Province of the
EASTERN CAPE
EDUCATION

Iphondo leMpuma Kapa: Isebe leMfundo
Provinsie van die Oos Kaap: Department van Onderwys
Porafensie Ya Kapa Botjahabela: Lefapha la Thuto

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2024

PHYSICAL SCIENCES P1

MARKS: **150**

TIME: **3 hours**

IPHSCE1

This question paper consists of 18 pages including 2 data sheet.

INSTRUCTIONS AND INFORMATION

1. Write your full NAME and SURNAME in the appropriate space in the ANSWER BOOK.
2. Answer ALL the questions in the ANSWER BOOK.
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. You may use a non-programmable calculator.
6. Leave ONE line between two sub-questions, for example between QUESTION 2.1 and QUESTION 2.2.
7. You are advised to use the attached DATA SHEETS.
8. Show ALL formulae and substitutions in ALL calculations.
9. Round off your FINAL numerical answers to a minimum of TWO decimal places.
10. Give brief motivations, discussions, etc. where required.
11. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

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

1.1 Which of the following is a scalar quantity?

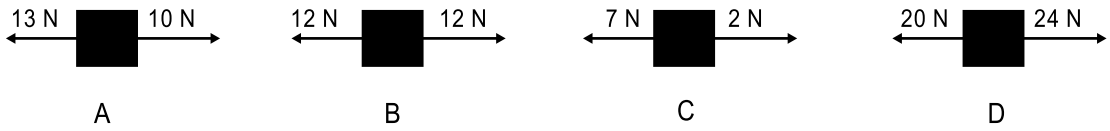
A Force

B Velocity

C Acceleration

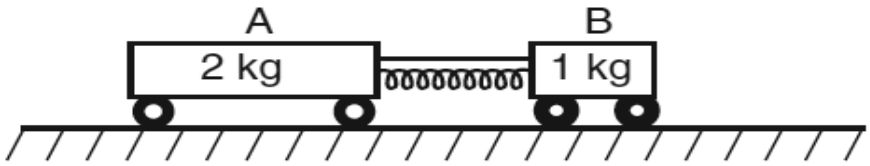
D Speed (2)

1.2 The objects below are all identical and resting on frictionless surfaces. Which object will experience the greatest acceleration?



(2)

1.3 The diagram below shows two trolleys held together by a compressed spring. The trolleys are initially at rest on a frictionless horizontal surface. Trolley **A** has a mass of 2 kg and trolley **B** has a mass of 1 kg.



The string breaks and the trollies move apart. The magnitude of the force that the spring exerts on trolley **A** is **F**. What is the magnitude of the force the spring exerts on trolley **B**?

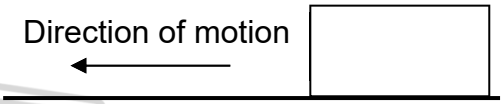
A ½ F

B F

C 2F

D 4F (2)

1.4 A block, slides to the left on a rough horizontal surface as shown in the diagram below. What are the directions of the resultant force and the acceleration of the block?



	DIRECTION OF RESULTANT FORCE	DIRECTION OF ACCELERATION
A	to the right	to the left
B	to the right	to the right
C	to the left	to the left
D	to the left	to the right

(2)

1.5 A crate is being pushed across a rough horizontal floor at a constant velocity. If the force applied is suddenly removed, the crate will …

A stop immediately.

B immediately start slowing down to a stop.

C continue at constant velocity for a short time and then slow down to a stop.

D continue at constant velocity. (2)

1.6 A satellite experiences a gravitational force of magnitude **F** on the surface of the earth. The radius of the earth is **R**. The satellite now orbits the earth at an unknown height above the surface of the earth and experiences a gravitational force of magnitude ¼ **F**.

This unknown height above the earth's surface is …

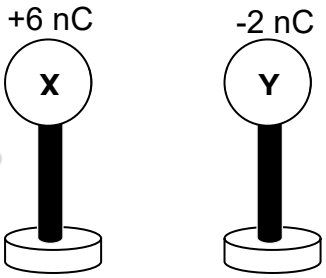
A **R**.

B 2**R**.

C 3**R**.

D 4**R**. (2)

1.7 Two identical metal spheres **X** and **Y**, on isolated stands, have charges of +6 nC and -2 nC respectively. **Y** is brought into contact with **X** and then placed at its original position again.

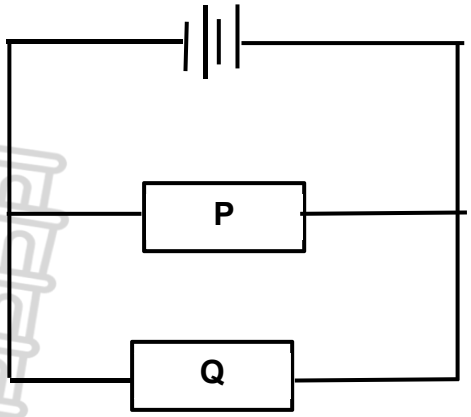


What is the direction in which electrons are transferred and the final charge on the spheres?

	DIRECTION OF ELECTRON TRANSFER	FINAL CHARGE
A	Y to X	-2 nC
B	Y to X	2 nC
C	X to Y	4 nC
D	X to Y	-4 nC

(2)

1.8 Two Ohmic conductors **P** and **Q** are connected in parallel to a battery as shown in the diagram below.

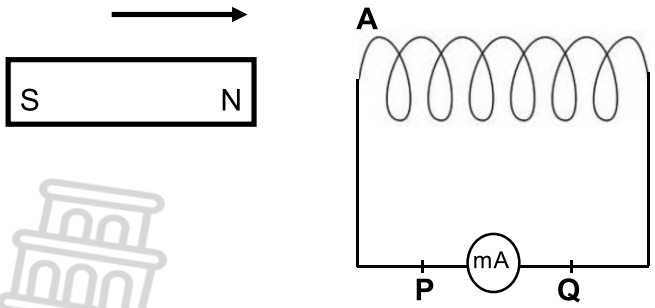


The resistance of conductor **Q** is much greater than that of conductor **P**. How does the potential difference across conductor **Q** and the current in **Q** compare to that of conductor **P**?

	POTENTIAL DIFFERENCE	CURRENT
A	Equal	Less than
B	Equal	Greater than
C	Greater than	Greater than
D	Less than	Less than

(2)

1.9 In the diagram below, the magnet is being pushed into the solenoid.

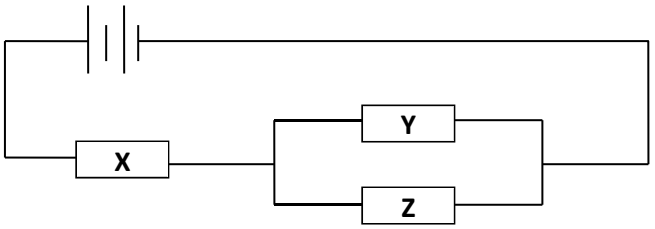


What will the polarity of point **A** on the solenoid and the direction of the induced current in the solenoid be?

A	North	**P** to **Q**
B	South	**Q** to **P**
C	South	**P** to **Q**
D	North	**Q** to **P**

(2)

1.10 Three identical resistors **X, Y** and **Z** with equal resistance are connected as shown in the circuit diagram below.



If the power in **X** is P, then the power in **Y** is …

A P.

B ½ P.

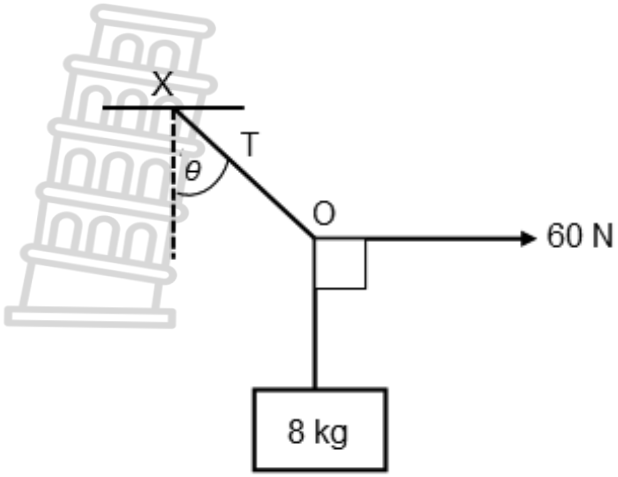
C ¼ P.

D 2P. (2)

[20]

QUESTION 2 (Start on a new page.)

A light string is suspended from the ceiling **X**. An object of mass 8 kg is tied to the string at **O**. A horizontal force of 60 N is exerted at point **O**, causing the string **OX** to experience a tension **T** as shown in the diagram below. The system is in equilibrium.



2.1 Explain the term *forces in equilibrium* in words. (2)

2.2 Draw a close vector diagram showing **ALL** the forces acting at point **O**. Indicate the angle θ on the diagram. (4)

2.3 Calculate the:

2.3.1 Magnitude of the tension **T** in the string **OX** (3)

2.3.2 Angle θ that the string **OX** makes with the vertical (3)

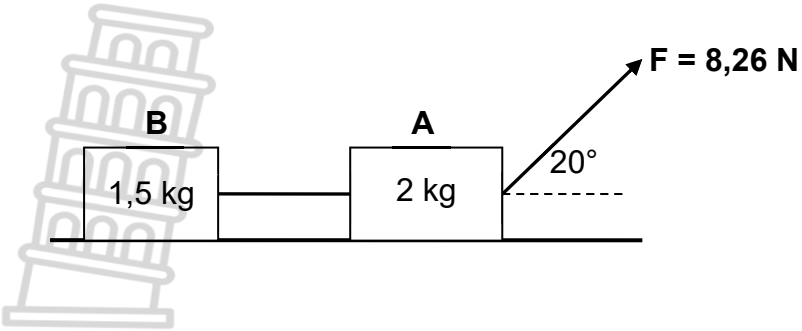
2.4 Without doing a calculation, write down the magnitude of the resultant force at point **O.** (2)

[14]

QUESTION 3 (Start on a new page.)

A light inelastic string connects two blocks **A** and **B** of mass 2 kg and 1,5 kg respectively.

A 8,26 N force is applied at an angle of 20° on block **A** to keep the blocks moving at a CONSTANT VELOCITY across a rough surface to the right, as shown in the diagram below.



The coefficient of kinetic friction between block **A** and the rough surface is 0,33.

3.1 Define *resultant force* in words. (2)

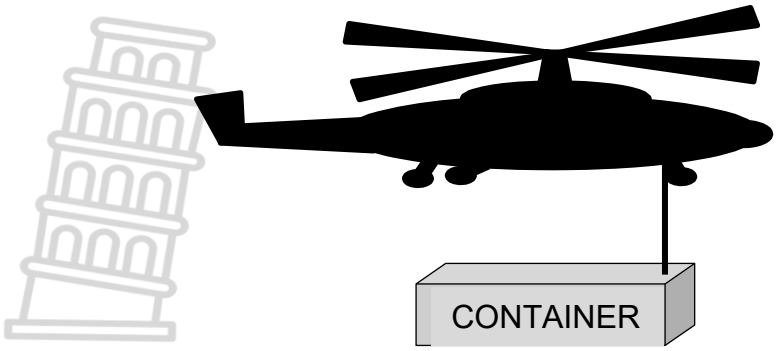
3.2 Calculate the:

3.2.1 Magnitude of the frictional force acting between block **A** and the rough surface (4)

3.2.2 Coefficient of kinetic friction between block **B** and the rough surface (6)
[12]

QUESTION 4 (Start on a new page.)

A hovering rescuer helicopter has a container of supplies with a weight of 1 960 N, hanging from a cable. The tension in the cable is 2 100 N. The effect of air friction cannot be ignored.



4.1 State Newton's First Law of Motion in words. (2)

4.2 Why does the container remain stationary despite the tension being greater than the weight? (2)

Now the winch inside the helicopter starts to pull the container upwards with an acceleration of 0,13 $m \cdot s^{-2}$ while the helicopter remains in its position.

4.3 Calculate the mass of the container. (3)

4.4 Calculate the magnitude of the tension in the cable as the container is being pulled upwards. (4)

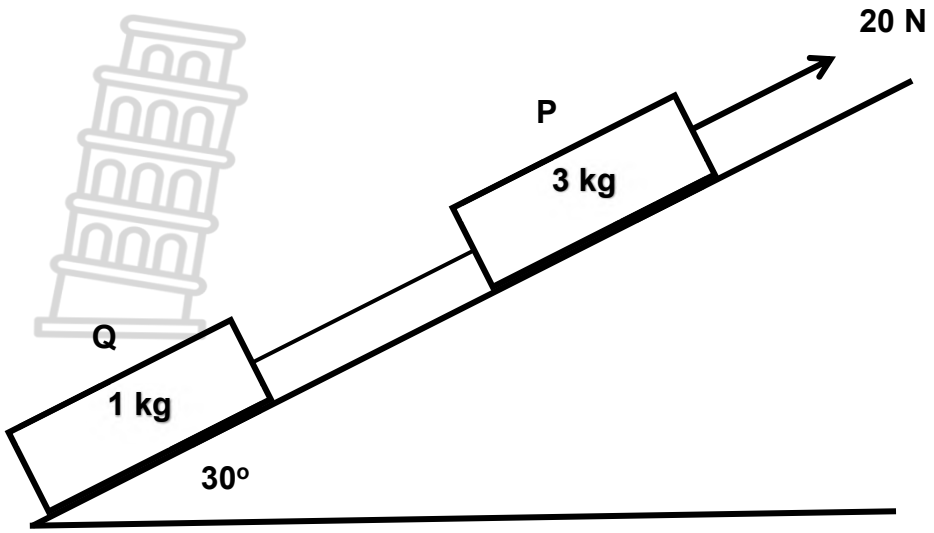
After an acceleration of a few metres the container is pulled up at a constant velocity of 0,8 $m \cdot s^{-1}$.

4.5 What will the magnitude of the tension in the cable be while the container moves upwards at a constant velocity? (1)

[12]

QUESTION 5 (Start on a new page.)

The diagram below shows a 3 kg block connected to a 1 kg block with a light inextensible string. A constant horizontal force of 20 N pulls the system along a rough horizontal surface.



The frictional force between blocks **P** and **Q** and the surface is 2 N and 1 N respectively.

5.1 State Newton's Second Law of Motion in words. (2)

5.2 Draw a labelled free-body diagram showing ALL the forces acting on the 3 kg block. (5)

5.3 Calculate the magnitude of the acceleration of the 3 kg block. (6)
[13]

QUESTION 6 (Start on a new page.)

Two satellites orbiting the earth are situated on opposite sides of the earth. Satellite **A** has a mass of 4 600 kg and Satellite **B** has a mass of 5 300 kg. Satellite **A** is at a height of 28 000 km above the surface of the earth.

6.1 State Newton's law of universal gravitation in words. (2)

6.2 Calculate the magnitude of the gravitational force between the earth and satellite **A**. (4)

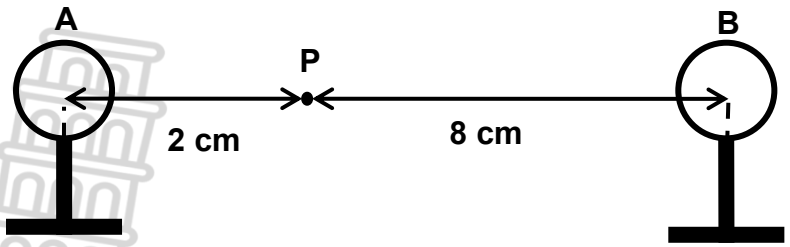
6.3 Explain the term *weightlessness*. (2)

6.4 What distance above the earth's surface should satellite **B** be to experience the same force towards the earth as satellite **A**?

Answer only GREATER THAN, LESS THAN or EQUAL TO.
Explain the answer. (4)
[12]

QUESTION 7 (Start on a new page.)

Two identical metal spheres, **A** and **B**, on insulated stands are placed with their centres 10 cm apart. Sphere **A** has a charge of –15 nC while sphere **B** carries an unknown positive charge. **P** is a point 2 cm away from the centre of **A**, as shown in the diagram below.



The NET electric field at point **P** is 3,943 x 10^5 N.C^{-1} to the left.

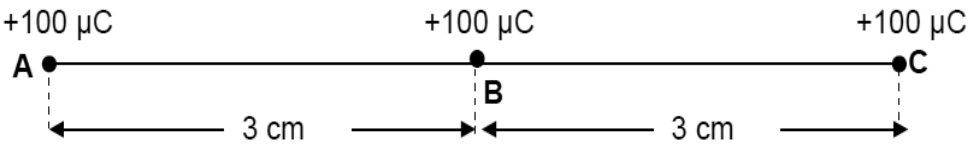
7.1 Define the term *electric field at a point.* (2)

7.2 Draw the electric field pattern between charges **A** and **B**. (3)

7.3 Calculate the magnitude of the unknown charge on sphere **B**. (8)

7.4 Sphere **B** is removed. State whether the electric field at **P**, due to charge on sphere **A**, will INCREASE, DECREASE or REMAIN THE SAME. (1)

7.5 Three +100 µC point charges, **A**, **B** and **C**, are equally spaced on a straight line in a vacuum. The charges are a distance of 3 cm from each other as shown in the diagram below.



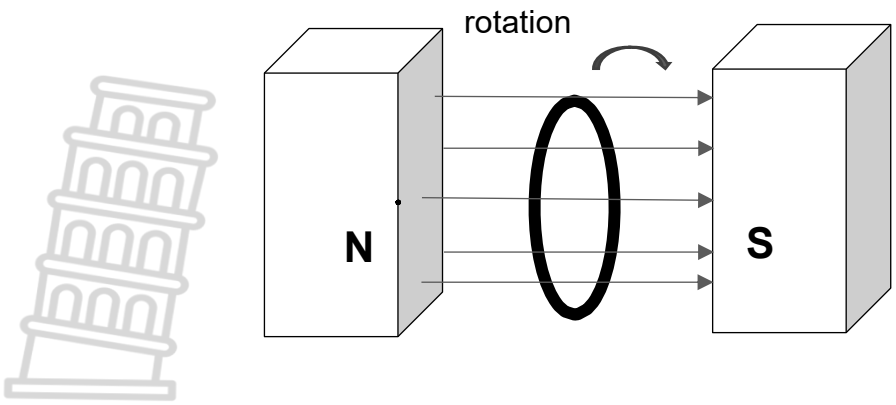
7.5.1 State Coulomb's law in words. (2)

7.5.2 Calculate the net electrostatic force experienced by point charge **C** due to charge **A** and **B**. (7)

[23]

QUESTION 8 (Start on a new page.)

A circular coil with 250 windings (turns) and a radius of 0,04 m, is rotated clockwise inside a magnetic field with a field strength of 3,2 T.



8.1 Calculate the magnetic flux through the coil at the position indicated on the diagram, where the coil is perpendicular to the field. (4)

8.2 If the coil rotates clockwise through 25°, and the emf induced is 2,8 V. Calculate the time in which this rotation took place. (4)

8.3 Which law can be used to explain the phenomenon described in QUESTION 8.2? NAME and state this law. (3)

8.4 8.4.1 If the circular coil is replaced with a square coil with a side length of 0,04 m, and the same movement is made in the same amount of time, will the induced emf be the same as, larger than or smaller than the circular coil?

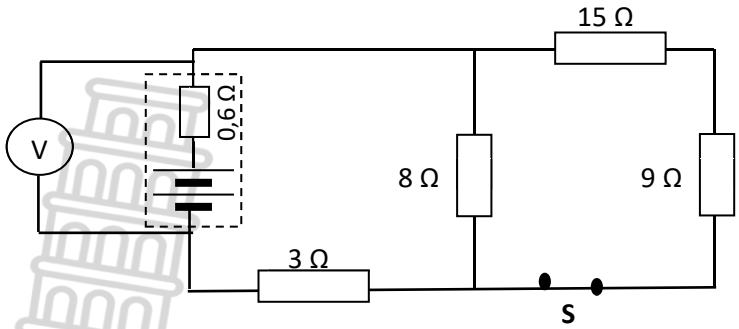
Write down only THE SAME AS, LARGER THAN or SMALLER THAN. (1)

8.4.2 Explain the answer to QUESTION 8.4.1. (2)

[14]

QUESTION 9 (Start on a new page.)

The battery used in the circuit below has emf of 12 V and internal resistance of 0,6 Ω.



The resistance of the connecting wires can be ignored.

9.1 Define the term *emf of a battery* in words. (2)

9.2 Calculate the current that flows through the 3 Ω resistor. (7)

9.3 Determine the reading on the voltmeter.

The switch, S, is now opened. (3)

9.4 Will the reading on the voltmeter, **V**, INCREASE, DECREASE or REMAIN THE SAME? (1)

9.5 Fully explain your answer to QUESTION 9.4 above. (3)

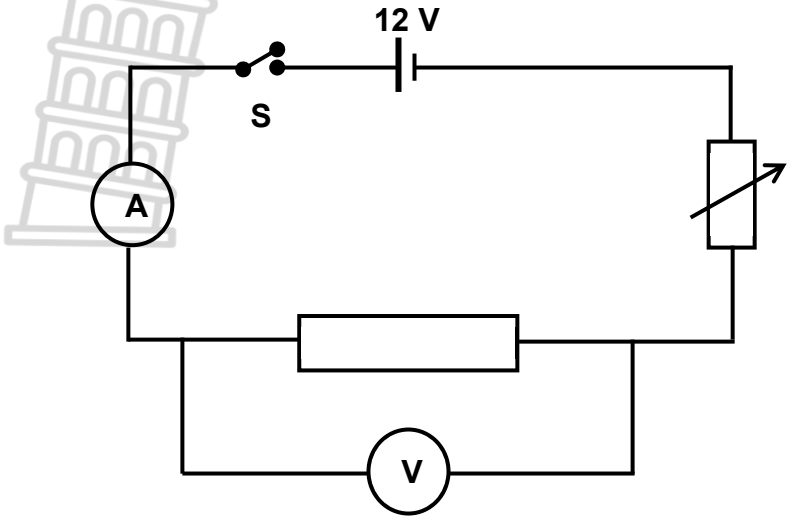
9.6 A learner uses an electrical heater of resistance 48 Ω that operates at a potential difference of 240 V to heat her room for half an hour.

Calculate the cost of operating the heater if the cost of electricity is R2,56 per unit. (1 unit = 1 kW.h) (5)

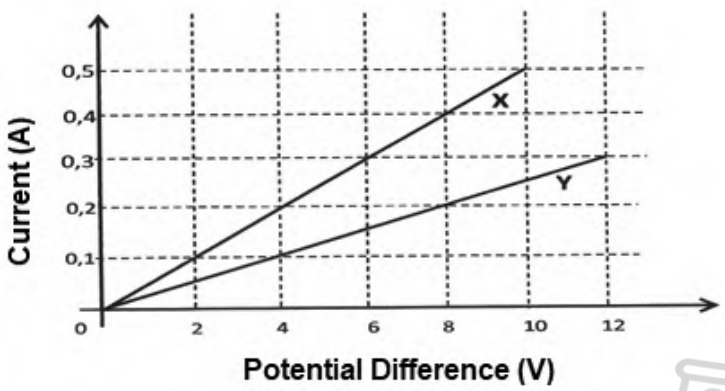
[21]

QUESTION 10 (Start on a new page.)

A learner sets up the circuit as shown below to investigate the relationship between potential difference and current for each of two unknown resistors **X** and **Y**. In experiment **1** she connected resistor **X** and recorded the ammeter and voltmeter readings. She then repeated the procedure in Experiment **2** with resistor **Y**. Ignore internal resistance of the battery.



The results of the two experiments are shown on graphs below.



10.1 State Ohm's Law in words. (2)

10.2 What does the gradient of the graphs represent? (1)

10.3 Without any calculation, state which resistor, **X** or **Y**, has the greater resistance.

Give a reason for your answer. (2)

10.4 Use the graph to determine the resistance of resistor **X**. (4)
[9]

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•s^{-2}
Universal gravitational constant *Universelegravitasiekonstant*	G	6,67 x 10^{-11} N•m^2•kg^{-2}
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	3,0 x 10^8 m•s^{-1}
Planck's constant *Planck se konstante*	h	6,63 x 10^{-34} J•s
Coulomb's constant *Coulomb se konstante*	k	9,0 x 10^9 N•m^2•C^{-2}
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 earth *Massa op aarde*	M	5,98 x 10^{24} kg
Radius of earth *Radius op aarde*	R_E	6,38 x 10^6 m

TABLE 2: FORMULAE/TABEL 2: FORMULES

MOTION/BEWEGING

$v_f = v_i + a\Delta t$	$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ or/*of* $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$v_f^2 = v_i^2 + 2a\Delta x$ or/*of* $v_f^2 = v_i^2 + 2a\Delta y$	$\Delta x = \left(\frac{v_i + v_f}{2}\right)\Delta t$ or/*of* $\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$

FORCE/*KRAG*

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

ELECTROSTATICS / *ELEKTROSTATIKA*

$F = \frac{kQ_1Q_2}{r^2}$ (k = 9,0 x 10^9 N·m^2·C^{-2})	$E = \frac{kQ}{r^2}$ (k = 9,0 x 10^9 N·m^2·C^{-2})
$E = \frac{F}{q}$	$V = \frac{W}{q}$
$n = \frac{Q}{e}$ or/*of* $n = \frac{Q}{q_e}$	

ELECTROMAGNETISM/ELEKTROMAGNETISME

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

CURRENT ELECTRICITY / *STROOMELEKTRISITEIT*

$R = \frac{V}{I}$	Emf/Emk = I(R = v)
$R = r_1 + r_2 + r_3 + ...$ $\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} + ...$	$q = I\Delta t$
$W = Vq$ $W = VI\Delta t$ $W = I^2R\Delta t$ $W = \frac{V^2\Delta t}{R}$	$P = \frac{W}{\Delta t}$ $P = VI$ $P = I^2R$ $P = \frac{V^2}{R}$

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NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIORSERTIFIKAAT*

GRADE/*GRAAD* 11

NOVEMBER 2024

PHYSICAL SCIENCES P1/ *FISIESE WETENSKAPPE V1* MARKING GUIDELINE/*NASIENRIGLYN*

MARKS/*PUNTE*: **150**

This marking guideline consists of 12 pages./
Hierdie nasienriglyn bestaan uit 12 bladsye.

QUESTION/*VRAAG* 1: MULTIPLE-CHOICE QUESTIONS/
MEERVOUDIGEKEUSE-VRAE

1.1	D ✓✓	(2)
1.2	C ✓✓	(2)
1.3	B ✓✓	(2)
1.4	C ✓✓	(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 Forces are in equilibrium when the net force acting at the point is equal to zero. ✓✓

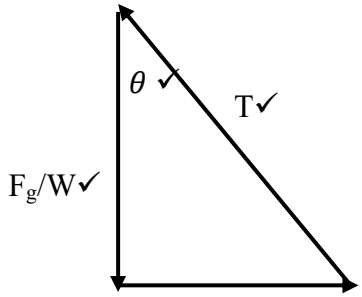
Kragte is in ewewig wanneer die netto kragte wat op 'n punt inwerk gelyk is aan nul.

OR/*OF*

It means the forces are balanced and the object will remain stationary/ moving at a constant velocity. ✓✓

Dit beteken dat die kragte gebalanseerd is en die voorwerp bly in rus / beweeg teen 'n konstante snelheid. (2)

2.2



T : Tension /*Spanning*

F_A : Applied Force / *Toegepaste krag*

F_g/W : Weight / *Gewig* **OR/*OF*** Gravitational Force / *Gravitasiekrag* (4)

2.3 2.3.1 $T^2 = F_A^2 + F_g^2$ (Pythagoras Theorem/*Stelling*)

$= [60^2 + \underline{(8 \times 9{,}8)^2}$ ✓] ✓

$= 9746{,}56$

$T = 98{,}72$ N ✓ (3)

2.3.2 **OPTION 1 / *OPSIE 1***

$\sin\theta = \frac{F_A}{T}$ ✓

$= \frac{60}{98{,}72}$ ✓

$\theta = 37{,}43°$ ✓

OPTION 2 / *OPSIE 2*

$\tan\theta = \frac{F_A}{W}$ ✓

$= \frac{60}{78{,}4}$ ✓

$\theta = 37{,}43°$ ✓ (3)

2.4 $F_R = 0$ ✓✓ (2)

[14]

QUESTION/*VRAAG 3*

3.1 It is a single force having the same effect as the sum of the forces acting together. ✓✓

Dit is 'n enkele krag wat dieselfde effek het as die som van kragte wat saamwerk.

OR/*OF*

The vector sum of two or more vectors. ✓✓

The vektor som van twee of meer kragte. (2)

3.2 3.2.1 $f_k = \mu_k \cdot N$ ✓
$f_k = [0,33[2 \times 9,8 - (\mathbf{8,26}\sin 20^o)$ ✓] ✓
$f_k = 5,54$ N ✓ (4)

3.2.2 **POSITIVE MARKING FROM QUESTION 3.2.1 / *POSITIEWE NASIEN VANAF VRAAG 3.2.1***

$F_{net} = ma$
$F\cos\theta - T - f = ma$
$T - f = ma$
$[\mathbf{8,26}\cos 20°$ ✓ $- T - 5,54 = 0]$ ✓
$T = 2,22$ N
$T = f$ (for block A/ vir blok A)
$f_k = \mu_k \cdot N$
$2,22$ ✓ $= \mu_k(1,5 \times 9,8)$ ✓
$\mu_k = 0,25$ ✓ (6)

[12]

QUESTION/*VRAAG 4*

4.1 A body will remain in its state of rest or motion at constant/uniform velocity ✓ unless a non-zero resultant/net force acts on it. ✓

'n Liggaam sal in sy toestand van rus of beweging teen konstante snelheid bly tensy 'n nie-nul resulterende/netto krag daarop inwerk. (2)

4.2 There is air friction on the container downwards. ✓✓

Daar is lugweerstand op die houer afwaarts.

There is an extra downward force ✓✓/ *Daar is 'n ekstra afwaartse krag* (2)

4.3 W = mg ✓

1960 = m 9,8 ✓

m = 200 kg ✓ (3)

4.4 **POSITIVE MARKING FROM QUESTION 4.3 / *POSITIEWE NASIEN VANAF VRAAG 4.3***

F_{net} = ma

T – F_g – F_{Fair} = ma } ✓

T – 1960 – 140 ✓ = (200)(0,13) ✓ = 26

T = 2126 N ✓ (4)

4.5 2 100 N ✓ (1)

[12]

QUESTION/*VRAAG 5*

5.1 When a net force is applied to an object, the object accelerates in the direction of the net force. The acceleration is directly proportional to the (net) force ✓ and inversely proportional to the mass ✓ of the object.

Wanneer 'n resulterende/netto krag op 'n voorwerp inwerk, sal die voorwerp in die rigting van die krag versnel teen 'n versnelling direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp.

OR/*OF*

The acceleration is directly proportional to the net force ✓ and inversely proportional to the mass ✓ of the object.

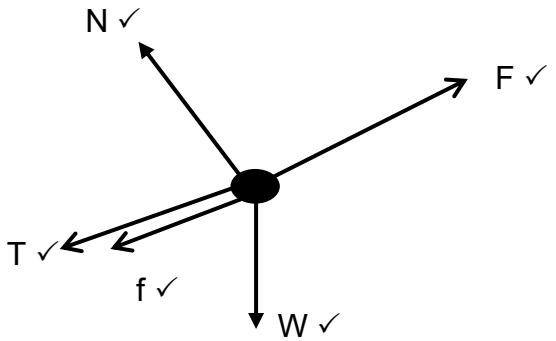
Die versnelling is direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp.

OR/*OF*

The net force is equal to the rate of change of momentum, the net force and change in momentum are in the same direction. ✓✓ **(2 or 0)**

Die netto krag is gelyk aan die tempo van verandering van momentum, die netto krag en verandering in momentum is in dieselfde rigting. ***(2 of 0)*** (2)

5.2



(5)

5.3 $F_{net} = ma$ ✓

$F - F_{g//} - T - f = ma$

$T - F_{g//} - f = ma$

Any one / *Enige een* ✓

T - (1 x 9,8 sin30°) - 1 = a…….. 1 ✓

20 – (2 x 9,8 sin30° - T – 2 ✓ = 2a …..2 ✓

a = 2,15 m.s^{-2} ✓

Formula
Calculating F_g for both blocks *Bereken F_g vir beide blokke*
Substituting for 1 kg block *Vervang vir 1 kg-blok*
Substituting for 2 kg block *Vervang vir 2 kg-blok*
Substituting for both 2a and a *Vervang vir beide 2a en a*
Answer/ *Antwoord*

(6)
[13]

QUESTION/*VRAAG 6*

6.1 Every particle in the universe attracts every other particle with a force that is directly proportional to the product of their masses, ✓ and inversely proportional to the square of the distance between their centres. ✓

Elke deeltjie in die heelal trek elke ander deeltjie aan met 'n gravitasiekrag wat direk eweredig is aan die produk van hul massas en omgekeerd eweredig is aan die kwadraat van die afstand tussen hulle middelpunte. (2)

6.2 $F = \frac{Gm_1m_2}{r^2}$ ✓

$F = \frac{(6,67 \times 10^{-11})(5,98 \times 10^{24})(4600)}{(6,38 \times 10^6 + 28 \times 10^6)^2}$ ✓ ✓

$F = 1552,29$ N ✓ (4)

6.3 Weightlessness is the sensation experienced when all contact forces are removed. ✓✓ /
Gewigloosheid is 'n sensasie ervaar wanneer al die kontakkragte verwyder is. (2)

6.4 **OPTION 1 / *OPSIE 1***
Greater than. ✓ The mass is greater ✓ and for the same force ✓ the distance must also be greater. ✓
Groter as. Die massa is groter en vir dieselfde krag moet die afstand groter wees.

OPTION 2
Greater than / *Groter as* ✓

$F = \frac{Gm_1m_2}{r^2}$

$1552,29 = \frac{(6,67 \times 10^{-11})(5,98 \times 10^{24})(5300)}{R^2}$ ✓

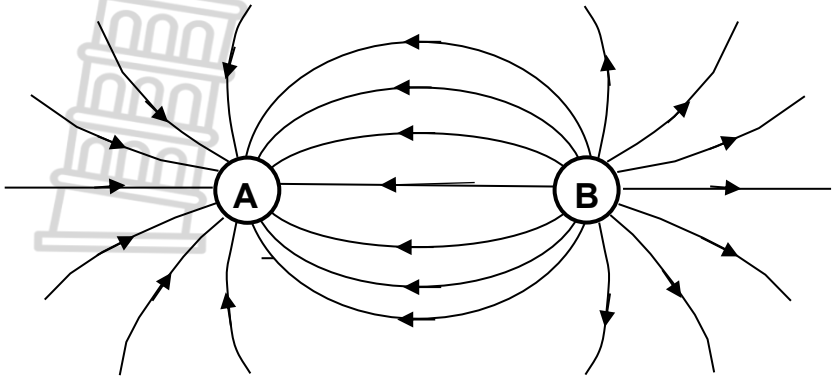
$R = 3,69 \times 10^7$ m
Distance above the surface of the earth / *Die afstand bokant die oppervlakte van die aarde*
$D = 3,69 \times 10^7 - 6,38 \times 10^6$ ✓
$= 3,05 \times 10^7$ m ✓ (or/*of* 30520000 m) (4)
[12]

QUESTION/*VRAAG 7*

7.1 Electric field at a point is the electrostatic force experienced per unit positive charge placed at that point. ✓✓

Die elektriese veld by 'n punt is die elektrostatiese krag ondervind per eenheid positiewe lading wat by daardie punt geplaas is. (2)

7.2



CRITERIA FOR MARKING / *NASIENKRITERIA*	
Correct shape / *Korrekte vorm*	✓
Correct field direction / *Korrekte veldrigting*	✓
Lines starting from sphere and not crossing each other *Lyne begin vanaf die sfeer en kruis nie mekaar nie*	✓

(3)

7.3 $E_1 = \frac{kQ}{r^2}$ ✓

$E_1 = \frac{9 \times 10^9 (15 \times 10^{-9})}{(2 \times 10^{-2})^2}$ ✓ ✓

E_1 = 337 500 N.C^{-1} to the left / *na links*

$E_2 = \frac{9 \times 10^9 Q}{(8 \times 10^{-2})^2}$ ✓ ✓

$E_2 = 1{,}40625 \times 10^{12} \times Q_x$ to the left / *na links*

$E_{net} = E_1 + E_2$

$3{,}943 \times 10^5$ ✓ = 337 500 + $1{,}40625 \times 10^{12} Q_{Xn}$ ✓

Q_X = (+)$4{,}04 \times 10^{-8}$ C ✓ (8)

7.4 Decrease / *Afneem* ✓ (1)

7.5.1 The electrostatic force of attraction or repulsion between two charges is directly proportional to the product of the charges ✓ and inversely proportional to the square of the distance between them. ✓

Die elektrostatiese krag van afstoting of aantrekking wat deur twee puntladings op mekaar uitoefen word, is direk eweredig aan die produk van die grootte van die ladings en omgekeerd eweredig aan die kwadraat van die afstand tussen hulle. (2)

7.5.2 $F = \frac{kQ_1Q_2}{r^2}$ ✓

$F_A = \frac{(9 \times 10^9)(100 \times 10^{-6})^2}{(0{,}06)^2}$ ✓ ✓

F_A = 25 000 N to the right / *na regs*

$F_B = \frac{(9 \times 10^9)(100 \times 10^{-6})^2}{(0{,}03)^2}$ ✓ ✓

F_B = 100 000 N to the right/ *na regs*

$F_{net} = F_A + F_B$
= 25 000 + 100 000 ✓
= 125 000 N to the right / *na regs* ✓ (7)

[23]

QUESTION/*VRAAG 8*

8.1 $\Phi = BA\cos\theta$ ✓

$= 3,2\ (\pi 0,04^2)$ ✓ $\cos 0°$ ✓

$= 0,016$ Wb ✓ (or 0,02 Wb) (4)

8.2 $\varepsilon = \frac{-N\Delta\Phi}{\Delta t}$ ✓

28 ✓ $= - \frac{250\ (0,016\cos 25° - 0,016\cos 0°)}{\Delta t}$ ✓

$\Delta t = 0,13$ s ✓ (0,17 s if 0,02 Wb is used / 0,17 s as 0,02 Wb gebruik is) (4)

8.3 Faraday's Law. ✓ The magnitude of the induced emf across the end of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor. ✓✓

Faraday se wet. 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. (3)

8.4 8.4.1 Smaller than / *Kleiner as* ✓ (1)

8.4.2 The area of a square is smaller than the area of a circle with the radius equal to the side length of the square. ✓✓

Die oppervlak van 'n vierkant is kleiner as die oppervlak van 'n sirkel met die radius gelyk aan die lengte van die sye van 'n vierkant.

OR/*OF*

$0,04^2 < \pi \times 0,04^2$ area of square is smaller than area of circle ✓✓ / *oppervlakte van 'n vierkant is kleiner as die oppervlak van 'n sirkel.*

OR/*OF*

ε directly proportional to / *direk eweredig aan* A ✓✓ (2)

[14]

QUESTION/*VRAAG 9*

9.1 The maximum energy per coulomb of charge supplied by the battery. ✓✓

Die maksimum energie per coulomb lading wat deur 'n battery verskaf word. (2)

9.2 $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓

$\frac{1}{R_p} = \frac{1}{8} + \frac{1}{9 + 15}$ ✓

✓

$R_p = 6\ \Omega$

$R_{ext} = 6 + 3$ ✓

$R_{ext} = 9\ \Omega$

emf = I(R + r) ✓

12 = I(9 + 0,6) ✓

I = 1,25 A ✓ (7)

9.3 V = IR ✓

V = (1,25)(9) ✓

V = 11,25 V ✓ (3)

9.4 Increase / *Toeneem* ✓ (1)

9.5 Total external resistance increases / *Totale eksterne weerstand neem toe* ✓

Total current decreases / *Totale stroom neem af* ✓

Lost volts decreases/ *Verlore volts neem af* ✓ (3)

9.6 $W = \frac{V^2 \Delta t}{R}$ ✓

$= \left[\frac{240^2 \times [30 \times 60]}{48}\right]$ ✓ ✓

= 2160 000 J

Cost /koste = $\frac{2160\ 000}{(3600 \times 1000)} \times 2,56$ ✓

= R 0,882 ✓ (5)

[21]

QUESTION/*VRAAG 10*

10.1 The potential difference across a conductor is directly proportional to the current in the conductor at constant temperature. ✓✓

Die potensiaalverskil oor 'n geleier is direk eweredig aan die stroom deur die geleier by konstante temperatuur.

OR/*OF*

The ratio of potential difference to the current is a constant provided the temperature remains constant. ✓✓

Die verhouding van potensiaalverskil tot die stroom is konstant mits die temperatuur konstant bly. (2)

10.2 Inverse of resistance / *Omgekeerde van weerstand* ✓ **OR/*OF*** 1/R ✓ (1)

10.3 Y ✓ The inverse of the gradient of graph Y is greater / *Die omgekeerde van die helling van grafiek Y is groter* ✓

OR/*OF*

Gradient of graph Y smaller /
Helling van grafiek Y is kleiner. ✓

Thus /*daarom* 1/R smaller / *kleiner* ✓

OR /*OF*

Hence/ *daarom*, R is greater/ *is groter.* ✓ (2)

10.4 **OPTION 1 / *OPSIE 1***

R_X = inverse of gradient /
omgekeerde helling

$$\text{gradient} = \frac{\Delta I}{\Delta V}$$

$$m = \frac{0,4 - 0,2}{8 - 4} \quad ✓ \quad ✓$$

$$m = 0,05$$

$$R_x = \frac{1}{0,05} \quad ✓$$

$R_x = 20\ \Omega$ ✓

OPTION 1 / *OPSIE 2*

$$R = \frac{V}{I} \quad ✓$$

$$R = \frac{6}{0,3} \quad ✓ \quad ✓$$

$R = 20\ \Omega$ ✓

(4)

(Any other correct values from graph / *Enige ander korrekte waardes vanaf die grafiek*) **[9]**

TOTAL/*TOTAAL*: 150