GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PROVINCIAL EXAMINATION

JUNE 2023

GRADE 11

PHYSICAL SCIENCES: PHYSICS
PAPER 1

EXEMPLAR

TIME: 2 hours

MARKS:

9 pages + data sheets and a graph paper

INSTRUCTIONS AND INFORMATION

1. Write your name in the appropriate space on the ANSWER BOOK.
2. This question paper consists of NINE questions. 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. 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, et cetera, where required.
12. Write neatly and legibly.

EXEMPLAR

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 number (1.1 to 1.6) in the ANSWER BOOK, for example 1.7 A.

1.1 Which of the following statements about an electric field is CORRECT?

A Electric field strength is measured in V.m.
B The direction of the field lines indicates the direction of the force on a test negative charge.
C Electric field strength is a scalar quantity.
D The electric field strength due to a point charge is inversely proportional to the square of the distance from the charge. (2)

1.2 A negatively charged object …

A has more electrons than neutrons.
B has more protons than neutrons.
C has an equal amount of electrons and protons.
D has more electrons than protons. (2)

1.3 The current is induced in a solenoid. Which of the following factors will NOT affect the potential difference induced across the ends of the solenoid?

A The rate of change of the magnetic field used
B The resistance of the solenoid
C The number of turns in the solenoid
D The strength of the magnetic field (2)

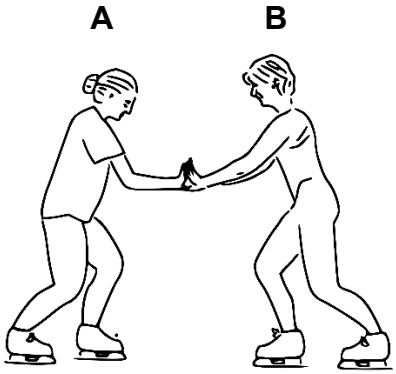
1.4 Two planets exert a force on each other. The force is …

A directly proportional to the product of their masses.
B directly proportional to the distance between them.
C directly proportional to the square of the distance between them.
D inversely proportional to the square of the distance between them. (2)

EXEMPLAR

1.5 Two learners, with the same mass, **A** and **B** on ice skates are facing each other on the ice rink. They press hard with their hands on one another.

Which of the following statements is correct?



A A will move away faster than B.
B B will move away faster than A.
C Both will move at the same speed in opposite directions.
D Both will move at the same velocity. (2)

1.6 The correct term for the rate of flow of charge is:

A Current
B Potential difference
C Resistance
D Power (2)
[12]

EXEMPLAR

QUESTION 2 (Start on a new page.)

A boy of 32 kg is sitting in the centre of a swing as shown in the diagram below. Ignore the mass of the seat. The swing hangs evenly.

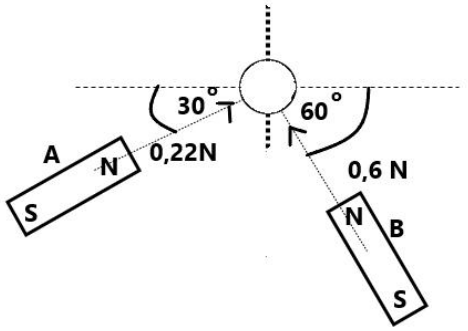


2.1 Define the term *resultant force*. (1)

2.2 State the magnitude of the resultant or net force on the boy if the seat of the swing hangs evenly. (1)

2.3 Calculate the tension in each of the ropes of the swing. (3)

2.4 A small steel ball is levitated (suspended in the air), by the forces of two magnets working in on it, at angles as shown in the diagram below. Magnet **A** exerts a force of 0,22 N at an angle of 30° to the horizontal and up on the steel ball. Magnet **B** exerts a force of 0,6 N at an angle of 60° to the horizontal and up on the steel ball. (Hint: Use the triangle rule for equilibrium.)

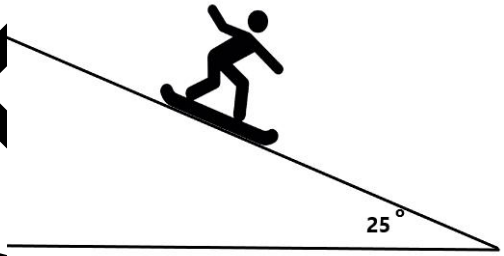


2.4.1 State *Newton's first law* in words. (2)

2.4.2 Calculate the mass of the steel ba (4)
[11]

QUESTION 3 (Start on a new page.)

A child, with a mass of 40 kg on a sandboard with a mass of 1,5 kg, skis down a sand dune with an incline of 25°. The coefficients of friction for the sand is: μ_s = 0,3 and μ_k = 0,12.



3.1 Identify the type of friction that is acting on the child with the board and the sand. (1)

3.2 Draw a free body diagram of all the forces acting on the child. (3)

3.3 Calculate the frictional force the child will experience. Show ALL workings. (4)

3.4 The child tries to ski down a sand dune with an incline of 30°. Will the frictional force experienced INCREASE, DECREASE OR REMAIN THE SAME? Explain the answer. (3)
[11]

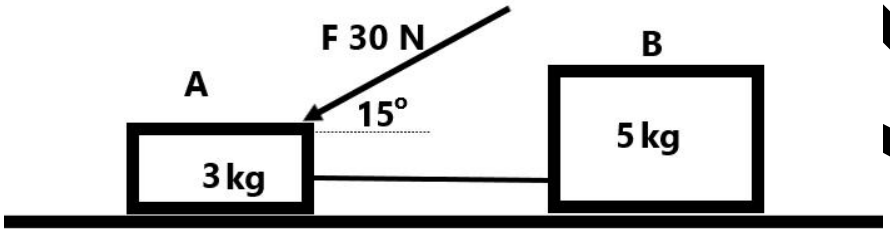
EXEMPLAR

QUESTION 4 (Start on a new page.)

Two blocks **A** and **B**, with masses 3 kg and 5 kg, are connected by a light inextensible string.

Block **A** experiences a pushing force of 30 N acting at an angle of 15° to the horizontal, as shown in the diagram below.

Block **A** experiences a frictional force of 9,28 N and block **B** experiences a frictional force of 12,25 N during its motion. The system accelerates to the left.



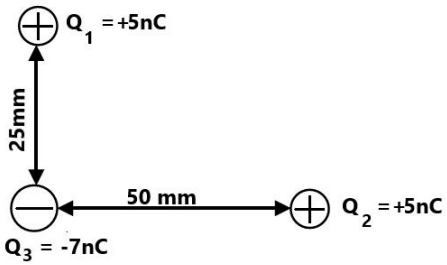
4.1 Define *Newton's second law* in words. (2)

4.2 Draw a free body diagram to show all the forces acting on block **A**. (5)

4.3 Calculate the magnitude of the acceleration of the system by applying Newton's second law of motion SEPARATELY to each of the blocks. (4)
[11]

QUESTION 5 (Start on a new page.)

Study the accompanying diagram that represents the charges situated on a flat plane with respect to each other. The positive charges Q_1 and Q_2 are identical with charges of +5 nC each and are respectively placed north and east of Q_3 with a charge of – 7 nC. The distances between the charges are 25 mm and 50 mm as indicated in the diagram.



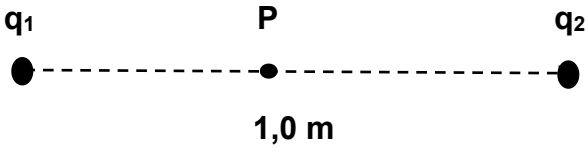
5.1 State *Coulomb's law* in words. (2)

5.2 Calculate the magnitude of the net electrostatic force that Q_3 experiences. (5)
[7]

EXEMPLAR

QUESTION 6 (Start on a new page.)

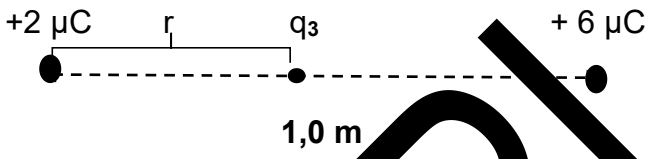
Two-point charges q_1= +2,0 µC and q_2= -2,0 µC, 1 m apart, are placed in vacuum as shown in the sketch below.



6.1 Draw the electric field pattern due to the two-point charges. (3)

6.2 Calculate the magnitude of the electric field at the midpoint between charges q_1 and q_2. (4)

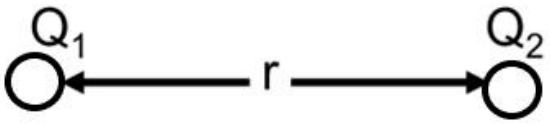
Point-charge q_2 is now replaced by a +6 µC charge as shown in the sketch below.



6.3 Determine by means of a calculation where a negative point charge ($-q_3$) must be placed with reference to the charge on the left (+2µC) so that it experiences a ZERO net force. (4)
[11]

QUESTION 7 (Start on a new page.)

A group of physicists wants to investigate the relationship between the electrostatic force experienced by two-point charges and the distance between the point charges, as indicated in the diagram below.



They record the following results:

Test	r (cm)	r^2 (cm^2)	F (N)
1	2	4	359,50
2	3	9	149,64
3	4	16	89,88
4	5	25	52,29
5	6	36	38,65

7.1 Write a suitable investigative question for this investigation. (2)

EXEMPLAR

7.2 Identify the following variables:

7.2.1 Independent variable (1)

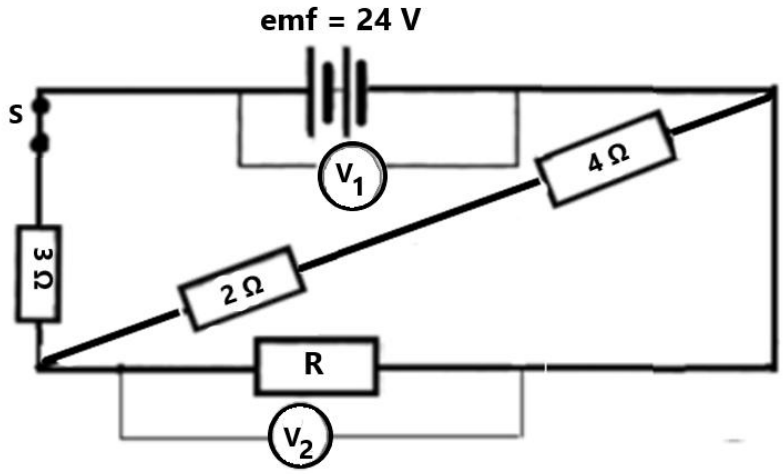
7.2.2 Controlled variable (1)

7.3 On the graph provided, draw an accurate graph of r^2 versus F. (5)

7.4 From the graph you have drawn, what conclusion can you make about the relationship between distance and force for two-points? (2)
[11]

QUESTION 8 (Start on a new page.)

In the circuit diagram below, resistors are connected in parallel as well as in series. The battery has an emf of 24 V and no internal resistance. When switch S_1 is closed the reading on V_2 is 9 V./



8.1 Define the term *potential difference*. (2)

8.2 Calculate:

8.2.1 The current through the 3 Ω resistor (3)

8.2.2 The current through the 4 Ω and 2Ω resistor (2)

8.2.3 The resistance on R (4)

8.3 The 4 Ω resistor burns out. What will happen to the current in the circuit? Write only INCREASES, DECREASES or REMAINS THE SAME. Explain the answer. (3)
[14]

EXEMPLAR

QUESTION 9 (Start on a new page.)

A single circular loop of wire, 12 cm in diameter, is placed in a 0,6 T magnetic field. It is removed from the magnetic field in 0,04 s.

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

9.2 Calculate:

9.2.1 The magnetic flux which is linked to this coil (3)

9.2.2 The average induced emf (4)

9.3 How does the emf change if the coil is removed from the field in 0,02 s? Write only INCREASES, DECREASES or REMAINS THE SAME. Explain the answer. (3)

[12]

TOTAL: 100

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END

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,[illegible] x 10^{-11} $N \cdot m^2 \cdot kg^{-2}$
Radius of Earth *Straal van Aarde*	R_E	6[illegible] 10^6 m
Coulomb's constant *Coulomb se konstante*	K	9,0 x [illegible]^9 $N \cdot m^2 \cdot C^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	[illegible]	3,[illegible] 10^8 $m \cdot s^{-1}$
Charge on electron *Lading op electron*	[illegible]	-1,6 x 10^{-19} C
Electron mass *Elektronmassa*	[illegible]	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*

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

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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*

$\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$	$\Phi = BA$ [illegible] θ

CURRENT ELECTRICITY/*ELEKTRIESE STROOMKRING*

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

/ / /

EXEMPLAR

ANSWER SHEET

QUESTION 7.3.

