



# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE/  
NASIONALE  
SENIOR SERTIFIKAAT**

**GRADE/GRAAD 11**

**PHYSICAL SCIENCES: PHYSICS (P1)  
FISIESE WETENSKAPPE: FISIKA (V1)**

**NOVEMBER 2017**

**MARKING GUIDELINES/NASIENRIGLYNE**

**MARKS/PUNTE: 150**

**These marking guidelines consist of 14 pages.  
*Hierdie nasienriglyne bestaan uit 14 bladsye.***

**QUESTION/VRAAG 1**

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

**QUESTION/VRAAG 2**

2.1 The vector sum of two or more vectors. ✓✓  
 Die vektorsom van twee of meer vektore. ✓✓

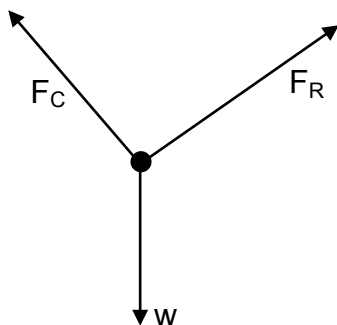
**OR/OF**

The single vector which has the same effect as two or more vectors together.

Die enkele vektor met dieselfde effek as twee of meer vektore saam. (2)

2.2 0 N ✓ (1)

2.3



(3)

Notes: Accepted Labels/Aanvaarbare Byskrifte		Mark/Punt
w	weight/ $F_G/F_g$ gewig/gravitasiekrag/swaartekrag	✓
$F_C$	Tension in cable/ $T_C$ Spanning in kabel/ $T_C$	✓
$F_R$	Tension in rope/ $T_R$ Spanning in tou/ $T_R$	✓
	Any additional force: deduct 1 mark (maximum $\frac{2}{3}$ ) Enige addisionele krag: trek 1 punt af (maksimum $\frac{2}{3}$ )	
	Lines must touch object otherwise (maximum $\frac{2}{3}$ ) Lyne moet voorwerp raak anders (maksimum $\frac{2}{3}$ )	

2.4 200 N ✓ (1)

2.5  $F_{RY} = \frac{200}{\tan 35^\circ} = 285,63 \text{ N} \checkmark$

$F_g = mg = 56(9,8) = 548,8 \text{ N} \checkmark$

$F_{RY} + F_{CY} = F_g$

$285,63 + F_{CY} = 548,8 \checkmark$

$F_{CY} = 263,17 \text{ N} \checkmark$

(4)

2.6 **POSITIVE MARKING FROM QUESTION 2.4 and 2.5**

**POSITIEWE NASIEN VANAF VRAAG 2.4 en 2.5**

$\tan \theta = \frac{263,17}{200} \checkmark$

$\theta = 52,77^\circ \checkmark$

(2)

**[13]**

**QUESTION/VRAAG 3**

3.1	Criteria for hypothesis/Riglyne vir hipotese	
	The dependent and independent variables are stated correctly. <i>Die afhanklike en onafhanklike veranderlikes korrek genoem.</i>	✓
	State the relationship between the dependent and independent variables. <i>Stel die verwantskap tussen die afhanklike en onafhanklike veranderlike.</i>	✓
	Dependent variable/afhanklike veranderlike: acceleration/versnelling Independent variable/onafhanklike veranderlike: (net) force/(netto) krag	

Example/Voorbeeld:

The (net) force is directly proportional to acceleration if the mass of the trolley is kept constant ✓✓

*Die (netto) krag is direk eweredig aan die versnelling indien die massa van die trollie konstant bly. ✓✓*

(2)

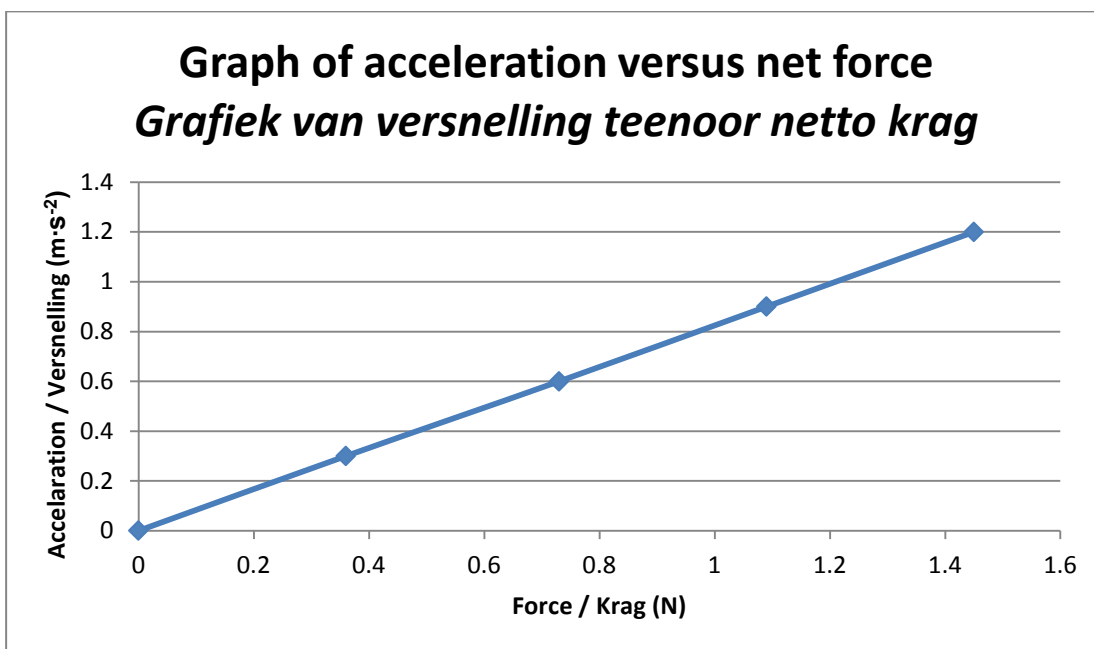
3.2.1 (Net) Force ✓  
(Netto) Krag ✓

(1)

3.2.2 Mass of trolley ✓  
Massa van die trollie ✓

(1)

3.3



Refer to back of memo for graph drawn to scale

*Verwys na die laaste bladsy van memorandum vir skaalgrafiek*

Marking criteria for graph <i>Nasienkriteria vir grafiek</i>	
Axes with correct/appropriate scale <i>Asse met korrekte/toepaslike skaal</i>	✓
3 or more coordinates correctly plotted <i>3 of meer koördinate korrek gestip</i>	✓✓
Drawing a line of best fit <i>Teken 'n lyn van beste passing</i>	✓

(4)

- 3.4 Accept any set of coordinates from the graph, for example:  
*Aanvaar enige kombinasie van koördinate vanaf die grafiek, byvoorbeeld:*

$$\text{gradient} = \frac{1,45 - 0,36}{1,2 - 0,3} \checkmark = 1,21 \checkmark$$

**OR/OF**

$$\text{gradient} = \frac{1,09 - 0}{0,9 - 0} = 1,21 \checkmark$$

**OR/OF**

$$\text{gradient} = \frac{0,73 - 0}{0,6 - 0} = 1,22 \checkmark$$

**OR/OF**

$$\text{gradient} = \frac{0,36 - 0}{0,3 - 0} = 1,2 \checkmark$$

(3)

- 3.5 **POSITIVE MARKING FROM QUESTION 3.4**  
**POSITIEWE NASIEN VANAF VRAAG 3.4**

$$\text{Gradient} = \frac{a}{F} = \frac{1}{m}$$

$$m = \frac{1}{1,21} \checkmark = 0,83 \text{ kg } \checkmark$$

(2)

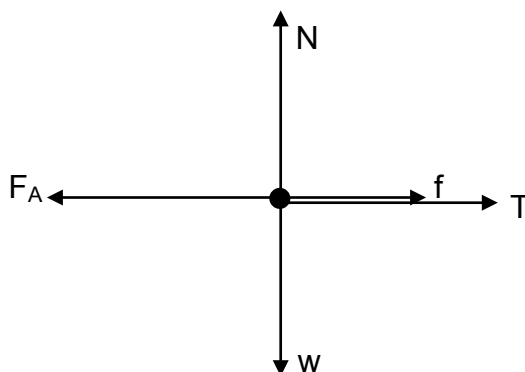
**[13]**

**QUESTION/VRAAG 4**

4.1 Frictional force is the force that opposes the motion of an object and which acts parallel to the surface. ✓✓  
*Wrywingskrag is die krag wat die beweging van 'n voorwerp teenstaan en ewewydig aan die oppervlak inwerk.* ✓✓ (2)

4.2 Newton's Third law: ✓ When object A exerts a force on object B, object B simultaneously exerts an oppositely directed force of equal magnitude on object A. ✓✓  
*Newton se Derde wet: ✓ Wanneer voorwerp A 'n krag op voorwerp B uitoefen sal voorwerp B gelyktydig 'n krag van gelyke grootte in die teenoorgestelde rigting op voorwerp A uitoefen.* ✓✓ (3)

4.3



(5)

<b>Notes: Accepted Labels/Aanvaarbare Byskrifte</b>		<b>Mark/Punt</b>
w	weight/gravitational force/ $F_G/F_g/12\ 740\ \text{N}$ <i>gewig/gravitasiekrag/swaartekrag/<math>F_G/F_g/12\ 740\ \text{N}</math></i>	✓
T	Tension/ $F_T$ <i>Spanning/<math>F_T</math></i>	✓
f	friction/ $F_f$ <i>Wrywing/<math>F_f</math></i>	✓
N	Normal/ $F_N/12\ 740\ \text{N}$ <i>Normaal/<math>F_N/12\ 740\ \text{N}</math></i>	✓
$F_A$	Applied force/ $F_{\text{applied}}/F_{\text{engine}}/F$ <i>Toegepaste krag/<math>F_{\text{toegepas}}/F_{\text{engin}}/F</math></i>	✓
	Any additional force: deduct 1 mark (maximum $4/5$ ) <i>Enige addisionele krag: trek 1 punt af (maksimum <math>4/5</math>)</i>	
	Lines must touch object otherwise (maximum $4/5$ ) <i>Lyne moet voorwerp raak anders (maksimum <math>4/5</math>)</i>	

4.4 4.4.1  $F_{\text{net}} = ma$  } ✓  
 $F_{\text{engine}} - f - T = 0$  } ✓  
 $9\ 000 - 0,45(F_g) - T = 0$   
 $9\ 000 \checkmark - 0,45(1\ 300)(9,8) \checkmark - T = 0 \checkmark$   
 $T = 3\ 267\ \text{N} \checkmark$  (5)

4.4.2 **POSITIVE MARKING FROM QUESTION 4.4.1**  
**POSITIEWE NASIEN VANAF VRAAG 4.4.1**

$$\left. \begin{array}{l} F_{\text{net}} = ma \\ T - f = 0 \end{array} \right\} \checkmark$$

$$3\,267 - f = 0 \checkmark$$

$$f = 3\,267 \text{ N (backwards/terugwaarts)}$$

$$f_k = \mu_k N \checkmark$$

$$f_k = \mu_k mg$$

$$3\,267 = \mu_k (950)(9,8) \checkmark$$

$$\mu_k = 0,35 \checkmark$$

(5)

- 4.5 According to Newton's first law,  $\checkmark$  an object will continue moving at a constant velocity unless a non-zero net force acts on it.  $\checkmark$  The net force acting on the car now is the frictional force and it causes the car to slow down.  $\checkmark$   
*Volgens Newton se eerste wet,  $\checkmark$  sal 'n voorwerp aanhou beweeg teen 'n konstante snelheid tensy 'n nie-nul netto krag daarop inwerk.  $\checkmark$  Die netto krag op die kar is nou wrywingskrag en dit veroorsaak dat die kar stadiger beweeg.  $\checkmark$*

(3)

- 4.6  $F_{\text{net}} = ma$   
 $-3\,267 = 950a \checkmark$   
 $a = -3,44 \text{ m}\cdot\text{s}^{-2}$   
 $= 3,44 \text{ m}\cdot\text{s}^{-2} \checkmark$  backwards/to the right / terugwaarts/regs  $\checkmark$

(3)

[26]

**QUESTION/VRAAG 5**

- 5.1 Weight is the gravitational force exerted on an object by the earth.  $\checkmark$   
*Gewig is die gravitasiekrag wat die Aarde op 'n voorwerp uitoefen.  $\checkmark$*   
Mass is the amount of matter in a body.  $\checkmark$   
*Massa is die hoeveelheid materie in 'n liggaam.  $\checkmark$*

(2)

- 5.2  $g = \frac{GM}{r^2} \checkmark$   
 $2,7 = \frac{6,67 \times 10^{-11} M}{\left(\frac{1}{3} \times 6,38 \times 10^6\right)^2} \checkmark$   
 $M = 1,83 \times 10^{23} \text{ kg} \checkmark$

(4)

- 5.3  $\frac{9,8}{2,7} \checkmark = 3,63$  times smaller on planet X than on Earth  $\checkmark$   
*keer kleiner op planeet X as op die Aarde*

(2)

[8]

**QUESTION/VRAAG 6**

6.1 Angle of incidence is the angle between the normal to a reflecting surface and incident ray. ✓✓  
*Invalshoek is die hoek tussen die normaal op die oppervlak en die invallende straal.* ✓✓ (2)

<p>6.2</p> <p><b>OPTION 1/OPSIE 1</b></p> $\text{gradient} = \frac{0,37 - 0}{0,56 - 0} = 0,66 \checkmark$ $\text{gradient} = \frac{\sin \theta_r}{\sin \theta_i} = \frac{n_i}{n_r}$ $\text{gradient} = \frac{1}{n_r}$ $n_r = \frac{1}{0,66} \checkmark$ $n_r = 1,51 \checkmark$	<p><b>OPTION 2/OPSIE 2</b></p> $n_i \sin \theta_i = n_r \sin \theta_r \checkmark$ $1(0,56) = n_r (0,37) \checkmark$ $n_r = 1,51 \checkmark$
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6.3 **POSITIVE MARKING FROM QUESTION 6.2**  
**POSITIEWE NASIEN VANAF VRAAG 6.2**

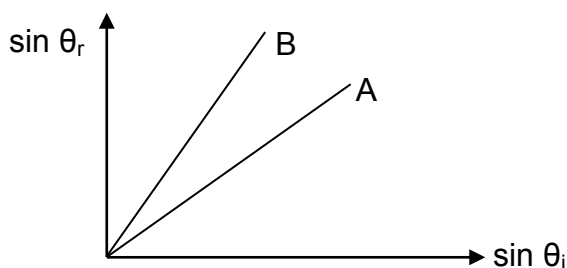
$$n = \frac{c}{v} \checkmark$$

$$1,51 = \frac{3 \times 10^8}{v} \checkmark$$

$$v = 1,99 \times 10^8 \text{ m}\cdot\text{s}^{-1} \checkmark$$

6.4.1  $n_i \sin \theta_i = n_r \sin \theta_r \checkmark$   
 $1 \sin 40^\circ \checkmark = n_r \sin 31^\circ \checkmark$   
 $n_r = 1,25 \checkmark$  (3)

6.4.2



Criteria/Kriteria:

The gradient of B must be bigger than the gradient of A. ✓✓  
*Die helling van B moet groter wees as die helling van A.* ✓✓ (2)

6.5.1 Angle of incidence should be between 49° and 90°. ✓✓  
*Invalshoeke tussen 49° en 90°.* ✓✓

**OR/OF**

$$49^\circ < \theta < 90^\circ. \quad (2)$$

6.5.2 Light must travel from optically denser medium (higher refractive index) to an optically less dense medium (lower refractive index). ✓✓  
*Lig moet beweeg vanaf 'n medium met hoë optiese digtheid (hoë brekingsindeks) na 'n medium met lae optiese digtheid (lae brekingsindeks)* ✓✓ (2)

**[18]**



**QUESTION/VRAAG 7**

7.1	Criteria for investigative question: / <i>Kriteria vir ondersoekende vraag</i>	
	The dependent and independent variables are stated correctly. <i>Die afhanklike en onafhanklike veranderlikes korrek genoem.</i>	✓
	State the relationship between the dependent and independent variables. <i>Stel die verwantskap tussen die afhanklike en onafhanklike veranderlike.</i>	✓
	Dependent variable/ <i>afhanklike veranderlike</i> : degree of diffraction/ <i>mate van diffraksie</i> Independent variable/ <i>onafhanklike veranderlike</i> : slit width/ <i>spleetwydte</i>	

Examples: / *Voorbeelde:*

What is the relationship between slit width and degree of diffraction?

*Wat is die verhouding tussen spleetwydte en mate van diffraksie?*

OR/OF

How does the width of the central bright band change as the slit width changes?

*Hoe word die breedte van die sentrale helder band beïnvloed deur die verandering in spleetwydte?*

(2)

7.2 Every point of a wave front serves as a point source of spherical, secondary waves that move forward with the same speed as the wave. ✓✓

*Elke punt van 'n golffront dien as 'n puntbron van sferiese, sekondêre golwe wat voortwaarts beweeg teen dieselfde spoed as die golf.* ✓✓

(2)

7.3 Decrease ✓

*Neem af* ✓

(1)

7.4 The degree/amount of diffraction is inversely proportional to the slit width. ✓✓

*Die mate van diffraksie is omgekeerd eweredig aan die spleetwydte.* ✓✓

(2)

7.5 Increase ✓

*Toeneem* ✓

(1)

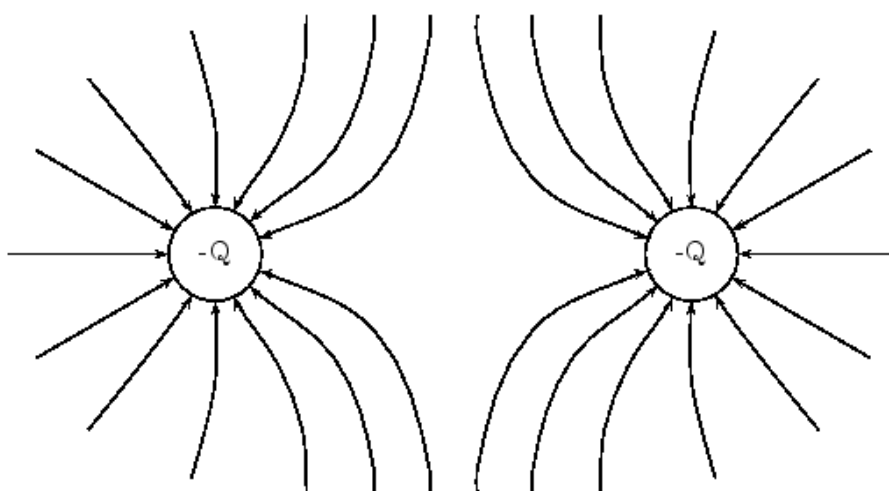
**[8]**

**QUESTION/VRAAG 8**

8.1 Electric field at a point is the electrostatic force experienced per unit positive charge placed at that point. ✓✓  
*Elektriese veld by 'n punt is die elektrostatiese krag wat per eenheid positiewe lading ondervind word by daardie punt. ✓✓* (2)

8.2 Negative ✓  
*Negatief ✓* (1)

8.3 **POSITIVE MARKING FROM QUESTION 8.2**  
**POSITIEWE NASIEN VANAF VRAAG 8.2**



Criteria for marking/Nasienkriteria	
Shape of the field <i>Vorm van veld</i>	✓
Direction of the field <i>Rigting van veld</i>	✓
Lines touch charge/line don't cross etc. <i>Lyne raak lading/lyne kruis nie ens.</i>	✓

(3)

8.4  $E_{net} = \frac{kQ}{r^2} + \frac{kQ}{r^2}$  ✓  
 $5,44 \times 10^6 \checkmark = \frac{9 \times 10^9 Q}{(5 \times 10^{-3})^2} \checkmark + \frac{9 \times 10^9 Q}{(3 \times 10^{-3})^2} \checkmark$   
 $Q = 4 \times 10^{-9} \text{ C} \checkmark$  (5)

8.5 Net electric field DECREASES ✓  
 The positive charge on X will have a field in the opposite direction. The electric field (strength) being a vector will decrease because of opposite directions. ✓  
*Netto elektriese veld NEEM AF ✓*  
*Die positiewe lading op X het 'n veld in die teenoorgestelde rigting. Die elektriese veld (sterkte) is 'n vektor en dit sal die veld laat afneem as die rigtings van die twee ladings se velde teenoorgesteld is. ✓* (2)

(2)  
**[13]**

**QUESTION/VRAAG 9**

9.1 The magnitude of the induced *emf* across the ends of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor. ✓✓

*Die grootte van die geïnduseerde emk oor die ente van 'n geleier is direk eweredig aan die tempo van verandering van die magnetiese vloedkoppeling met die geleier.* ✓✓

(2)

9.2 Accept any correct combination of coordinates from the graph for example:

$(\frac{1}{\Delta t}; \epsilon)$  can be (1,8 ; 3) OR (1,2 ; 2) OR (0,6 ; 1)

*Aanvaar enige korrekte kombinasie van koördinate vanaf die grafiek*

*byvoorbeeld:  $(\frac{1}{\Delta t}; \epsilon)$  kan wees (1,8 ; 3) OF (1,2 ; 2) OF (0,6 ; 1)*

<p><b>OPTION 1/OPSIE 1</b></p> $\epsilon = \frac{-N\Delta\Phi}{\Delta t} \checkmark$ $3 \checkmark = (-200) \checkmark \Delta\Phi(1,8) \checkmark$ $\Delta\Phi = -0,0083 \text{ Wb} \checkmark$	<p><b>OPTION 2/OPSIE 2</b></p> $\epsilon = \frac{-N\Delta\Phi}{\Delta t} \checkmark$ $3 \checkmark = (-200) \checkmark \Delta\Phi\left(\frac{1}{0,56}\right) \checkmark$ $\Delta\Phi = -0,0083 \text{ Wb} \checkmark$
<p><b>OPTION 3/OPSIE 3</b></p> <p>gradient = <math>\epsilon\Delta t = -N\Delta\Phi \checkmark</math></p> $3 \checkmark (0,56) \checkmark = (-200) \checkmark \Delta\Phi$ $\Delta\Phi = -0,0083 \text{ Wb} \checkmark$	

(5)

9.3 **POSITIVE MARKING FROM 9.2**

**POSITIEWE NASIEN VANAF VRAAG 9.2**

$$\Delta\Phi = \Phi_f - \Phi_i \checkmark$$

$$-0,0083 \checkmark = (4,86 \times 10^{-3})(2,4) \cos 90^\circ - (4,86 \times 10^{-3})(2,4) \cos \theta \checkmark$$

$$\theta = 44,64^\circ \checkmark$$

(4)

**[11]**

**QUESTION/VRAAG 10**

- 10.1.1 Power is the rate at which work is done or energy is transferred. ✓✓  
*Drywing is die tempo waarteen arbeid verrig of energie oorgedra word ✓✓* (2)

10.1.2	<b>OPTION 1/OPSIE 1</b> $\frac{1}{R_{//}} = \frac{1}{R_1} + \frac{1}{R_2}$ $\frac{1}{R_{//}} = \frac{1}{6} + \frac{1}{15} \checkmark$ $R_{//} = 4,29 \Omega \checkmark$	<b>OPTION 2/OPSIE 2</b> $R_{//} = \frac{R_1 \times R_2}{R_1 + R_2}$ $R_{//} = \frac{6 \times 15}{6 + 15} \checkmark$ $R_{//} = 4,29 \Omega \checkmark$	(2)
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- 10.1.3 **POSITIVE MARKING FROM QUESTION 10.1.2**  
**POSITIEWE NASIEN VANAF VRAAG 10.1.2**

$$P = \frac{V^2}{R} \checkmark$$

$$50 = \frac{V^2}{4,29} \checkmark$$

$$V = 14,65 \text{ V} \checkmark$$

(3)

- 10.1.4 **POSITIVE MARKING FROM QUESTION 10.1.2 and 10.1.3**  
**POSITIEWE NASIEN VANAF VRAAG 10.1.2 en 10.1.3**

<b>OPTION 1/OPSIE 1</b> $R = \frac{V}{I} \checkmark$ $4,29 = \frac{14,65}{I} \checkmark$ $I = 3,41 \text{ A} \checkmark$	<b>OPTION 2/OPSIE 2</b> $P = VI \checkmark$ $50 = (14,65)I \checkmark$ $I = 3,41 \text{ A} \checkmark$	(3)
<b>OPTION 3/OPSIE 3</b> $P = I^2R \checkmark$ $50 = I^2(4,29) \checkmark$ $I = 3,41 \text{ A} \checkmark$	<b>OPTION 4/OPSIE 4</b> $V = IR \checkmark$ $14,65 = I(6)$ $I = 2,44 \text{ A}$ $V = IR$ $14,65 = I(15)$ $I = 0,98 \text{ A}$ $2,44 + 0,98 \checkmark = 3,42 \text{ A} \checkmark$	

- 10.1.5 Decreases ✓  
*Neem af ✓* (1)

- 10.1.6 The total resistance increases ✓  
 The current in the circuit decreases ✓  
 The resistance of R is constant, ✓ then the potential difference across R decreases.  
*Totale weerstand neem toe ✓*  
*Die stroom in die stroombaan neem af ✓*  
*Die weerstand van R is konstant ✓ so die potensiaalverskil oor resistor R sal afneem* (3)

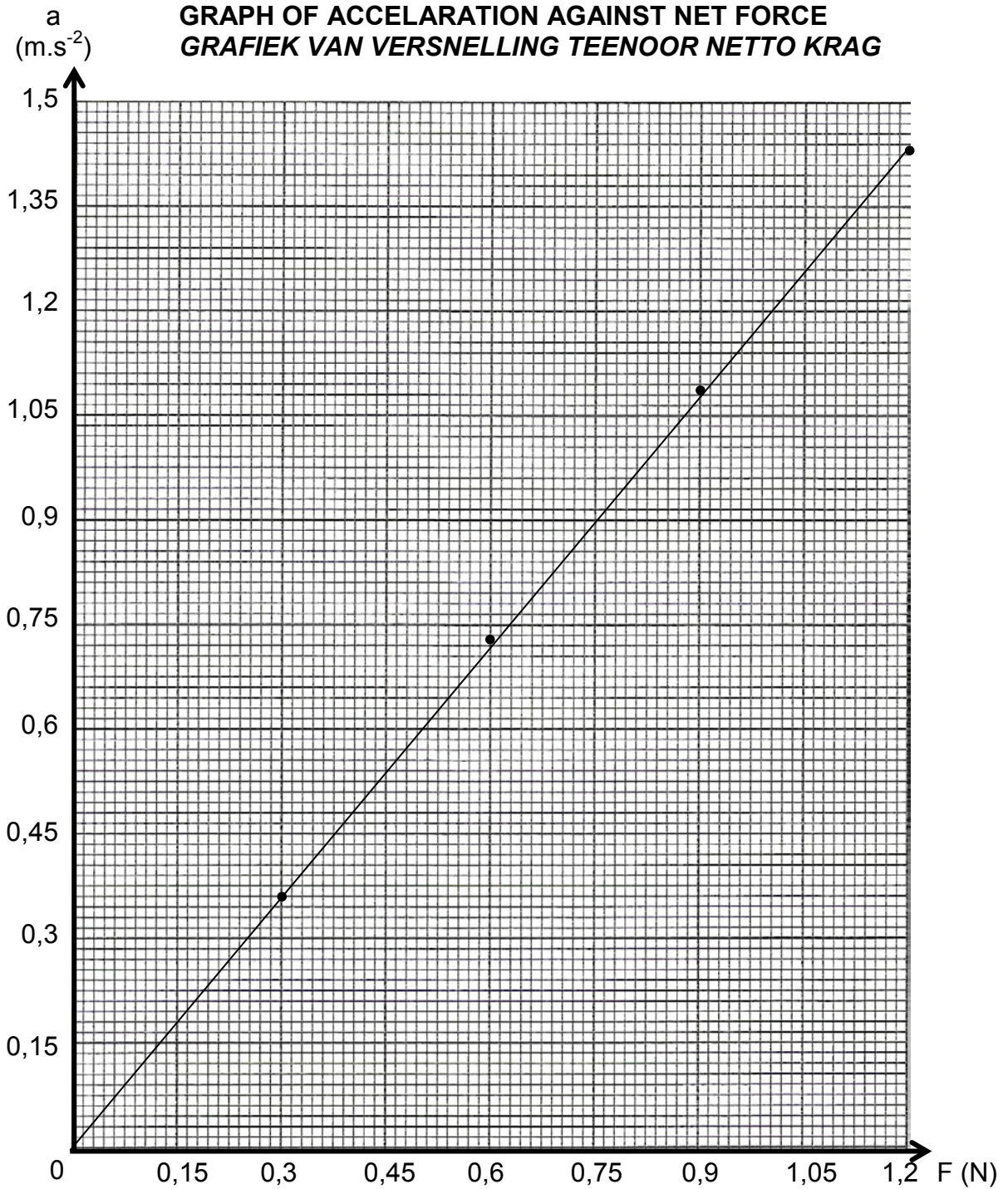
- 10.2.1  $P = \frac{W}{\Delta t}$  ✓  
 $2\,000 \text{ ✓} = \frac{W}{18\,000} \text{ ✓}$   
 $W = 3,6 \times 10^7 \text{ J ✓}$  (4)

- 10.2.2 Cost = price x unit kWh / *Koste = prys x eenheid kWh*  
 Cost = 80(2)(5)(30) ✓  
 Cost = 24 000 cents = R240 ✓  
 (answer can be given in rand or cents)  
 (*antwoord kan in rand of sent gegee word*) (2)  
**[20]**

**ANSWER SHEET/ANTWOORDBLAD**

**NAME/NAAM:** \_\_\_\_\_ **CLASS/KLAS:** \_\_\_\_\_

**QUESTION/VRAAG 3.3**



**TOTAL/TOTAAL: 150**