$$

OPTION / OPSIE 2

$$F_y = 120 \cos 60^\circ \checkmark$$

$$= 60 \text{ N} \checkmark$$

2.2.2 **OPTION / OPSIE 1**

Apply positive marking from question 2.2.1 /
Pas positiewe nasien toe van vraag 2.2.1

$$f_k = \mu_k N \checkmark$$

$$= 0,13 \checkmark [(12 \times 9,8) - 120 \sin 30^\circ] \checkmark$$

$$= 7,49 \text{ N (to the right/ na regs)} \checkmark$$

NOTE: Credit if $120 \sin 30^\circ$ is expressed as 60/
LET WEL: Gee krediet indien $120 \sin 30^\circ$ as 60 uitgedruk word.

OPTION / OPSIE 2

Apply positive marking from question 2.2.1/
Pas positiewe nasien toe van vraag 2.2.1

$$N = mg - F_y$$

$$N = (12 \times 9,8) - 120 \sin 30^\circ \checkmark$$

$$= 117,6 - 60$$

$$= 57,6 \text{ N}$$

$$f_k = \mu_k N \checkmark$$

$$= 0,13 \checkmark \times 57,6$$

$$= 7,49 \text{ N (to the right/ na regs)} \checkmark$$

NOTE: Credit if 57,6 N is expressed as $117,6 - 60$ /
LET WEL: Gee krediet indien 57,6 N uitgedruk word as $117,6 - 60$

2.2.3 **POSITIVE MARKING FROM QUESTION 2.2.2 / POSITIEWE NASIEN VAN VRAAG 2.2.2**

$$\left. \begin{array}{l} F_{\text{net}} = ma \\ F_x + f_k = ma \end{array} \right\} \text{Any one/ Enige een} \checkmark$$

$$\frac{60 \cos 30^\circ + (-3,74)}{a} \checkmark = 6a \checkmark$$

$$a = 8,04 \text{ m.s}^{-2} \text{ to the left/ na links} \checkmark$$

(4)

2.3 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./

—

Neem af ✓

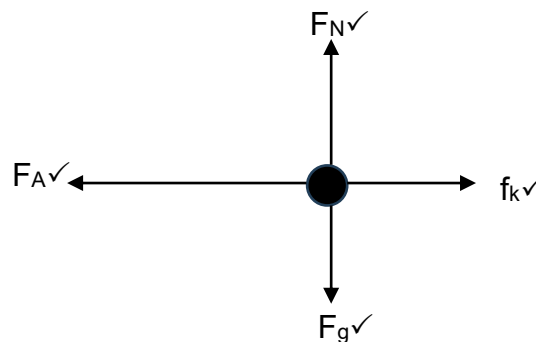
Die vertikale komponent (F_y) sal toeneem en dus sal die normaalkrag afneem. ✓✓

OF

Die krag sal geneig wees om die voorwerp van die oppervlak op te lig en sodoende die wrywing te verminder. (3)

- 2.4 2.4.1 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, oefen voorwerp **B** gelyktydig 'n teenoorgestelde gerigte krag van gelyke grootte op voorwerp **A** uit. (2)

2.4.2



NOTES:

One mark for each force represented by an arrow with a correct label.

Penalise ONCE for each of the following:

- No arrows
- There is no dot
- Gap between the line and the dot
- Dotted lines are used
- A force diagram is given
- Extra force is given /

NOTAS:

Een punt vir elke krag wat deur 'n pyl met 'n korrekte etiket voorgestel word.

Penaliseer EEN KEER vir elk van die volgende:

- *Geen pyle nie*
- *Daar is geen kolletjie nie*
- *Gaping tussen die lyn en die kolletjie*
- *Gestippelde lyne word gebruik*
- *'n Kragtediagram word gegee*
- *Ekstra krag word gegee*

Acceptable labels:

N/F_N : Normal

F_g/w : Force due to

gravity/Weight/

$F/F_A/F_{car}$: Applied force/

$f_k/F_f/f$: frictional force/

NOTE: ACCEPT if F_T/T is used in place of applied force./

Aanvaarbare etikette:

N/F_N : Normaal

F_g/w : Krag as gevolg van

swaartekrag/Gewig/

$F/F_A/F_{car}$: Toegepaste krag/

$f_k/F_f/f$: wrywingskrag/

LET WEL: AANVAAR as F_T/T in plaas van toegepaste krag gebruik word. /

(4)

[21]

QUESTION / VRAAG 3

- 3.1 The product of the resultant/net force acting on an object and the time the net force acts on the object. ✓✓ /

Die produk van die resulterende/netto krag wat op 'n voorwerp inwerk en die tyd wat die netto krag op die voorwerp inwerk.

(2)

3.2 OPTION / OPSIE 1

Positive to the right/Positief na regs

$$\begin{aligned} \text{Impulse} &= \Delta p \\ F_{\text{net/netto}} \Delta t &= \Delta p \quad \left. \begin{array}{l} \text{Any one/ Enige} \\ \text{een} \end{array} \right\} \checkmark \\ &= m(v_f - v_i) \\ &= 0,08 \checkmark (32,5 - (-20)) \checkmark \\ &= 4,2 \text{ kg} \cdot \text{m} \cdot \text{s}^{-1} \text{ to the right./} \\ &\quad \text{na regs} \checkmark \end{aligned}$$

OPTION / OPSIE 2

Positive to the left / Positief na links

$$\begin{aligned} \text{Impulse} &= \Delta p \\ F_{\text{net/netto}} \Delta t &= \Delta p \quad \left. \begin{array}{l} \text{Any one/Enige een} \end{array} \right\} \checkmark \\ &= m(v_f - v_i) \\ &= 0,08 \checkmark (-32,5 - 20) \checkmark \\ &= -4,2 \\ &= 4,2 \text{ kg} \cdot \text{m} \cdot \text{s}^{-1} \text{ to the right/} \\ &\quad \text{na regs} \checkmark \end{aligned}$$

(4)

3.3 POSITIVE MARKING FROM 3.2/ POSITIEWE NASIEN VAN 3.2**OPTION / OPSIE 1**

$$\begin{aligned} F_{\text{net}} &= \frac{\Delta p}{\Delta t} \checkmark \\ &= \frac{4,2}{2 \times 10^{-3}} \checkmark \\ &= 2100 \text{ N} \checkmark \end{aligned}$$

POSITIVE MARKING FROM 3.2/ POSITIEWE NASIEN VAN 3.2**OPTION / OPSIE 2**

$$\begin{aligned} F_{\text{net}} &= \frac{\Delta p}{\Delta t} \checkmark \\ &= \frac{-4,2}{2 \times 10^{-3}} \checkmark \\ &= 2100 \text{ N} \checkmark \end{aligned}$$

OPTION / OPSIE 3

$$\begin{aligned} a &= \frac{v_f - v_i}{\Delta t} \\ &= \frac{32,5 - (-20)}{2 \times 10^{-3}} \checkmark \\ &= 26250 \text{ m} \cdot \text{s}^{-2} \end{aligned}$$

$$\begin{aligned} F_{\text{net}} &= ma \checkmark \\ &= 0,08 \times 26250 \\ &= 2100 \text{ N} \checkmark \end{aligned}$$

(3)

- 3.4 3.4.1 The total linear momentum in an isolated system ✓ remains constant/is conserved in magnitude and direction. ✓

OR

In an isolated system, the total momentum before a collision/explosion is equal to the total momentum after the collision/explosion in magnitude and direction. /

Die totale lineêre momentum in 'n geïsoleerde stelsel ✓ bly konstant/ word behou in grootte en rigting. ✓

OF

In 'n geïsoleerde stelsel is die totale momentum voor 'n botsing/ontploffing gelyk aan die totale momentum na die botsing/ontploffing in grootte en rigting.

(2)

3.4.2 $\Sigma p_{\text{before}} = \Sigma p_{\text{after}}$

$$m_1 v_{i1} + m_2 v_{i2} = m_1 v_{f1} + m_2 v_{f2}$$

$$(1)(5) + (1,8)(2,5) \checkmark = (1)(v_{1f}) + (1,8)(3) \checkmark$$

$$5 + 4,5 = v_{1f} + 5,4$$

$$4,1 = v$$

$$\therefore v_{1f} = 4,1 \text{ m}\cdot\text{s}^{-1} \text{ to the right } \checkmark / \text{ in the direction of motion. /}$$

na regs/ in rigting van beweging

(4)

3.4.3 **POSITIVE MARKING FROM 3.4.2 / POSITIEWE NASIEN VAN 3.4.2**

$$\begin{aligned} \Sigma E_{k\text{before/voor}} &= \frac{1}{2} m_1 v_i^2 + \frac{1}{2} m_2 v_i^2 \checkmark & \Sigma E_{k\text{after/na}} &= \frac{1}{2} m_1 v_f^2 + \frac{1}{2} m_2 v_i^2 \\ &= \frac{1}{2} (1)(5)^2 + & &= \frac{1}{2} (1)(4,1)^2 + \frac{1}{2} (1,8) \times (3)^2 \checkmark \\ &\frac{1}{2} (1,8)(2,5)^2 \checkmark & &= 16,51 \text{ J} \\ &= 18,13 \text{ J} \end{aligned}$$

$$\Sigma E_{k\text{before/voor}} \neq \Sigma E_{k\text{after/na}} \checkmark$$

$\therefore$ Inelastic $\checkmark$ / Onelasties

(5)
[20]

QUESTION / VRAAG 4

- 4.1 4.1.1 Total mechanical energy (sum of gravitational potential energy and kinetic energy) in an isolated system ✓ remains constant. ✓ / Totale meganiese energie (som van gravitasiepotensiële energie en kinetiese energie) in 'n geïsoleerde stelsel bly konstant. (2)

4.1.2 $E_p = mgh$ ✓
 $= (2)(9,8)(1,2)$ ✓
 $= 23,52 \text{ J}$ ✓ (3)

- 4.1.3 **POSITIVE MARKING FROM QUESTION 4.1.2 / POSITIEWE NASIEN VAN VRAAG 4.1.2**

$ME = E_p + E_k$ ✓
 $= 23,52$ ✓ + $(\frac{1}{2})(2)(0,88)^2$ ✓
 $= 24,29 \text{ J}$ ✓ (4)

- 4.1.4 **POSITIVE MARKING FROM QUESTION 4.1.3 / POSITIEWE NASIEN VAN VRAAG 4.1.3**

$ME \text{ at/by C} = ME \text{ at/by B}$
 $(E_p + E_k)_{\text{at C}} = (E_p + E_k)_{\text{at B}}$ ✓
 $0 + (\frac{1}{2})(2)v^2$ ✓ = $24,29$ ✓
 $v = 4,93 \text{ m.s}^{-1}$ ✓ (4)

- 4.2 Power is the rate at which work is done. ✓✓

OR

Power is the rate at which energy is expended/ transferred./

Drywing is die tempo waarteen arbeid verrig word.

OF

Drywing is die tempo waarteen energie verbruik/oorgedra word. (2)

- 4.3 $P_{\text{avel/gemidd}} = Fv_{\text{avel/gemidd}}$ ✓
 43000 ✓ = $F(2)$ ✓
 $F = 21500 \text{ N}$ ✓ (4)

[19]

QUESTION / VRAAG 5**5.1 5.1.1 OPTION / OPSIE 1**

$$\begin{aligned}
 \text{Area} &= \frac{\pi D^2}{4} \\
 &= \frac{\pi(2,5 \times 10^{-3})^2}{4} \checkmark \\
 &= 4,909 \times 10^{-6} \text{m}^2 \\
 \sigma &= \frac{F}{A} \checkmark \\
 &= \frac{16}{4,909 \times 10^{-6}} \checkmark \\
 &= 3,26 \times 10^6 \text{Pa} \checkmark
 \end{aligned}$$

OPTION / OPSIE 3

$$\begin{aligned}
 \sigma &= \frac{F}{A} \checkmark \\
 &= \left[\frac{16}{\pi \left(\frac{2,5 \times 10^{-3}}{2} \right)^2} \right] \checkmark \\
 &= 3,26 \times 10^6 \text{Pa} \checkmark
 \end{aligned}$$

OPTION / OPSIE 2

$$\begin{aligned}
 A &= \pi r^2 \\
 &= \pi(1,25 \times 10^{-3})^2 \checkmark \\
 &= 4,909 \times 10^{-6} \text{m}^2 \\
 \sigma &= \frac{F}{A} \checkmark \\
 &= \frac{16}{4,909 \times 10^{-6}} \checkmark \\
 &= 3,26 \times 10^6 \text{Pa} \checkmark
 \end{aligned}$$

OPTION / OPSIE 4

$$\begin{aligned}
 \sigma &= \frac{F}{A} \checkmark \\
 &= \left[\frac{16}{\pi(1,25 \times 10^{-3})^2} \right] \checkmark \\
 &= 3,26 \times 10^6 \text{Pa} \checkmark
 \end{aligned}$$

(4)

5.1.2 OPTION / OPSIE 1

$$\begin{aligned}
 \varepsilon &= \frac{\Delta l}{L} \checkmark \\
 &= \frac{0,5}{3 \times 10^3} \checkmark \\
 &= 1,666 \times 10^{-4} \checkmark
 \end{aligned}$$

NOTE: Penalise if the unit is given./**LET WEL:** Penaliseer as eenheid gegee word**OPTION / OPSIE 2**

$$\begin{aligned}
 \varepsilon &= \frac{\Delta l}{L} \checkmark \\
 &= \frac{5 \times 10^{-4}}{3} \checkmark \\
 &= 1,666 \times 10^{-4} \checkmark
 \end{aligned}$$

NOTE: Penalise if the unit is given./**LET WEL:** Penaliseer as eenheid gegee word

(3)

5.1.3 POSITIVE MARKING FROM QUESTION 5.1.1 AND QUESTION 5.1.2/ POSITIEWE NASIEN VAN VRAAG 5.1.1 EN VRAAG 5.1.2

$$\begin{aligned}
 K &= \frac{\sigma}{\varepsilon} \checkmark \\
 &= \frac{3,26 \times 10^6}{1,666 \times 10^{-4}} \checkmark \\
 &= 1,956 \times 10^{10} \text{Pa} \checkmark
 \end{aligned}$$

(3)

- 5.2 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 eenheidsoppervlakte rondom daardie punt inwerk.

LET WEL: Moenie penaliseer as krag in plaas van stukrag gebruik word nie. (2)

$$5.2.2 \quad P = \frac{F}{A} \checkmark$$

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

$$= 3,3099 \times 10^5 Pa \checkmark \quad (3)$$

5.2.3 **OPTION 1 / OPSIE 1**

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

$$\frac{26}{7,855 \times 10^{-5}} = \frac{1278}{A_2} \checkmark$$

$$= 3,861 \times 10^{-3} \checkmark$$

OPTION 2 / OPSIE 2

$$P = \frac{F_2}{A_2} \checkmark$$

$$3,3099 \times 10^5 = \frac{1278}{A_2} \checkmark$$

$$= 3,861 \times 10^{-3} Pa \checkmark$$

(3)
[18]

QUESTION / VRAAG 6

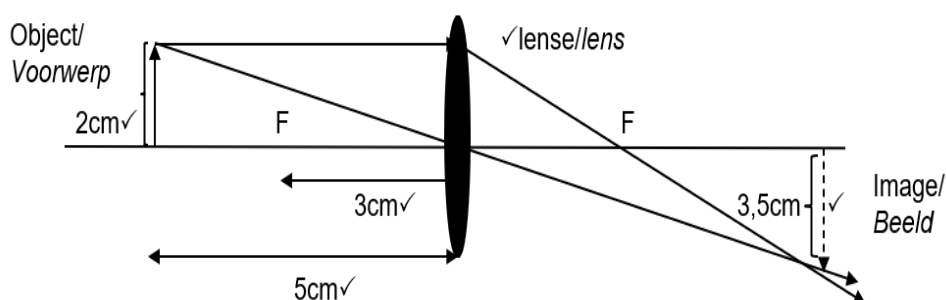
6.1 6.1.1 critical angle ✓ / *grenshoek* (1)

6.1.2 Total internal reflection will take place. ✓✓ /
Totale interne weerkaatsing sal plaasvind. (2)

6.1.3 The incident angle must be more than the critical angle. ✓ **ANY ONE**
The light must move from a higher dense medium to a lower dense medium. ✓/

Die invalshoek moet meer as die kritieke hoek wees. **ENIGE EEN**
Die lig moet van 'n hoër digte medium na 'n laer digte medium beweeg. (1)

6.2 6.2.1



(5)

MARKING CRITERIA / NASIEN KRITERIA

Object is 2 cm tall upright ✓ / <i>Voorwerp is 2 cm hoog regop</i>	1
Object is 5 cm from convex lens midpoint. ✓ / <i>Voorwerp is 5 cm vanaf die konvekse lens se middelpunt.</i>	1
Convex lens ✓ / <i>Konvekse lens</i>	1
Focal point 3 cm from lens midpoint ✓ / <i>Fokuspunt 3 cm vanaf die lens se middelpunt</i>	1
Image is 3 cm-3,6 cm downwards ✓ / <i>Beeld is 3 cm-3,6 cm afwaarts</i>	1
Maximum mark/ Maksimum punt	5

- 6.2.2
- Image is upside down/inverted ✓ / *Beeld is onderstebo/omgekeerd*
 - Image is bigger/Enlarged/Magnified ✓ / *Beeld is groter/Vergroot*
 - Image is real ✓ / *Beeld is werklik*

(3)
[12]

QUESTION / VRAAG 7

7.1 It is a quantum of energy (light). ✓✓/ *Dit is 'n kwantum van energie (lig).* (2)

7.2 $E = h f$ ✓
 $E = 6,63 \times 10^{-34} \times 750 \times 10^{14}$ ✓
 $E = 4,97 \times 10^{-17} \text{ J}$ ✓ (3)

7.3 (Radiography) To observe bone structures.
 (Mammography) used to screen breast cancer.
 CT Scans
 (Radiotherapy) killing cancer cells.
ACCEPT: Any other correct answer. /

✓ **ANY ONE**

*(Radiografie) Om beenstrukture waar te neem.
 (Mammografie) word gebruik om borskanker te ondersoek.
 CT-skanderings.
 (Radioterapie) wat kankerselle doodmaak.
AANVAAR: Enige ander korrekte antwoord.*

✓ **ENIGE EEN**

(1)
[6]

QUESTION / VRAAG 8

8.1 A device for storing electrical charge. ✓✓/ *'n Toestel wat elektriese lading stoor.* (2)

8.2 $C = \frac{\epsilon_0 \times A}{d}$ ✓
 $C = \frac{8,85 \times 10^{-12} \times 0,3}{0,15}$ ✓
 $C = 1,77 \times 10^{-11} \text{ F}$ ✓ (3)

8.3 Increase the area. ✓/ *Vergroot die area.*
 Decrease the distance between the plates. ✓/ *Verminder die afstand tussen die plate.*
 Use material with high dielectric constant. ✓/ *Gebruik materiaal met 'n hoë diëlektriese konstante.* (3)
[8]

QUESTION / VRAAG 9

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

Die potensiaalverskil oor die geleier is direk eweredig aan die stroom in die geleier teen konstante temperatuur.

(2)

$$\begin{aligned} 9.2 \quad 9.2.1 \quad \frac{1}{R_p} &= \frac{1}{R_1} + \frac{1}{R_2} \checkmark \\ &= \frac{1}{4} + \frac{1}{3} \checkmark \\ R_p &= 1,71 \, \Omega \end{aligned}$$

$$\begin{aligned} R_t &= R_s + R_p \\ R_t &= 2 + 1,71 \checkmark \\ R_t &= 3,71 \, \Omega \checkmark \end{aligned}$$

(4)

9.2.2 **POSITIVE MARKING FROM QUESTION 9.2.1/
POSITIEWE NASIEN VAN VRAAG 9.2.1**

$$\begin{aligned} R &= \frac{V}{I} \checkmark \\ 3,71 &= \frac{24}{I} \checkmark \\ I &= 6,47 \, \text{A} \checkmark \end{aligned}$$

(3)

9.2.3 **POSITIVE MARKING FROM QUESTION 9.2.1 AND QUESTION 9.2.2/
POSITIEWE NASIEN VAN VRAAG 9.2.1 EN VRAAG 9.2.2**

$$\begin{aligned} R &= \frac{V}{I} \\ 1,71 \checkmark &= \frac{V}{6,47} \checkmark \\ V &= 11,06 \, \text{V} \checkmark \end{aligned}$$

(3)

- 9.3 The rate at which electrical energy is converted in an electric circuit. ✓✓/ *Die tempo waarteen elektriese energie in 'n elektriese stroombaan omgeskakel word.*

(2)

9.4 **POSITIVE MARKING FROM QUESTION 9.2.2 AND QUESTION 9.2.3/
POSITIEWE NASIEN VAN VRAAG 9.2.2 EN VRAAG 9.2.3**

OPTION / OPSIE 1

$$\begin{aligned} P &= I^2 R \checkmark \\ &= (6,47^2)(2) \checkmark \\ &= 83,72 \, \text{W} \checkmark \end{aligned}$$

OPTION / OPSIE 3

$$\begin{aligned} P &= VI \checkmark \\ &= (12,94)(6,47) \checkmark \\ &= 83,72 \, \text{W} \checkmark \end{aligned}$$

OPTION / OPSIE 2

$$\begin{aligned} V_s &= V_t - V_p \\ V_s &= 24 - 11,06 \\ V_s &= 12,94 \, \text{V} \end{aligned}$$

$$\begin{aligned} P &= \frac{V^2}{R} \checkmark \\ &= \frac{(12,94^2)}{2} \checkmark \\ P &= 83,72 \, \text{W} \checkmark \end{aligned}$$

(3)

[17]

QUESTION / VRAAG 10

10.1 10.1.1 Step-up transformer ✓/ *verlagingstransformator* (1)

10.1.2 The input voltage is lower than the output voltage. ✓✓

OR

Primary voltage is lower than secondary voltage./

Die insetspanning is laer as die uitsetspanning.

OF

Primêre spanning is laer as sekondêre spanning.

(2)

$$10.1.3 \quad \frac{V_s}{V_p} = \frac{N_s}{N_p} \checkmark$$

$$\frac{V_s}{240000} = \frac{50}{500} \checkmark$$

$$V_s = 24000V \checkmark$$

(3)

10.2 10.2.1 AC motor ✓/ *WS motor* (1)

10.2.2 Electrical energy is converted to mechanical energy. ✓✓ /
Elektriese energie word omgeskakel na meganiese energie.

(2)

[9]

TOTAL: 150