basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

PHYSICAL SCIENCES: PHYSICS (P1)

NOVEMBER 2017

MARKS: 150

TIME: 3 hours

This question paper consists of 15 pages, 2 data sheets and 1 answer sheet.

* I P H S C E 1 *

EASTERN CAPE

INSTRUCTIONS AND INFORMATION

1. Write your name and class (for example 11A) in the appropriate spaces on the ANSWER BOOK.

2. This question paper consists of TEN questions. Answer ALL the questions in the ANSWER BOOK, except QUESTION 3.3 which has to be answered on the attached ANSWER SHEET.

3. Hand in the ANSWER SHEET together with the ANSWER BOOK.

4. Start EACH question on a NEW page in the ANSWER BOOK.

5. Number the answers correctly according to the numbering system used in this question paper.

6. Leave ONE line between two subquestions, for example between QUESTION 2.1 and QUESTION 2.2.

7. You may use a non-programmable calculator.

8. You may use appropriate mathematical instruments.

9. You are advised to use the attached DATA SHEETS.

10. Show ALL formulae and substitutions in ALL calculations.

11. Round off your final numerical answers to a minimum of TWO decimal places.

12. Give brief motivations, discussions et cetera where required.

13. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write only the letter (A–D) next to the question number (1.1–1.10) in the ANSWER BOOK, for example 1.11 E.

1.1 Which ONE of the following pairs of physical quantities is vector quantities?

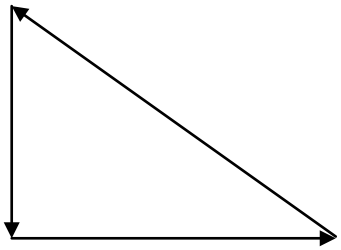
A Force and distance

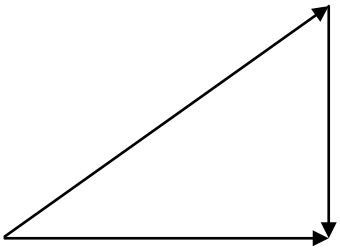
B Velocity and speed

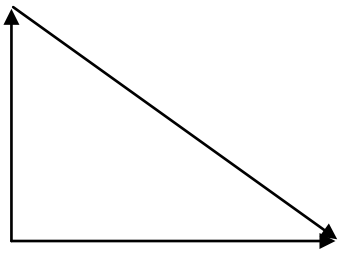
C Charge and electric field

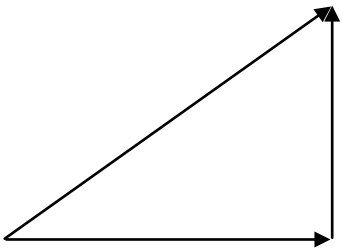
D Electric field and force (2)

1.2 Which ONE of the following vector diagrams represents three forces acting on an object simultaneously while the object moves at CONSTANT VELOCITY?

A 

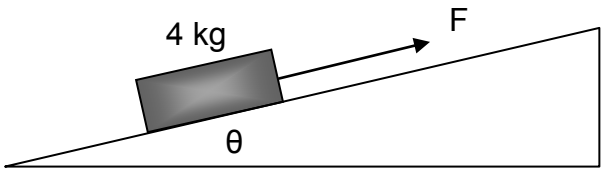
B 

C 

D 

(2)

1.3 A block with a mass of 4 kg is pulled upwards along a frictionless slope, inclined at an angle θ, with a force F, as shown in the sketch below.



Which ONE of the following equations can be used to calculate the magnitude of the normal force (N)?

A N = (4)(9,8)sinθ

B N = F - (4)(9,8)cosθ

C N = F + (4)(9,8)cosθ

D N = (4)(9,8)cosθ (2)

1.4 A satellite orbits Earth at a height where the gravitational force is a quarter (¼) of the force it experiences on the surface of the Earth. If the radius of Earth is **R**, the height of the satellite ABOVE THE SURFACE of Earth is …

A 4**R**

B 2**R**

C **R**

D ½**R** (2)

1.5 A light ray passes from glass to air. The angle of incidence is 35°. The critical angle of glass is 38°.

The light ray will undergo …

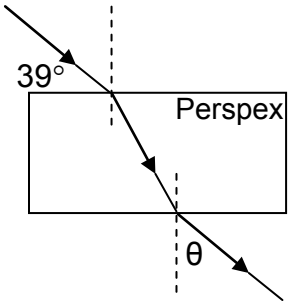
A diffraction.

B refraction and bend away from the normal.

C total internal reflection.

D refraction and bend towards the normal. (2)

1.6 The path of a light ray passing from air through a rectangular Perspex block is shown below.



The magnitude of angle θ will be …

A less than 39°.

B equal to 39°.

C equal to 51°.

D equal to 90°. (2)

1.7 A monochromatic red light ray passes through a single slit of width ***d***. The diffraction pattern is projected on a screen. The red light is then replaced with monochromatic blue light and passed through the same single slit.

The degree of diffraction will …

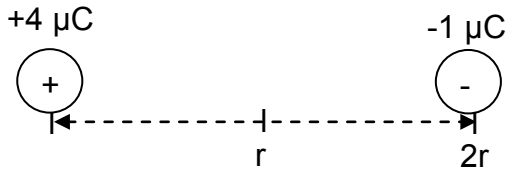
A increase because the degree of diffraction is directly proportional to wavelength.

B decrease because blue light has a shorter wavelength than red light.

C increase because blue light has a longer wavelength than red light.

D decrease because the degree of diffraction is inversely proportional to wavelength. (2)

1.8 A negative charge of 1 μC, which is free to move, is placed at a distance 2r from a positive charge of 4 μC.



Which ONE of the following statements regarding the -1 μC charge, when it is at distance r, is CORRECT?

The electrostatic force experienced by the -1 μC charge will …

A remain the same.

B be halved.

C be doubled.

D increase four times. (2)

1.9 A circular coil is placed inside a magnetic field and rotated clockwise to induce an emf. Which ONE of the following changes will increase the induced emf?

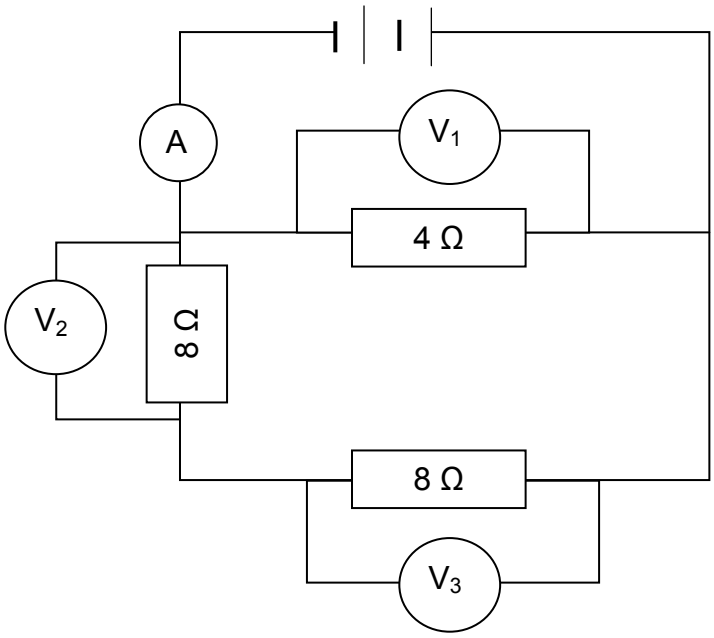
A Rotating the coil slower

B Decreasing the number of turns/windings of the coil

C Increasing the speed of rotation of the coil

D Changing the polarity of the magnets (2)

1.10 In the circuit diagram below, the battery has negligible internal resistance. The resistance of the ammeter and wires may also be ignored.



The reading on voltmeter V_3 will be equal to …

A V_1

B ½ V_1

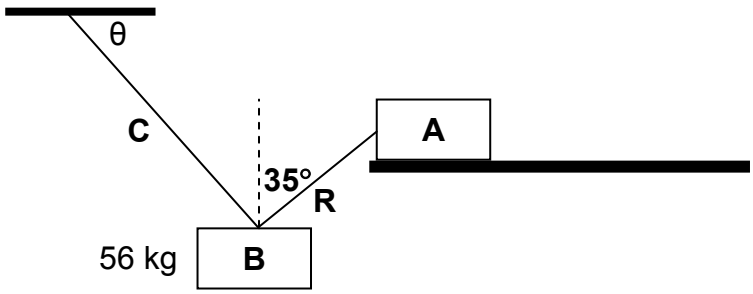
C $V_1 + V_2$

D $V_2 - V_1$ (2)

[20]

QUESTION 2 (Start on a new page.)

Block **A**, which is at rest on a horizontal rough surface, is used as an anchor to hold block **B**, with a mass of 56 kg, in the air at a certain height above the ground. The two blocks are connected with rope **R**, which makes an angle of 35° with the vertical. Block **B** is suspended from the ceiling with cable **C**. Refer to the diagram below.



Block **A** experiences a frictional force of magnitude 200 N. The system is stationary.

2.1 Define the term *resultant vector*. (2)

2.2 What is the magnitude of the resultant force acting on block **B**? (1)

2.3 Draw a labelled free-body diagram indicating all the forces acting on block **B**. (3)

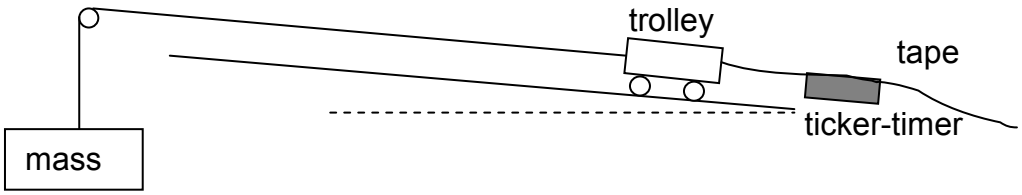
2.4 Determine the horizontal component of the force in rope **R**. (1)

2.5 Calculate the vertical component of the force in cable **C**. (4)

2.6 Calculate the angle θ between the cable and the ceiling. (2)
[13]

QUESTION 3 (Start on a new page.)

Learners investigate the relationship between net force and acceleration by pulling a trolley across a surface which is slightly inclined to compensate for friction. The trolley is connected to different masses by a string of negligible mass. The string passes over a frictionless pulley. Refer to the diagram below.



Ticker-tape attached to the trolley passes through the ticker-timer. The acceleration of the trolley is determined by analysing the ticker-tape. The results of the net force produced by the different masses and the acceleration of the trolley were recorded in the table below.

NET FORCE (N)	**a ($m \cdot s^{-2}$)**
0,3	0,36
0,6	0,73
0,9	1,09
1,2	1,45

3.1 Write down a hypothesis for this experiment. (2)

3.2.1 Identify the *independent variable*. (1)

3.2.2 Identify the *controlled variable*. (1)

3.3 Use the graph paper on the ANSWER SHEET and draw a graph of the acceleration versus net force. (4)

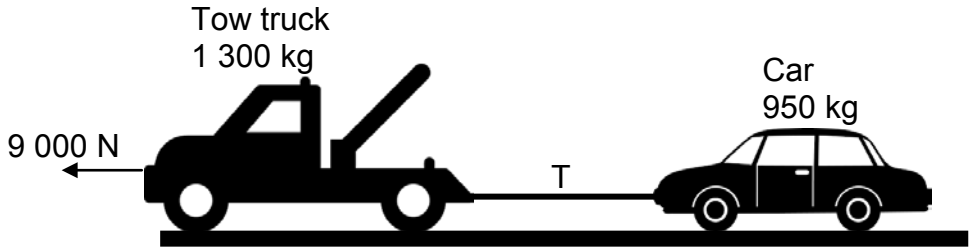
3.4 Calculate the gradient of the graph. (3)

3.5 Use the gradient of the graph calculated in QUESTION 3.4 to determine the mass of the trolley. (2)
[13]

QUESTION 4 (Start on a new page.)

A tow truck pulls a car along a gravel road.

The force applied by the engine of the tow truck is 9 000 N. The mass of the tow truck is 1 300 kg and the mass of the car is 950 kg. The vehicles are connected to each other by an inelastic tow bar of negligible mass. See the diagram below.



The tow truck and car move at a CONSTANT VELOCITY.

4.1 Define the term *frictional force*. (2)

4.2 NAME AND STATE the law that explains why the force exerted by the tow truck on the car is the same as the force exerted by the car on the tow truck. (3)

4.3 Draw a labelled free-body diagram indicating all the forces acting on the tow truck. (5)

4.4 If the coefficient of kinetic friction between the tow-truck tyres and the road surface is 0,45, calculate the:

4.4.1 Magnitude of the tension in the tow bar (5)

4.4.2 Coefficient of kinetic friction between the CAR tyres and the road surface (5)

Suddenly the tow bar between the car and the tow truck disconnects and the car comes loose.

4.5 Using a relevant law of motion, explain why the car continues moving forward for a short distance. (3)

4.6 Calculate the acceleration of the car as it comes to a stop after a short distance. (3)
[26]

QUESTION 5 (Start on a new page.)

The acceleration due to gravity on planet X is 2,7 $m \cdot s^{-2}$. The radius of this planet is a third (⅓) of the radius of Earth.

5.1 Explain the difference between *weight* and *mass*. (2)

5.2 Calculate the mass of planet X. (4)

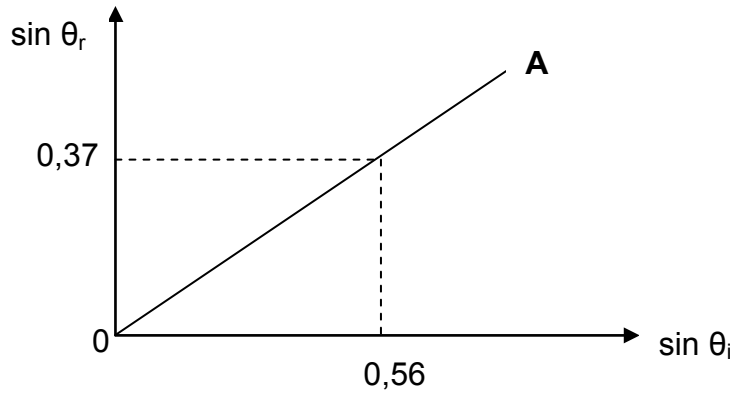
5.3 Determine the factor by which the weight of an object on planet X will differ from the weight of the same object on Earth. (2)
[8]

QUESTION 6 (Start on a new page.)

Experiments are performed to compare the refractive indices of different materials.

In one experiment a light ray passes from air to material **A** and the angles of incidence and refraction are measured. The refractive index for air is 1.

The graph below was drawn using the results of material **A**.



6.1 Define the term *angle of incidence*. (2)

6.2 Calculate the refractive index of material **A** using the data in the graph. (3)

6.3 Calculate the speed of the light through material **A**. (3)

6.4 If material **A** is replaced by material **B**, the angle of refraction is 31° when the angle of incidence is 40°.

6.4.1 Calculate the refractive index of material **B**. (4)

6.4.2 Redraw the graph of material **A**, and on the same set of axis, draw the graph you expect for material **B**. Label the graphs of material **A** and material **B** clearly. (2)

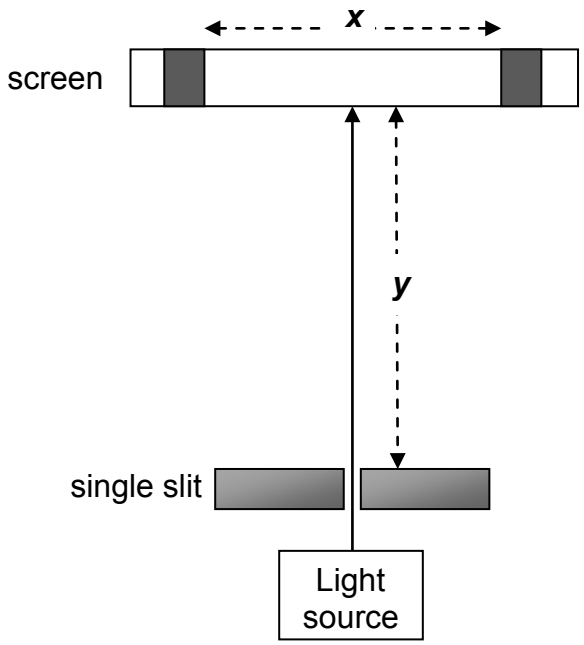
6.5 Total internal reflection occurs when a light ray passes from material **A** to material **B**. The critical angle of material **A** is 49°.

6.5.1 Which range of angles will make it possible for total internal reflection to occur? (2)

6.5.2 What OTHER condition is necessary for total internal reflection to take place? (2)
[18]

QUESTION 7 (Start on a new page.)

An experiment is set up, as shown below, to investigate the effect of slit width on the degree of diffraction. Distance ***y*** on the diagram represents the distance between the screen and the single slit. Distance ***x*** on the diagram represents the width of the central bright band.



7.1 Write down an investigative question for this experiment. (2)

7.2 State *Huygens' principle* in words. (2)

7.3 How will distance ***x*** be affected if the slit width is increased? Choose from INCREASE, DECREASE or REMAIN THE SAME. (1)

7.4 Explain the answer to QUESTION 7.3. (2)

7.5 How will distance ***x*** be affected if distance ***y*** is increased? Choose from INCREASE, DECREASE or REMAIN THE SAME. (1)
[8]

QUESTION 8 (Start on a new page.)

Two IDENTICAL point charges, **X** and **Y**, are placed 2 mm apart. Point **P** is 3 mm to the right of charge **Y**. The net electric field at point **P** is $5,44 \times 10^6$ $N \cdot C^{-1}$ to the left.

8.1 Define the term e*lectric field* at a point. (2)

8.2 Are the charges NEGATIVE or POSITIVE? (1)

8.3 Draw the resultant electric field pattern for charges **X** and **Y**. (3)

8.4 Calculate the magnitude of the charge **X**. (5)

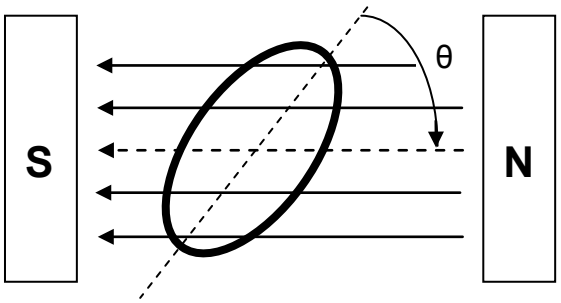
8.5 Charge **Y** is now replaced by an identical oppositely charged point charge.

How will the magnitude of the net electric field at point **P** be affected? Choose from INCREASE, DECREASE or REMAIN THE SAME.

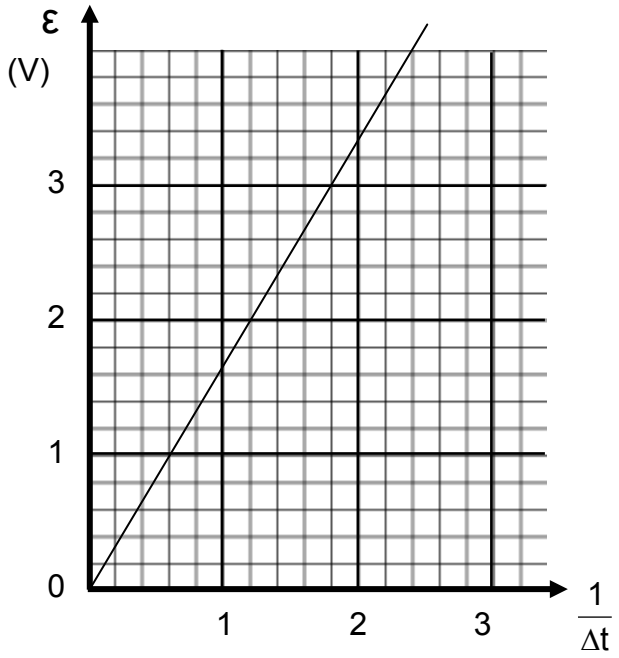
Give a reason for the answer. (2)
[13]

QUESTION 9 (Start on a new page.)

An induction coil of area 48,6 cm^2 and 200 windings is rotated clockwise in a constant magnetic field of magnitude 2,4 T. Refer to the diagram below.



The graph below shows how the induced emf varies with the inverse of time.



9.1 State *Faraday's law* in words. (2)

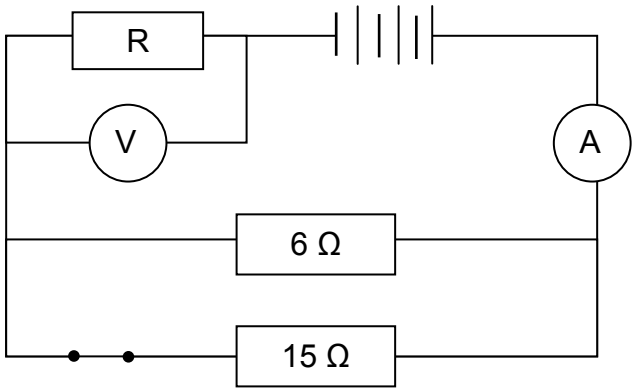
9.2 Use the information in the graph to calculate the change in magnetic flux. (5)

9.3 The coil rotates through an angle θ to a position where the magnetic flux becomes zero. Calculate angle θ. (4)

[11]

QUESTION 10 (Start on a new page.)

10.1 The circuit below consists of a 6 Ω and 15 Ω resistor connected in parallel and an unknown resistor R, in series. An ammeter, a high-resistance voltmeter, a closed switch and battery are connected, as shown. The resistance of the battery and wires can be ignored.



The total power dissipated in the parallel part of the circuit is 50 W.

10.1.1 Define the term *power*. (2)

10.1.2 Calculate the effective resistance of the parallel combination. (2)

10.1.3 Calculate the potential difference across the resistors in parallel. (3)

10.1.4 Calculate the current through resistor R. (3)

The switch in the circuit is now OPENED.

10.1.5 How will the reading on the voltmeter (V) be influenced? Choose from INCREASE, DECREASE or REMAIN THE SAME. (1)

10.1.6 Explain the answer to QUESTION 10.1.5. (3)

10.2 A geyser, labelled 2 000 W, is used for an average of 5 hours per day. The cost of electricity is 80 cents per kWh.

10.2.1 Calculate the energy used by the geyser for 5 hours per day. (4)

10.2.2 Calculate the cost of electricity to operate the geyser for a month with 30 days. (2)

[20]

TOTAL: 150

DATA FOR PHYSICAL SCIENCES GRADE 11
PAPER 1 (PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 11
VRAESTEL 1 (FISIKA)

TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	9,8 $m \cdot s^{-2}$
Gravitational constant *Swaartekragkonstante*	G	6,67 x 10^{-11} $N \cdot m^2 \cdot kg^{-2}$
Radius of Earth *Straal van Aarde*	R_E	6,38 x 10^6 m
Coulomb's constant *Coulomb se konstante*	k	9,0 x 10^9 $N \cdot m^2 \cdot C^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	3,0 x 10^8 $m \cdot s^{-1}$
Charge on electron *Lading op elektron*	e	-1,6 x 10^{-19} C
Electron mass *Elektronmassa*	m_e	9,11 x 10^{-31} kg
Mass of the earth *Massa van die Aarde*	M	5,98 x 10^{24} kg

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

MOTION/*BEWEGING*

$v_f = v_i + a\,\Delta t$	$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$
$v_f^{\,2} = v_i^{\,2} + 2a\Delta x$	$\Delta x = \left(\frac{v_f + v_i}{2}\right)\Delta t$

FORCE/*KRAG*

$F_{net} = ma$	$w = mg$
$F = \frac{Gm_1m_2}{r^2}$	$\mu_s = \frac{f_{s(max)}}{N}$
$\mu_k = \frac{f_k}{N}$	

WAVES, SOUND AND LIGHT/*GOLWE, KLANK EN LIG*

$v = f\lambda$	$T = \frac{1}{f}$
$n_i \sin\theta_i = n_r \sin\theta_r$	$n = \frac{c}{v}$

ELECTROSTATICS/*ELEKTROSTATIKA*

$F = \frac{kQ_1Q_2}{r^2}$ $(k = 9{,}0 \times 10^9\ N{\cdot}m^2{\cdot}C^{-2})$	$E = \frac{F}{q}$
$E = \frac{kQ}{r^2}$ $(k = 9{,}0 \times 10^9\ N{\cdot}m^2{\cdot}C^{-2})$	$n = \frac{Q}{e}$

ELECTROMAGNETISM/*ELEKTROMAGNETISME*

$\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$	$\Phi = BA\cos\theta$

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

$I = \frac{Q}{\Delta t}$	$R = \frac{V}{I}$
$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} + \ldots$	$R = r_1 + r_2 + r_3 + \ldots$
$W = Vq$ $W = VI\Delta t$ $W = I^2R\Delta t$ $W = \frac{V^2\Delta t}{R}$	$P = \frac{W}{\Delta t}$ $P = VI$ $P = I^2R$ $P = \frac{V^2}{R}$

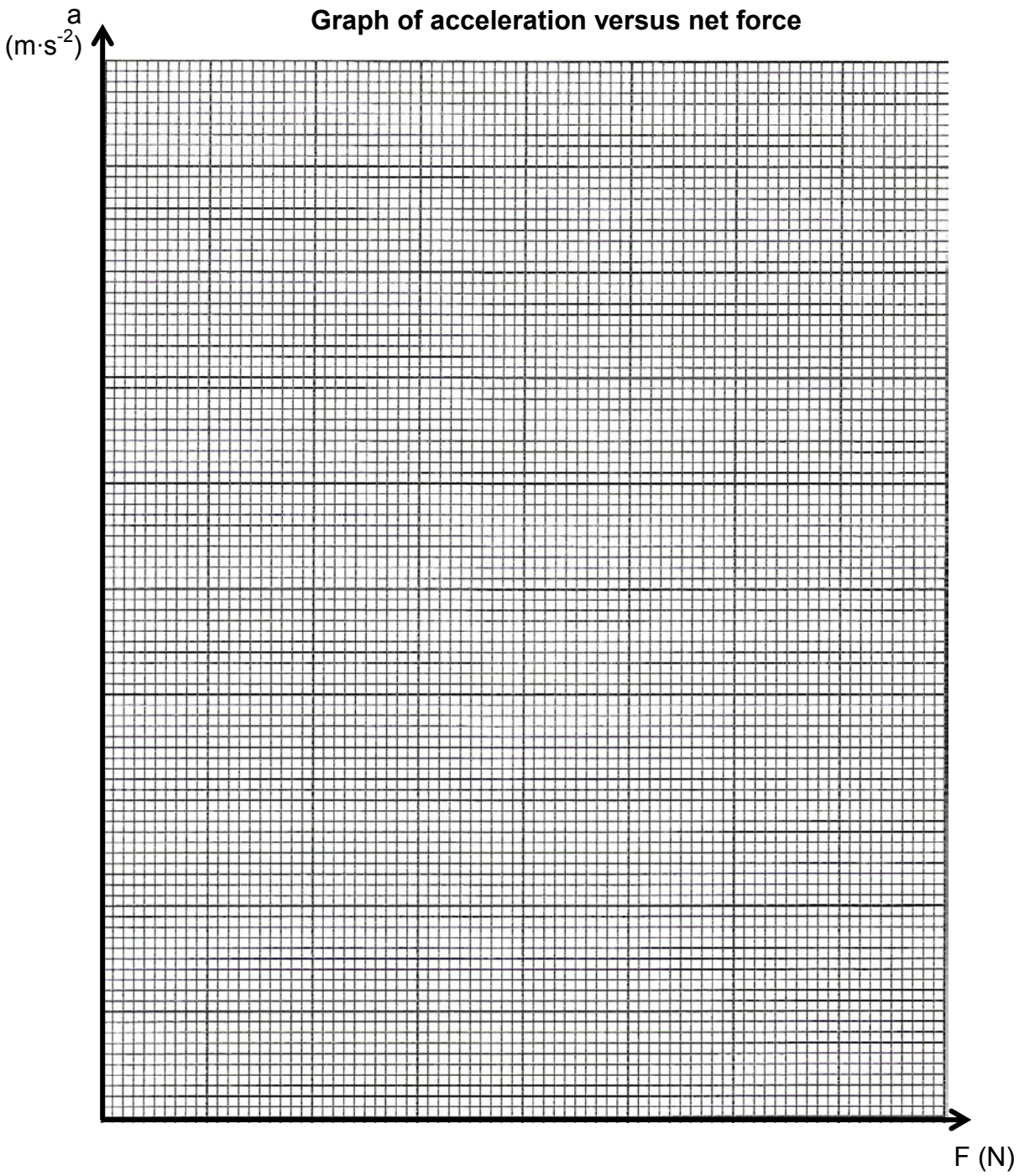
ANSWER SHEET

HAND IN THIS ANSWER SHEET TOGETHER WITH THE ANSWER BOOK.

NAME: _____ CLASS: _____

QUESTION 3.3

Graph of acceleration versus net force



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.

Approved
Sayranga
2017:11:05
Snr Mod.

Approved.
MKoetaan
2017/11/5
Chief Examiner

Please turn over/*Blaai om asseblief*

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)

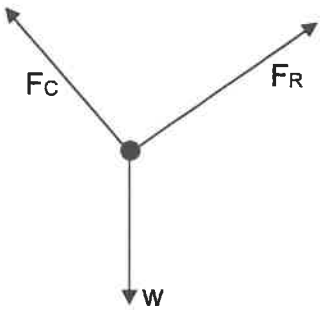
1.10 B ✓✓ (2)
[20]

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

2.2 0 N ✓ (Accept 0/Zero *Aanvaar 0/Nul)* (1)

2.3 (3)



Notes: Accepted Labels/*Aanvaarbare Byskrifte*		Mark/*Punt*
w	weight/F_G/F_g *gewig/gravitasiekrag/swaartekrag*	✓
F_C	Tension force in cable/T_C *Spanningskrag in kabel/T_C*	✓
F_R	Tension force in rope/T_R *Spanningskrag in tou/T_R*	✓
	Any additional force: deduct 1 mark (maximum ⅔) *Enige addisionele krag: trek 1 punt af (maksimum ⅔)*	
	Lines must touch object otherwise (maximum ⅔) *Lyne moet voorwerp raak anders (maksimum ⅔)*	
	Subtract one mark if arrows are not shown *Trek een punt af indien pylpunte nie gewys word nie*	

2.4 200 N ✓ (to the left/*links*) (1)

2.5 **POSITIVE MARKING FROM QUESTION 2.4**
POSITIEWE NASIEN VANAF VRAAG 2.4

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

$F_g = mg = 56(9,8)$ ✓= 548,8 N

$F_{RY} + F_{CY} = F_g$
$285,63 + F_{CY} = 548,8$ } ✓ any one/*enige een*
F_{CY} = 263,17 N ✓ (upwards/opwaarts) (4)

Mark allocation: *Puntetoekenning*
Calculating/*Bereken* F_{RY} ✓
Calculating weight/*Bereken* gewig ✓
Vector sum/vektorsom ✓
Answer/Antwoord ✓

2.6 **POSITIVE MARKING FROM QUESTION 2.4 and 2.5**
POSITIEWE NASIEN VANAF VRAAG 2.4 en 2.5

$\tan\theta = \frac{263,17}{200}$ ✓

$\theta = 52,77°$ ✓ (2)

[13]

QUESTION/*VRAAG 3*

3.1

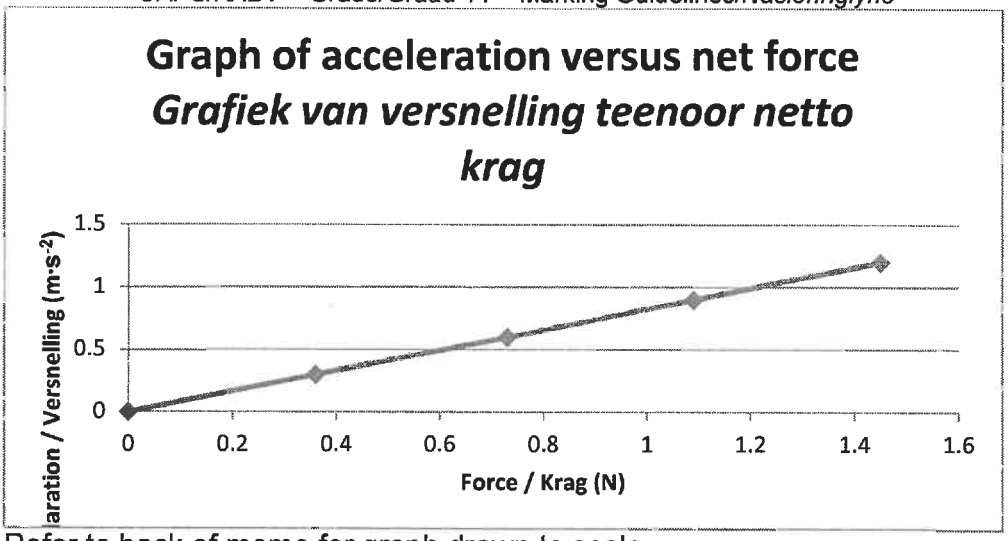
Criteria for hypothesis/*Riglyne vir hipotese*	
State the relationship between the correct dependent and independent variables. *Stel die verwantskap tussen die korrekte afhanklike en onafhanklike veranderlike.*	✓
The controlled variable is stated as part of the hypothesis *Die gekontrolleerde veranderlike word genoem as deel van die hipotese*	✓
Dependent variable/*afhanklike veranderlike*: acceleration/*versnelling* Independent variable/*onafhanklike veranderlike*: (net) force/*(netto) krag*	

Example/*Voorbeeld*:
The acceleration is directly proportional to (net) force ✓if the mass of the trolley is kept constant ✓
Die versnelling is direk eweredig aan die (netto) krag ✓ 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 ***Nasienkriteria vir grafiek***	
Axes with correct/appropriate scale *Asse met korrekte/toepaslike skaal*	✓
3 or more coordinates correctly plotted *3 of meer koördinate korrek gestip* If 2 coordinates correctly plotted - one mark *Indien 2 koördinate korrek gestip – een punt*	✓✓
Drawing a line of best fit through the origin *Teken 'n lyn van beste passing deur die oorsprong*	✓

(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*

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

OR/*OF*

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

OR/*OF*

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

If the origin is used and zeros are not shown, max $^2/_3$
Indien die oorsrong gebruik word en nulwaardes word nie getoon, maks $^2/_3$ (3)

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

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

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

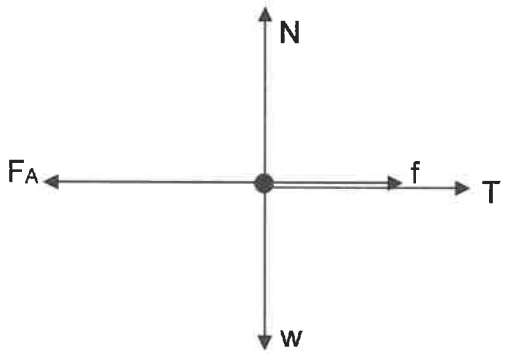
(2)
[13]

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)

Notes: Accepted Labels/*Aanvaarbare Byskrifte*		Mark/*Punt*
w	weight/gravitational force/F_G/F_g/12 740 N *gewig/gravitasiekrag/swaartekrag*/F_G/F_g/12 740 N	✓
T	Tension force /F_T *Spanningskrag*/F_T	✓
f	friction/F_f *Wrywing*/F_f	✓
N	Normal/F_N/12 740 N *Normaal*/F_N/*12 740 N*	✓
F_A	Applied force/$F_{applied}$/F_{engine}/F *Toegepaste krag*/$F_{toegepas}$/F_{engin}/F	✓
	Any additional force: deduct 1 mark (maximum $^4/_5$) *Enige addisionele krag: trek 1 punt af (maksimum $^4/_5$)*	
	Lines must touch object otherwise (maximum $^4/_5$) *Lyne moet voorwerp raak anders (maksimum $^4/_5$)*	
	Subtract one mark if arrows are not shown *Trek een punt af indien pylpunte nie gewys word nie*	

4.4 4.4.1

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

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

$F_{net} = ma$
$F_{net} = 0$
$T - f_k = 0$
} ✓ Any one / *enige een*

$3\,267 - f_k = 0$ ✓
$f_k = 3\,267$ N (backwards/*terugwaarts*)
$f_k = \mu_k N$ ✓
$f_k = \mu_k mg$
$3\,267 = \mu_k(950)(9,8)$ ✓
$\mu_k = 0,35$ ✓

OR
$f_k = \mu_k N$ ✓
$f_k = \mu_k mg$
$3\,267$ ✓ $= \mu_k(950)(9,8)$ ✓
$\mu_k = 0,35$ ✓

(5)

4.5 Newton's second law ✓ the oject experiences a net force slowing it down to stop ✓✓
OR
Newton's first law, ✓ an object will continue moving at a constant velocity unless a non-zero net force acts on it. ✓✓
Newton se tweede wet ✓ die voorwerp ervaar 'n netto krag wat dit laat stadiger beweeg totdat dit stop. ✓✓
OF
Newton se eerste wet, ✓ sal 'n voorwerp aanhou beweeg teen 'n konstante snelheid tensy 'n nie-nul netto krag daarop inwerk.✓✓ (3)

4.6 **POSITIVE MARKING FROM QUESTION 4.4.1**
POSITIEWE NASIEN VANAF VRAAG 4.4.1
$F_{net} = ma$
$-3\,267 = 950a$ ✓
$a = -3,44\ m\cdot s^{-2}$
$= 3,44\ m\cdot s^{-2}$ ✓ backwards/to the right / *terugwaarts/regs* ✓ (3)
[26]

QUESTION/*VRAAG 5*

5.1 Weight is the gravitational force exerted on an object by the earth. ✓
Gewig is die gravitasiekrag wat die Aarde op 'n voorwerp uitoefen. ✓
Mass is the amount of matter in a body. ✓
Massa is die hoeveelheid materie in 'n liggaam. ✓ (2)

5.2 $g = \frac{GM}{r^2}$ ✓

$2,7 = \frac{6,67 \times 10^{-11} M}{(\frac{1}{3} \times 6,38 \times 10^6)^2}$ ✓ ✓

$M = 1,83 \times 10^{23}$ kg ✓ (4)

5.3 $\frac{9,8}{2,7}$ = 3,63 times smaller ✓✓on planet X than on Earth
3,63 *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)

6.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\text{gradient} = \frac{0,37-0}{0,56-0} = 0,66$ ✓ $\text{gradient} = \frac{\sin\theta_r}{\sin\theta_i} = \frac{n_i}{n_r}$ $\text{gradient} = \frac{1}{n_r}$ $n_r = \frac{1}{0,66}$ ✓ $n_r = 1,51$ ✓	$n_i \sin\theta_i = n_r \sin\theta_r$ ✓ $1(0,56) = n_r\,(0,37)$ ✓ $n_r = 1,51$ ✓

(3)

6.3 **POSITIVE MARKING FROM QUESTION 6.2**
POSITIEWE NASIEN VANAF VRAAG 6.2

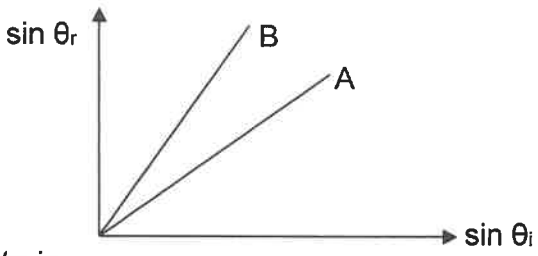
$n = \frac{c}{v}$ ✓

$1,51 = \frac{3\times10^8}{v}$ ✓

$v = 1,99 \times 10^8\ m\cdot s^{-1}$ ✓ (3)

6.4.1 $n_i \sin\theta_i = n_r \sin\theta_r$ ✓
$1 \sin 40° ✓ = n_r \sin 31°$ ✓
$n_r = 1,25$ ✓ (4)

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*
$49° < \theta < 90°$. (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:/*Kriteria vir ondersoekende vraag*	
The dependent and independent variables are stated correctly. *Die afhanklike en onafhanklike veranderlikes korrek genoem.*	✓
State the relationship between the dependent and independent variables. *Stel die verwantskap tussen die afhanklike en onafhanklike veranderlike.*	✓
Dependent variable/*afhanklike veranderlike*: degree of diffraction/*mate van diffraksie* Independent variable/*onafhanklike veranderlike*: slit width/*spleetwydte*	

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. ✓✓
OR Degree of difraction $\alpha\ ^1/_w$
Die mate van diffraksie is omgekeerd eweredig aan die spleetwydte. ✓✓
OF *Mate van diffraksie* $\alpha\ ^1/_w$ (2)

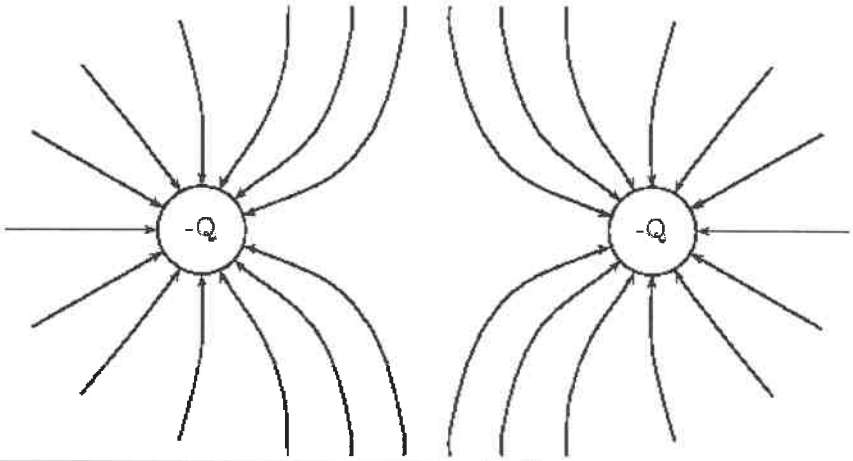
7.5 Increase ✓
Toeneem ✓ (1)
[8]

QUESTION/*VRAAG 8*

8.1 The electrostatic force experienced per unit positive charge (placed at that point) ✓✓
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 *Vorm van veld*	✓
Direction of the field *Rigting van veld*	✓
Lines touch charge/line don't cross etc. *Lyne raak lading/lyne kruis nie ens.*	✓

NOTE: If only one charge is drawn, no marks
NOTA: Indien slegs een lading geteken word, geen punte

(3)

8.4 $E = \frac{kQ}{r^2}$

$E_{net} = \frac{kQ}{r^2} + \frac{kQ}{r^2}$ ✓ Any one/*enige een*

$5{,}44 \times 10^6$ ✓ $= \frac{9\times10^9 Q}{(5\times10^{-3})^2}$ ✓ $+ \frac{9\times10^9 Q}{(3\times10^{-3})^2}$ ✓

$Q = 4 \times 10^{-9}$ C ✓ (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)

[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:
($^1/_{\Delta t}$; ε) can be (1,8 ; 3) OR (1,2 ; 2) OR (0,6 ; 1)
Aanvaar enige korrekte kombinasie van koördinate vanaf die grafiek byvoorbeeld: ($^1/_{\Delta t}$; ε) kan wees (1,8 ; 3) OF (1,2 ; 2) OF (0,6 ; 1)

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$\varepsilon = \frac{-N\Delta\Phi}{\Delta t}$ ✓ 3✓ = -(200)✓ΔΦ(1,8) ✓ ΔΦ = -0,0083 Wb ✓	$\varepsilon = \frac{-N\Delta\Phi}{\Delta t}$ ✓ 3 ✓ = -(200)✓ΔΦ($\frac{1}{0,56}$) ✓ ΔΦ = -0,0083 Wb ✓
OPTION 3/*OPSIE 3*	
gradient = εΔt = -NΔΦ ✓ 3✓(0,56) ✓ = -(200)✓ΔΦ ΔΦ = -0,0083 Wb ✓	

(5)

9.3 **POSITIVE MARKING FROM 9.2**
POSITIEWE NASIEN VANAF VRAAG 9.2
$\Delta\Phi = \Phi_f - \Phi_i$✓
-0,0083 ✓ = $\underline{(4,86 \times 10^{-3})(2,4)\cos 90° - (4,86 \times 10^{-3})(2,4)\cos\theta}$ ✓
θ = 44,64° ✓ (4)
[11]

QUESTION/*VRAAG 10*

10.1.1 Power is the rate at which work is done/energy is transfered. ✓✓
Drywing is die tempo waarteen arbeid verrig /energie oorgedra word ✓✓ (2)

10.1.2

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

$\frac{1}{R_{//}}=\frac{1}{R_1}+\frac{1}{R_2}$
$\frac{1}{R_{//}}=\frac{1}{6}+\frac{1}{15}$ ✓
R_{II} = 4,29 Ω ✓
	$R_{//}=\frac{R_1\times R_2}{R_1+R_2}$
	$R_{//}=\frac{6\times 15}{6+15}$ ✓
	$R_{//}$ = 4,29 Ω ✓

(2)

10.1.3 **POSITIVE MARKING FROM QUESTION 10.1.2**
POSITIEWE NASIEN VANAF VRAAG 10.1.2

$P=\frac{V^2}{R}$ ✓

$50=\frac{V^2}{4,29}$ ✓

V = 14,65 V ✓ (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

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

(3)

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 $P = \frac{W}{\Delta t}$ ✓

$2\,000$ ✓ $= \frac{W}{18\,000}$ ✓

$W = 3{,}6 \times 10^7$ J ✓ (4)

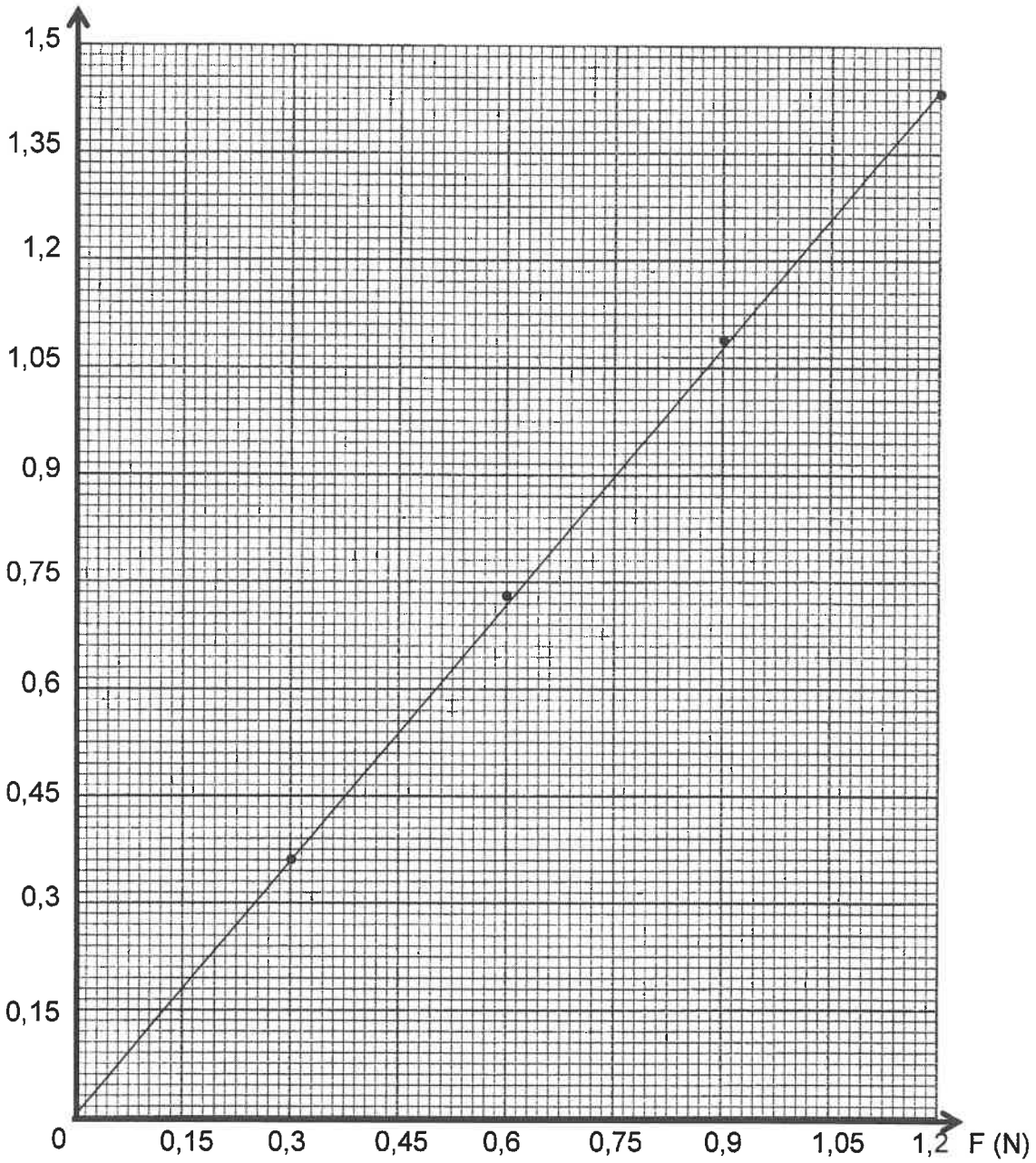
10.2.2 Cost = price x unit kWh / *Koste = prys x eenheid kWh*
Cost = 80(2)(5)(30) ✓
Cost = 24 000 cents = R240 ✓
(answer can be given in rand or cents)
(antwoord kan in rand of sent gegee word) (2)
[20]

ANSWER SHEET/*ANTWOORDBLAD*

NAME/*NAAM*: _____ **CLASS/*KLAS*:** _____

QUESTION/*VRAAG 3.3*

GRAPH OF ACCELARATION AGAINST NET FORCE
GRAFIEK VAN VERSNELLING TEENOOR NETTO KRAG



TOTAL/*TOTAAL*: **150**