GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PROVINCIAL EXAMINATION

NOVEMBER 2023

GRADE 11

PHYSICAL SCIENCES: PHYSICS

PAPER 1

TIME: 3 hours

MARKS: 150

13 pages + 2 data sheets

INSTRUCTIONS AND INFORMATION

1. Write your name in the appropriate space in the ANSWER BOOK.

2. This question paper consists of NINE questions. Answer ALL questions in the ANSWER BOOK except QUESTION 3.5.1 which has to be answered on the graph paper attached to this question paper. Write your name in the appropriate space on the graph paper.

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

6. You may use a non-programmable calculator.

7. You may use appropriate mathematical instruments.

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

9. Show ALL formulae and substitutions in ALL calculations.

10. Round-off your FINAL numerical answers to a minimum of TWO decimal places.

11. Give brief motivations, discussions, etc. where required.

12. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A – D) next to the question numbers (1.1 to 1.10) in the ANSWER BOOK, for example 1.11 A.

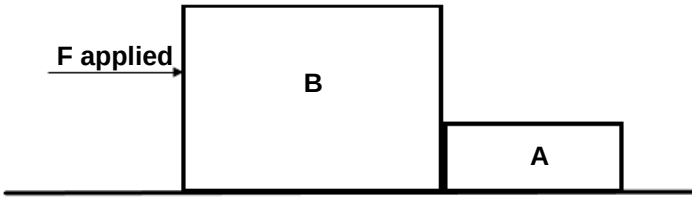
1.1 The statements below refer to vector and scalar quantities.

(i) A vector has magnitude and direction while a scalar has magnitude only.
(ii) A scalar quantity can always be added to a vector quantity.
(iii) Force is an example of a vector quantity, while distance is an example of a scalar quantity.

Which of the above statements is/are TRUE?

A (i) and (ii) only
B (i) and (iii) only
C (ii) and (iii) only
D (i) only (2)

1.2 A learner pushes two blocks **A** and **B** across a rough horizontal surface, at constant velocity. The mass of block **A** is less than that of block **B**.



How does the force F_1, that block **A** exerts on block **B**, compare in magnitude with force F_2, that block **B** exerts on block **A**?

A $F_1 = F_2 \neq 0$
B $F_1 = F_2 = 0$
C $F_1 > F_2$
D $F_1 < F_2$ (2)

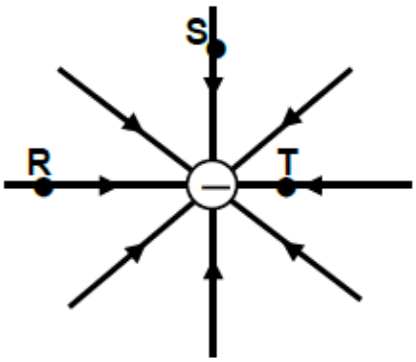
1.3 Two forces, F_1 and F_2, act on a point. If F_1 and F_2 act in the same direction, the maximum resultant has a magnitude of 15 N. If forces F_1 and F_2 act in opposite directions, the magnitude of the minimum resultant is 3 N. The magnitude of the two forces, in Newton, is:

A 8 and 7
B 12 and 3
C 11 and 4
D 9 and 6 (2)

1.4 The gravitational acceleration on a planet twice the mass of Earth and half the radius of Earth will be …

A 9,8 $m.s^{-2}$.
B 19,6 $m.s^{-2}$.
C 39,2 $m.s^{-2}$.
D 78,4 $m.s^{-2}$. (2)

1.5 The diagram below represents the electric field pattern around a negative point charge. R, S and T are points at different distances from the negative point charge.



The magnitude of the electric field of the point charge is the ...

A greatest at point R.
B greatest at point S.
C greatest at point T.
D the same at points R, S and T. (2)

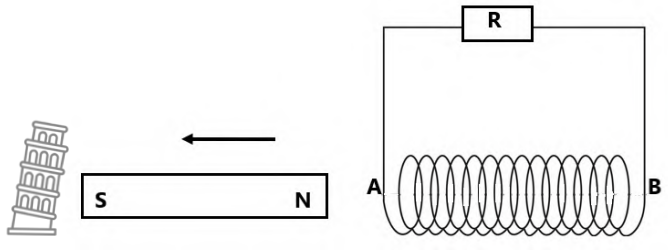
1.6 Two identical conducting spheres that have positive charges Q_1 and Q_2 (double the charge of Q_1), are separated by a distance r. If they are made to touch each other and then separated to the same distance, the force between them will be …

A zero.
B bigger than before.
C smaller than before.
D the same as before. (2)

1.7 Which of the following will give the most effective (strongest) electromagnet?

A A single wire with a high current flowing through it.
B A single wire with a low current flowing through it.
C Many turns of wire in a coil with a low current flowing through the coil.
D Many turns of wire in a coil with a high current flowing through the coil. (2)

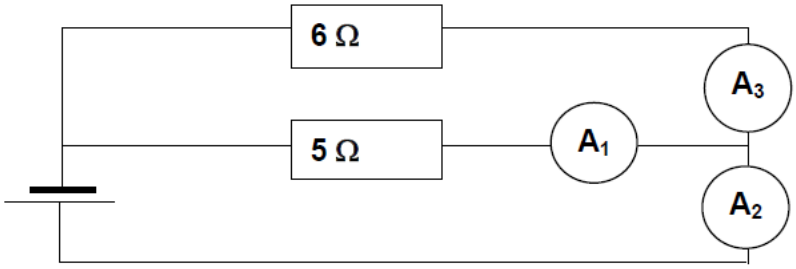
1.8 The diagram below shows a magnet that is being moved away from a solenoid.



Which of the following statements is CORRECT?

A The induced current will flow from **A** to **B** as it moves through the resistor.
B The induced current will flow from **B** to **A** as it moves through the resistor.
C No current will flow through the resistor.
D Alternating current will flow through the resistor. (2)

1.9 The circuit diagram represented below contains two resistors and three identical ammeters, registering readings I_1, I_2 and I_3 respectively.



Which of the following statements is INCORRECT**?**

A $I_2 = I_1 + I_3$.
B I_1 is less than I_3.
C I_2 is the current in the cell.
D I_3 is the current in the 6 Ω resistor. (2)

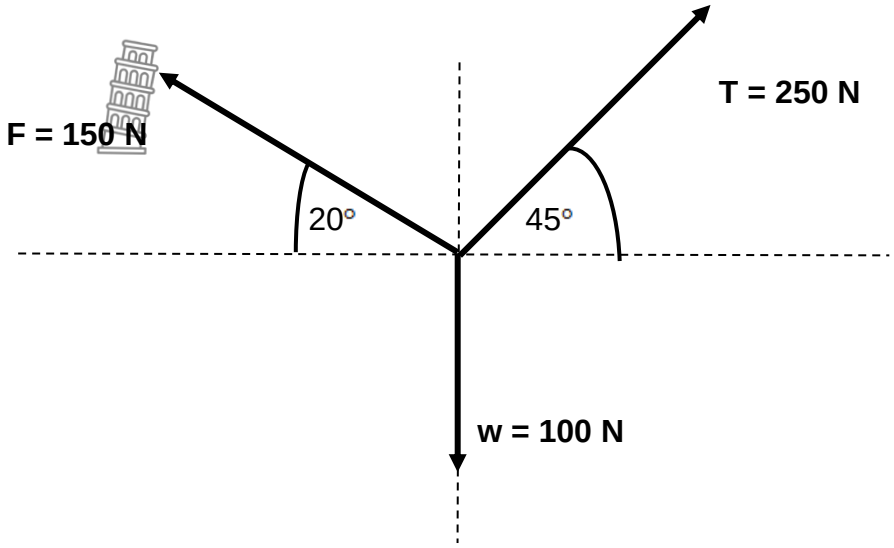
1.10 The meaning of a potential difference of 15V is …

A when a current of 5A flows through a circuit with a resistance of 3Ω.
B when 15 joules of energy is delivered to each Coulomb of charge travelling in the circuit.
C when 45 watts are used with a current of 3A.
D when the EMF is 15V. (2)

[20]

QUESTION 2 (Start on a new page.)

Consider the three forces acting on an object as shown in the diagram below.



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

2.2 Determine the magnitude and direction of the resultant horizontal and vertical forces. (4)

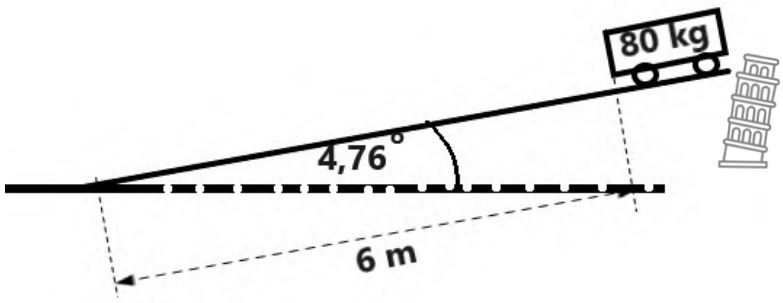
2.3 Determine the magnitude and direction of the resultant force acting on the object. (5)

2.4 Give the magnitude and bearing of the force that can balance the system. (2)

[13]

QUESTION 3 (Start on a new page.)

National Building Regulations for trolley and wheelchair ramps specify that a ramp must be 6 m in length, while the angle of the ramp must be 4,76°. The combined mass of the trolley and its contents is 80 kg. The coefficient of static friction between the wheels of the trolley and the ramp is 0,1.



3.1 Define the term *static frictional force.* (2)

3.2 Draw a labelled free body diagram of all the forces acting on the trolley at the top of the ramp, just as it starts to roll down the ramp. (3)

3.3 While the trolley is at the top of the ramp, calculate the magnitude of the maximum force of static friction. (3)

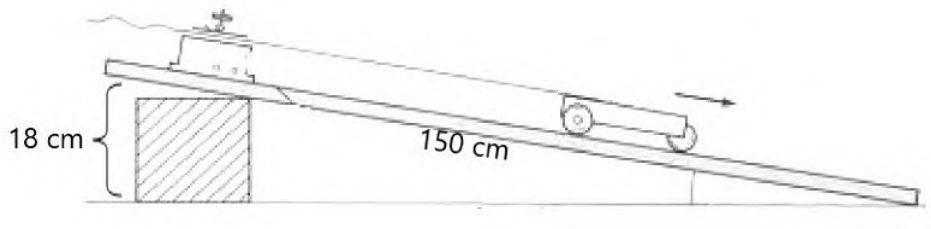
3.4 If the ramp is longer than 6 m, a less steep gradient is required. For a ramp of a less steep gradient, state whether the following would INCREASE, DECREASE or REMAIN THE SAME.

3.4.1 The coefficient of static friction (1)

3.4.2 The force of static friction (1)

3.4.3 Explain the answer to QUESTION 3.4.2 in scientific terms. (2)

3.5 Learners in the Physical Sciences laboratory perform an experiment with a trolley and a wooden block on a ramp. The aim of this experiment is to compare kinetic friction to static friction by plotting the values of the two experiments on the same set of axes.



The following values were recorded for this experiment.

READINGS	Normal (A) (TROLLEY) (in N)	f_s (A) (in N)	Normal (B) (BLOCK) (in N)	f_s (B) (in N)
1	6,80	0,185	6,80	0,15
2	7,75	0,21	7,75	0,17
3	8,70	0,235	8,70	0,19

3.5.1 Use the information in the table to plot a graph of both the trolley and the block ON THE SAME SET OF AXES. Label the graph of the trolley as A and the graph of the block as B. (4)

3.5.2 Which part of each of the graphs represents the coefficient of friction? (1)

3.5.3 If the graph of the trolley represents static friction and the graph of the block represents kinetic friction, explain the difference between the coefficient of static friction and the coefficient of kinetic friction that can be observed on the graph. (2)

[19]

QUESTION 4 (Start on a new page.)

A bakkie stops at a crossing. The driver of the bakkie suddenly pulls away. A person sitting at the back of the bakkie falls off.

4.1 Identify the law that will cause the person to fall off the back of the bakkie. (2)

4.2 Name the property of matter that will determine the inertia of an object. (1)

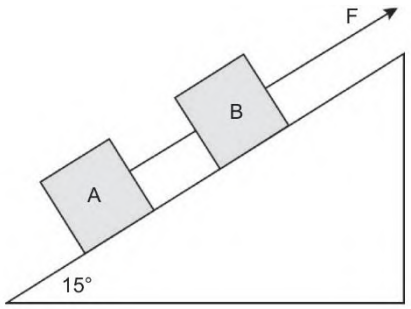
4.3 Give an example of a safety precaution that is used in motor vehicles to prevent such an incident. (1)

4.4 What should the net force on a man of 70 kg be if he sits inside the vehicle and moves at a constant velocity of 15 $m.s^{-1}$? (2)

[6]

QUESTION 5 (Start on a new page.)

Two blocks, **A** and **B**, are tied to each other by means of a light, inextensible string as indicated in the diagram below. Block **A** has a mass of 10 kg and experiences a frictional force of 29,88 N. Block **B** has a mass of 8 kg. The coefficient of kinetic friction of the rough incline is 0,31. A force **F** moves the blocks up the inclined plane at a constant velocity.



5.1 State *Newton's first law* in words. (2)

5.2 Draw a labelled free-body diagram for block **B**. (5)

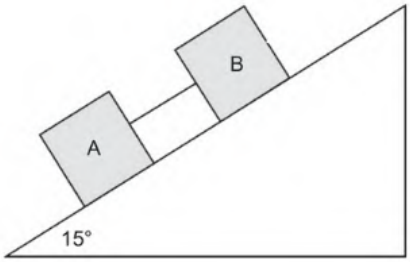
5.3 Calculate the:

5.3.1 Normal force acting on block **B**. (3)

5.3.2 Tension in the string. (3)

5.3.3 Force applied onto block **B**. (4)

The force applied on **B** is removed and the two blocks start to slide down the inclined plane.



5.4 State *Newton's second law of motion* in words. (2)

5.5 How will the frictional force experienced by block **A** change? (2)

5.6 Calculate the acceleration of the system. (5)

5.7 The two blocks reach a flat surface, with the same properties as the surface on the incline and continue to move on a flat surface till they finally stop.

5.7.1 How will the frictional force experienced by the blocks change on the flat surface? Write only INCREASES, DECREASES or REMAINS THE SAME. (1)

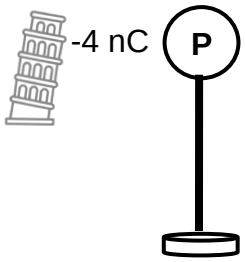
5.7.2 Explain the answer to QUESTION 5.7.1. (3)

5.8 Identify a of Newton's third law of motion pair while the blocks are sliding down the inclined plane. (2)

[32]

QUESTION 6 (Start on a new page.)

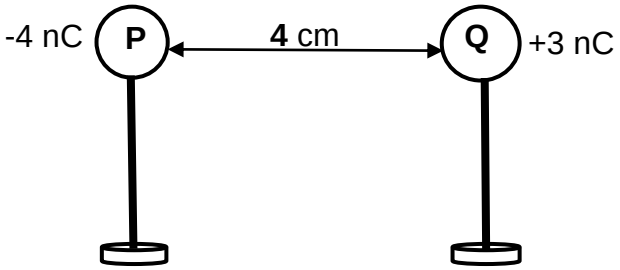
A small metal sphere **P** is placed on an insulated stand. The sphere carries a charge of -4 nC.



6.1 State the *principle of conservation of charge*. (2)

6.2 Calculate the number of electrons in excess on sphere **P**. (3)

A second identical metal sphere **Q**, carrying a charge of +3 nC, is placed 4 cm from sphere **P** as shown in the diagram below.



6.3 State *Coulomb's law* in words. (2)

6.4 Is the force that sphere **P** exerts on sphere **Q** a force of ATTRACTION or REPULSION? (1)

The spheres are now brought into contact with each other and then returned to their original positions.

6.5 Calculate the new charge on each sphere. (2)

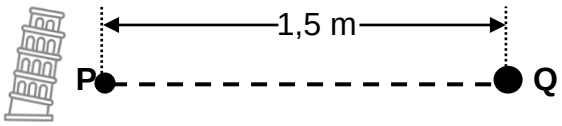
6.6 Calculate the magnitude of the electrostatic force now exerted by sphere **P** on sphere **Q**. (4)

6.7 By what factor will the magnitude of the force in QUESTION 6.6 change if the distance between the spheres is halved? (Do not calculate the new value of the force.) (1)

[15]

QUESTION 7 (Start on a new page.)

P is a point 1,5 m from a charged sphere **Q**. The electric field at **P** is 6 x 10^7 N·C^{-1} directed towards **Q**. Refer to the diagram below.

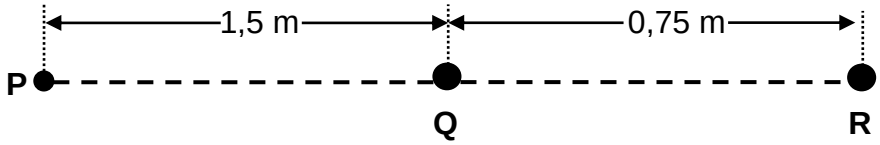


7.1 Define the term *electric field at a point*. (2)

7.2 Draw the electric field pattern caused by the charged sphere **Q**. (2)

7.3 Calculate the magnitude of the charge on sphere **Q**. (4)

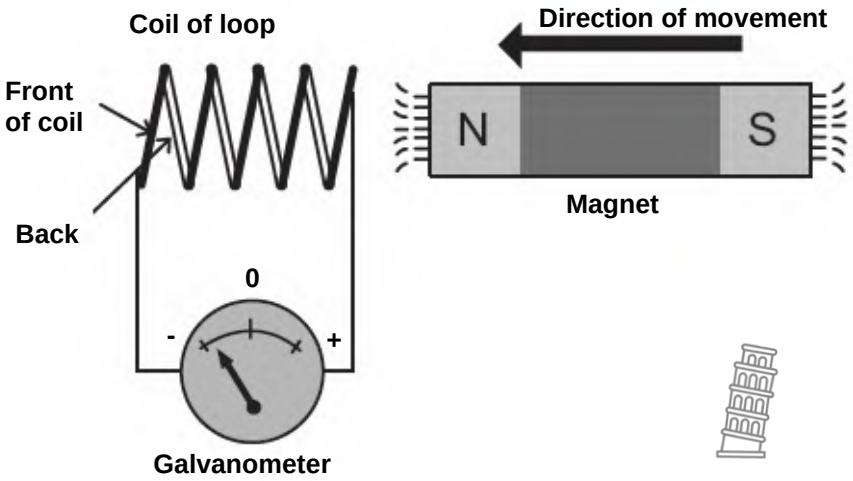
7.4 Another charged sphere, **R**, having an excess of 10^5 electrons, is now placed 0,75 m to the right of charge **Q**. Calculate the net electric field strength at point **P**.



(5)
[13]

QUESTION 8 (Start on a new page.)

A magnet is brought near a solenoid or coil as shown in the diagram below.



8.1 State *Faraday's law of Electromagnetic induction*. (2)

8.2 Why does the galvanometer deflect as the magnet is brought close to the coil? (1)

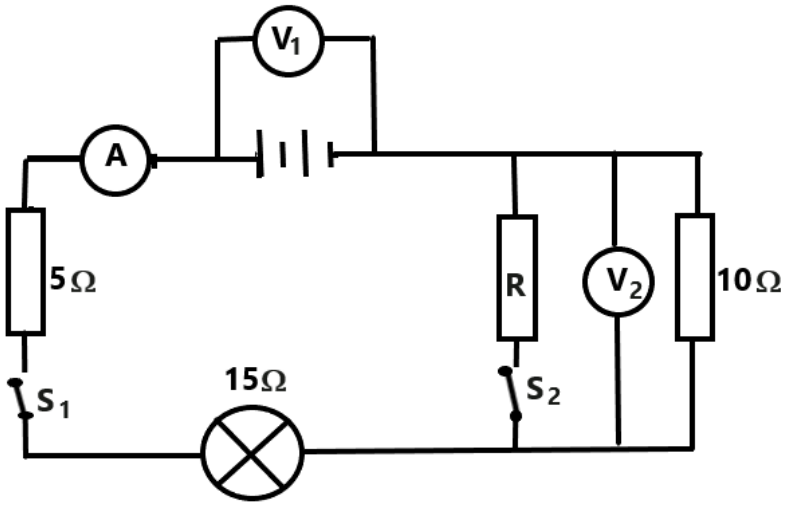
8.3 What rule can be used to predict the direction of the induced current? (1)

8.4 Give THREE ways in which the strength of the induced current can be increased. (3)

8.5 A coil with 200 windings (turns) is rotated so that the magnetic flux linkage with each winding changes from 5×10^{-4} Wb to 1×10^{-4} Wb in 0,2 s.
Calculate the induced emf in the coil. (3)
[10]

QUESTION 9 (Start on a new page.)

Study the circuit diagram below where the battery has an EMF of 15V. Ignore any internal resistance and answer the questions that follow.



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

9.2 Identify the resistor that is NOT an ohmic resistor. (2)

9.3 Give a reason for the answer to QUESTION 9.2. (2)

9.4 With Only switch **S_1** closed,

Calculate:

9.4.1 The total resistance of the circuit (2)

9.4.2 The reading on the ammeter (3)

9.4.3 The reading on **V_2** (2)

Switch **S_2** is now also closed. (**S_1** remains closed.) The reading on the ammeter is 1,2 A.

9.5 What will you observe in connection with the brightness of the lamp? Choose from INCREASES, DECREASES or REMAINS THE SAME. (1)

9.6 Give reasons for your answer to QUESTION 9.5. (2)

9.7 Calculate:

9.7.1 The reading on **V_2** (3)

9.7.2 The value of **R** (3)

[22]

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 electron*	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*

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

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*

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

ELECTROMAGNETISM/*ELEKTROMAGNETISME*

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

CURRENT ELECTRICITY/*ELEKTRIESE STROOMBANE*

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

GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PROVINCIAL EXAMINATION/
PROVINSIALE EKSAMEN

NOVEMBER 2023

GRADE/*GRAAD* 11

MARKING GUIDELINES/
NASIENRIGLYNE

PHYSICAL SCIENCES: (PHYSICS) PAPER 1
FISIESE WETENSKAPPE: (FISIKA) VRAESTEL 1

13 pages/*bladsye*

QUESTION/*VRAAG* 1

1.1 B ✓✓ (2)

1.2 A ✓✓ (2)

1.3 D ✓✓ (2)

1.4 D ✓✓ (2)

1.5 C ✓✓ (2)

1.6 B ✓✓ (2)

1.7 D ✓✓ (2)

1.8 B ✓✓ (2)

1.9 B ✓✓ (2)

1.0 B ✓✓ (2)

[20]

QUESTION/*VRAAG* 2

2.1 The vector sum of two or more vectors, i.e. a single vector having the same effect as two or more vectors together. ✓✓
Die vektorsom van twee of meer vektore, dit is 'n enkele vektor wat dieselfde effek het as twee of meer vektore saam. ✓✓

OR/*OF*

The single force that will have the same effect as all the other forces together. ✓✓
Die enkele krag wat dieselfde effek sal hê as al die ander kragte saam. ✓✓ (2)

2.2 $T_X = (250)\cos45° = 176,78$ N right/*regs*
$T_y = (250)\sin45° = 176,78$ N up/*opwaarts* ✓

$F_X = (150)\cos20° = 140,95$ N left/*links*
$F_Y = (150)\sin20° = 51,30$ N up/*opwaarts* ✓

$R_x = T_X - F_X$
$= +176,78 + (-140,95)$
$= 35,83$ N right/*regs* ✓
$R_y = T_y + F_Y - w$

$+ 176,78 + 51,30 - 100 = 128,08$ N up/*opwaarts* ✓ (4)

Marking criteria/*Nasienkriteria*	
Components of T and direction Komponente van T en rigting	✓
Components of F and direction Komponente van T en rigting	✓
F_{netx} and direction F_{netx} *en rigting*	✓
F_{nety} and direction F_{nety} *en rigting*	✓

2.3 $R^2 = R_x^2 + R_y^2$

$= 128,08^2 + 35,83^2$ ✓

$R = 133,00$ N ✓

$\tan\theta = \frac{128,08}{35,83}$ ✓

$\theta = 74,37°$ ✓

R = 133,00 N at 74,37° above the horizontal/*bokant die horisontaal* ✓

OR/*OF*

R = 133,00 N at bearing of/*in die rigting van* 15,62° (5)

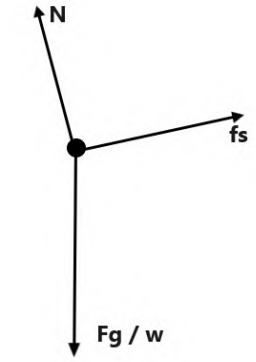
2.4 130,50 N ✓ at bearing of/*in die rigting van* 254,38° ✓ (2)

[13]

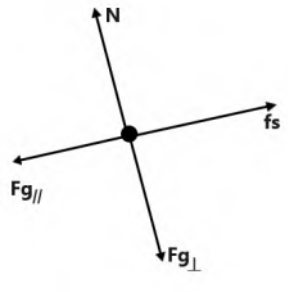
QUESTION/*VRAAG* 3

3.1 Static frictional force is the force that opposes the tendency of motion of a stationary object relative to a surface. ✓✓/*Statiese wrywingskrag is die krag wat die beweging van 'n stilstaande voorwerp relatief tot 'n oppervlak teenstaan.* ✓✓ (2)

3.2



OR/*OF*



Marking criteria/*Nasienkriteria*
✓ F_g/w (lower case) and direction of arrow OR its components. *F_g/w (klein letter), en rigting van pylpunt. OF sy komponente*
✓ f_s direction correct *f_s rigting korrek*
✓ N direction correct *N rigting korrek*

(3)

3.3 $f_s^{max/maks} = \mu s\ N$ ✓

$= \mu s\ F_{g\perp}$

$= 0,1x\ (80 \times 9,8)\cos 4,76°$ ✓

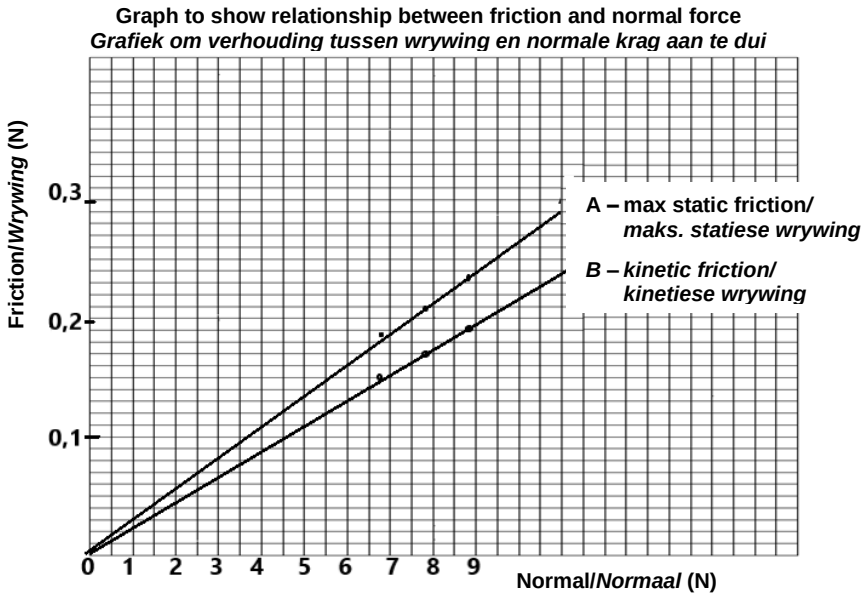
$= 78,13$ N ✓ (3)

3.4 3.4.1 Remain the same ✓/*Bly dieselfde* ✓ (1)

3.4.2
- μs remains constant ✓/*μs bly constant* ✓ (1)

3.4.3
- The Normal will increase ✓ as the <u>incline decreases</u>, the mass will remain the same,
- Static frictional force is proportional to the normal force therefore <u>static frictional force increases</u> ✓ (Must answer IN WORDS)
- *Die normaal sal toeneem ✓as die <u>helling afneem</u>, die massa sal dieselfde bly.*
- *Statiese wrywingskrag is eweredig aan die normaalkrag daarom sal statiese wrywingskrag toeneem. ✓(Moet in WOORDE antwoord)* (2)

3.5 3.5.1



Marking criteria/*Nasienkriteria*

✓ Friction and units on y-axis./*Wrywing en eenhede op y-as*
✓ Normal and units on x-axis/*Normaal en eenhede op x-as*
✓✓ Two staight lines through the origin/*Twee reguitlyne deur die oorsprong* (4)

3.5.2 The gradient of the gradient. ✓
Die gradiënt van die helling. ✓ (1)

3.5.3 The **coefficient of kinetic friction** is always smaller than **the coeffiecient of static friction.** ✓✓
(Award 1 mark for an answer if it is not stated exactly as above.)
Kinetic frictician is a constant for a specific surface. **OR**
Gradient = coefficient **OR**
Constant for a specific surface **OR**
At rest/wheels/walking = static friction.
Two flat surfaces moving towards each other is static friction.

*Die **koëffisiënt van kinetiese wrywing** is altyd kleiner as **die koëffisiënt van statiese wrywing.** ✓✓*
(Ken 1 punt vir die antwoord toe as dit nie presies soos hierbo gestel word nie.)
*Kinetiese wrywing is 'n konstante vir 'n spesifieke oppervlakte **OF***
*Gradiënt = koëffisiënt **OF***
*Konstant vir 'n spesifieke oppervlakte **OF***
In rus/wiele/loop = statiese wrywing.
Twee plat oppervlaktes wat teenmekaar beweeg is statiese wrywing. (2)
[19]

QUESTION/*VRAAG* 4

4.1 Newton's first law ✓✓/*Newton se eerste wet* ✓✓ (2)

4.2 The mass of the object ✓/*Die massa van die voorwerp* ✓ (1)

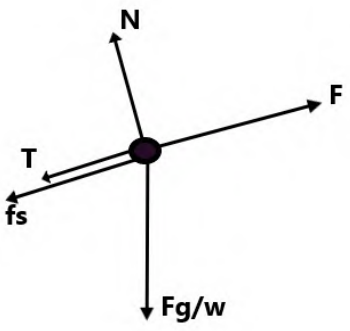
4.3 Seatbelts ✓/*Sitplekgordels*✓ (1)

4.4 $F_{net\ y}$ = 0N ✓✓/Zero/*Nul* (2)
[6]

QUESTION/*VRAAG* 5

5.1 A body will remain in its state of rest or motion at constant velocity unless a non-zero resultant/net force acts on it. ✓✓
'n Liggaam sal in sy toestand van rus of beweging teen 'n konstante snelheid bly tensy 'n nie-nul resultante/netto krag daarop inwerk. ✓✓ (2)

5.2



Marking criteria/*Nasienkriteria*
✓ F_g/w (lower case) and direction of arrow *F_g/w (klein letter) en rigting van pylpunt.*
✓ T direction correct/*T rigting korrek*
✓ F direction correct/*F rigting korrek*
✓ f_s direction correct/ *f_s rigting korrek*
✓ N direction correct/*N rigting korrek*

(5)

5.3 5.3.1 For/*Vir* B: F_{netY} = 0N ✓

$\therefore$ N = $F_{g\perp}$

= 8 x 9,8 x cos 15° ✓

= 75,72 N $\perp$ up incline/*op helling* ✓ (3)

5.3.2 $F_{net\ 0n\ A}$ = 0N ✓

T = $f_{s\ on\ A}$ + $F_{g//A}$

= 29,88 + (10 x 9,8 x sin 15°) ✓

= 55,24 N up slope/*teen helling op* ✓ (3)

5.3.3 $F_{net\ 0n\ B}$ = 0N ✓

F = T + $f_{s\ on\ B}$ + $F_{g//B}$

= 55,26 + (0,21 x 75,72) ✓ + (8 x 9,8 x sin 15°) ✓

= 91,43 N up slope/*teen helling op* ✓ (4)

5.4 When a resultant/net force acts on an object, the object will accelerate in the direction of the force at an acceleration directly proportional to the force ✓ and inversely proportional to the mass of the object. ✓

Wanneer 'n resulterende krag op 'n voorwerp inwerk, versnel die voorwerp in die rigting van die krag met 'n versnelling direk eweredig aan die krag ✓en omgekeerd eweredig aan die massa van die voorwerp. ✓ (2)

5.5 29,88 N ✓ down slope/*teen die helling af* ✓

OR/*OF*

Same size ✓ but opposite direction. ✓
Dieselfde grootte ✓maar teenoorgestelde rigting. ✓ (2)

5.6 $F_{net\ A}$ = m x a ✓ = + $F_{g//}$ + f_k - T

10a = +(10 x 9,8 x sin 15˚) + 29,88 – T

10 a = + 55,24 - T …1✓

$F_{net\ B}$ = m x a = +T – $F_{g//}$ – f_{sB}

8a = +T - (8 x 9,8 sin 15°) – (0,31 x 75,72)

8 a = +T - 43,76 …2 ✓

1 + 2 ✓

10a = + 55,24 -T

8 a = +T – 43,76

18 a = 11,48

a = 0,638 m.s^{-2} down the incline/*teen die helling af*. ✓ (5)

5.7 5.7.1 INCREASES ✓/*NEEM TOE* ✓ (1)

5.7.2 The μk is constant ✓ thus,
the normal will increase, with a decrease of the incline. ✓
The normal is directly proportional to the frictional force. ✓

Die μk is konstant ✓dus,
die normaal sal toeneem met 'n afname van die helling. ✓
Die normaal is direk eweredig aan die wrywingskrag. ✓ (3)

5.8 Block A on Block B and Block B on Block A. ✓✓
Block A on the earth and the Earth on block A.
ANY ONE RELEVANT Newton's third law pair. – **NOTE:** Normal force and the force of gravity is NOT a third law pair.

Blok A op Blok B en Blok B op Blok A. ✓✓
Blok A op die aarde en die aarde op blok A
ENIGE RELEVANTE Newton se derde wet paar,. – ***LET WEL:*** *Normaalkrag en swaartekrag is NIE 'n derde wetspaar nie.* (2)
[32]

QUESTION/*VRAAG* 6

6.1 Charges cannot be created or destroyed but can only be transferred from one object to another. ✓✓

Ladings kan nie geskep of vernietig word nie maar kan slegs oorgedra word van een voorwerp na 'n ander. ✓✓ (2)

6.2 $n_{electrons/elektrone} = \frac{Q}{q_e}$ ✓

$= \frac{4\ x\ 10^{-9}}{1,6\ x\ 10^{-19}}$ ✓ OR/*OF* $\frac{-4\ x\ 10^{-9}}{-1,6\ x\ 10^{-19}}$

= 2,5 x 10^{10} (electrons/*elektrone*) ✓ (3)

6.3 The magnitude of the electrostatic force exerted by one point charge on another point charge is directly proportional to the product of the magnitudes of the charges ✓ and inversely proportional to the square of the distance between them. ✓

Die grootte van die elektrostatiese krag wat deur twee puntladings op mekaar uitgeoefen 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)

6.4 Attraction✓/*Aantrekkingskrag* ✓ (1)

6.5 $Q_{new/nuut} = \frac{Q_1+Q_2}{2}$

$= \frac{-4\ x\ 10^{-9} + 3\ x\ 10^{-9}}{2}$ ✓

= –5 x 10^{-10} C✓ (2)

6.6 $F = \frac{kQ_1Q_2}{r^2}$ ✓

$= \frac{(9\ x\ 10^{9})(5\ x\ 10^{-10})(5\ x\ 10^{-10})✓}{(4\ x\ 10^{-2})^2✓}$ OR/*OF* $\frac{(9\ x\ 10^{9})(5\ x\ 10^{-10})(5\ x\ 10^{-10})✓}{(0,04)^2✓}$

= 1,41 x 10^{-6} N ✓ (4)

6.7 Four time greater ✓/*Vier keer groter* ✓ (1)

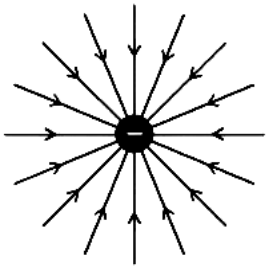
[15]

QUESTION/*VRAAG* 7

7.1 Electric field at a point is the force per <u>unit positive</u> charge placed at that point. ✓✓

Elektriese veld by 'n punt is die krag per <u>eenheid positiewe</u> lading wat by die punt in die veld geplaas word. ✓✓ (2)

7.2



Marking criteria/*Nasienkriteria*	
✓	Correct shape as shown *Korrekte vorm*
✓	Direction towards negative *Rigting na negatief*

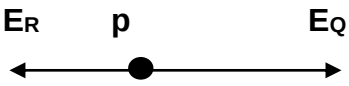
(2)

7.3 $E = \frac{kQ}{r^2}$ ✓

6×10^7 ✓ $= \frac{(9 \times 10^9)Q}{(1)^2}$ ✓

$Q = 6{,}67 \times 10^{-3}$ C✓ (4)

7.4



$E_R = \frac{k\,Q_R}{r^2}$ ✓

$E_{net} = E_Q - E_R$

$= 6 \times 10^7$ ✓ $- \frac{(9 \times 10^9)4 \times 10^{-3}}{(1{,}75)^2}$ ✓

$= 4{,}82 \times 10^{-7}$ N.C^{-1} ✓ to the right/*na regs* ✓ (5)

[13]

QUESTION/*VRAAG* 8

8.1 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 die geleier is direk eweredig aan die tempo van verandering van magnetiese vloedkoppeling met die geleier. ✓✓ (2)

8.2 Current is induced into the coil. ✓/*Stroom word in die spoel geïnduseer* ✓ (1)

8.3 The right-hand solenoid rule. ✓/*Die regterhand solenoïde reël.* ✓ (1)

8.4 Increase the number of turns/coils on the solenoid. ✓
Increase the current in the solenoid. ✓
Use a stronger magnet on the right. ✓
Use a soft metal bar inside the solenoid. (Any THREE)

Verhoog die aantal windinge in die solenoïde. ✓
Verhoog die stroom in die solenoïde. ✓
Gebruik 'n sterker magneet aan die regterkant. ✓
Gebruik 'n sagte metaalkern binne in die solenoïde. *(Enige DRIE)* (3)

8.5 $\varepsilon = N\frac{\Delta \Phi}{\Delta t}$ ✓

$= -200\frac{(1\ x\ 10^{-4} - 5\ x\ 10^{-4})}{0,2}$ ✓

$= 0,4$ V ✓

(3)
[10]

QUESTION/*VRAAG* 9

9.1 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 in die geleier by 'n konstante temperatuur. ✓✓ (2)

9.2 The light bulb/*Die Gloeilamp*/15 Ω resistor ✓✓ (2)

9.3 The temperature will increase as it heats up, the resistance will increase if the current is flowing for a long time. ✓✓

OR

The temperature will not be controlled thus resistance will increase.

Die temperatuur sal toeneem soos wat dit warm word, die weerstand sal toeneem indien die stroom vir 'n lang tyd vloei. ✓✓

OF

Die temperatuur sal nie gekontroleer word nie en daarom sal die weerstand toeneem. (2)

9.4 9.4.1 $R_T = R_1 + R_2 + R_3$

$= 5 + 15 + 10$ ✓

$= 30\ \Omega$ ✓ (2)

9.4.2 $I_{tot} = \frac{V_T}{R_T}$ ✓

$= \frac{15}{30}$ ✓

$= 0{,}5$ A ✓ (3)

9.4.3 $V = I \times R$

$= 0{,}5 \times 10$ ✓

$= 5$ V ✓ (2)

9.5 Brightness will increase ✓/*Helderheid sal toeneem* ✓ (1)

9.6
- Total resistance of the parallel connection decreases ✓
  Die totale weerstand van die paralleltak sal afneem. ✓

OR/*OF*

- More energy is available to the other two resistors in series. ✓
  Meer energie is beskikbaar vir die ander twee resistors in serie. ✓

OR/*OF*

- Power is directly proportional to the volts over the resistor and the current through the resistor. ✓
  Drywing is direk eweredig aan die potensiaalverskil oor die resistors en die stroom deur die resistors. ✓ (2)

9.7 9.7.1 $V_{5\Omega} = I \times R$

$= 0,58 \times 5$

$= 2,9\ V$ ✓

$V_{15\Omega} = I \times R$

$= 0,58 \times 15$

$= 8,7\ V$ ✓

$V_T = V_1 + V_2 + V_P$

$15 = 2,9 + 8,7 + V_P$

$V_P = 3,4\ V$ ✓ (3)

9.7.2 $R_T = \frac{V}{I} = \frac{15}{0,58}$

$= 25,86\ \Omega$ ✓

$R_P = R_T - R_s = 25,86 - 20 = 5,86\ \Omega$ ✓

$\frac{1}{R_p} = \frac{1}{R_{10}} + \frac{1}{R}$

$\frac{1}{5,86} = \frac{1}{10} + \frac{1}{R}$

$R = 14,15\ \Omega$ ✓ (3)

[22]

TOTAL/*TOTAAL*: 150

Taxonomy Grid

	Recall		Comprehension		Analysis		Evaluation	
	Q no:	**Mark**	**Q no:**	**Mark**	**Q no:**	**Mark**	**Q no:**	**Mark**
	1.1	2	1.3	2	1.4	2		
	1.2	2	1.5	2	1.6	2		
			1.7	2	1.9	3		
			1.8	2				
			1.10	2				
	2.1	2	2.4	2	2.2	4		
					2.3	5		
	3.1	2	3.2	3			3.3.2	3
			3.3.1	1			3.4.3	2
			3.4.1	4				
			3.4.2	1				
	4.1	2	4.4	2				
	4.2	1						
	4.3	1						
	5.1	2	5.2	5	5.3	10		
	5.4	2	5.5	2	5.6	5	5.7	4
			5.8	2				
	6.1	2			6.2	3		
	6.3	2	6.4	1	6.5	2		
					6.6	4		
					6.7	1		
	7.1	2	7.2	2	7.3	4		
					7.4	5		
	8.1	2	8.2	1	8.5	3		
	8.3	1	8.4	3				
	9.1	2	9.2	2	9.4	7	9.5	2
			9.3	2	9.7	6	9.6	3
Total marks	**18%**	**27**	**28**	**43**	**44%**	**66**	**9%**	**14**
Total %/**100%**	**P1&2: 15%**		**P1:35%/P2:40%**		**P1:40%/P2:35%**		**P1&2: 10%**	